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Engineering Report on Testing of Weatherford M45AP Float Collar

Report PN 1751225

Prepared for:

BP America Inc. Houston, Texas

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Engineering Report On Testing of Weatherford M45AP Float Collar

Prepared for: BP America Inc. Houston, Texas

PN 1751225 22 November 2010

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All recommendations, findings and conclusions stated in this report are based on facts and circumstances as they existed at the time that this report was prepared. A change in any fact or circumstance on which this report is based may adversely affect the recommendations, findings, and conclusions expressed in this report.

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Executive Summary

Stress Engineering Services (SES) was contracted by BP America Inc. (BP) to conduct various performance tests on the Weatherford 7" Model M45AP float collar with dual valve seats and an auto-fill tube. The objective of the test program is to evaluate the performance and design limits of various aspects of the float collar and to document its performance under conditions similar (according to information provided to SES) to those downhole in the Macondo well before, during, and after the cementing operation.

API RP 10F Testing

API RP 10F specifies procedures and parameters for qualification testing of float collars. SES completed flow endurance tests based on API RP 10F on Weatherford float collar SN 29679918-01. Water-base mud was used for all tests in the program. Mud weight for the API tests was 12.0–12.5 ppg. Flow rate, pressures upstream and downstream of the float collar, and fluid temperature were continuously recorded throughout the testing.

The first phase of the API test was to pump mud through the float collar in the reverse direction at a flow rate of 3 bpm (126 gpm) for 6 hours. This test, intended to simulate running the casing in the hole, was completed successfully.

The second phase of the test was to flow normally through the float collar at a sufficient flow rate to convert the auto-fill float collar into a flapper check valve. During this test, the flow rate was incrementally increased to near 2.7 bpm and held steady. At that rate, the upstream pressure was about 136 psi and downstream pressure was 19 psi. Conversion of the float collar was then observed, with three upstream pressure spikes recorded at pressure levels of approximately 450 psi. Immediately after the pressure spikes, the upstream pressure level dropped and became equal with the downstream pressure at near 20 psi, indicating that conversion had occurred.

The last phase of the API tests was flow endurance testing. A sequence of cycles comprising a back-pressure test followed by forward flow for 2 hr at 10 bpm was to be repeated 12 times for a total flow duration of 24 hours. These cycles were completed as specified. The average differential pressure across the float collar during the 24-hr flow test was approximately 13 psi. The pressure decline rate during the 250-psi back-pressure tests increased during the sequence. For the first cycle, the pressure loss was about 6 psi/min; for the twelfth (final) cycle, the pressure loss was about 27 psi/min.

After flow cycling was completed, a final back-pressure test to 5000 psi was performed, with a pressure decline rate of 32 psi/min measured during the 30-minute hold period. The corresponding leakage rate was estimated as 0.8 in³/min. The relatively high pressure decline rate, for both low-pressure and high-pressure tests, can partly be attributed to the comparatively small total fluid volume in the test setup.

Visual inspection of the float collar subsequent to API testing did not reveal any obvious wear. However, the visual inspection is limited since the valves are still encased within the 7" float collar casing. Dimensional inspection of the auto-fill tube and the ball showed that all features met Weatherford's manufacturing drawing requirements.

Mechanical Failure Testing

A mechanical loading test was performed to measure loads required to convert the float collar. The float collar shear ring was supported while a downward load was applied directly to the 2" ball. The shear pins supporting the auto-fill tube sheared from the retainer ring with a load of 2420 lb applied to the ball.

A second load test was performed to test the load capacity of the auto-fill tube under conditions where the shear pins might fail to shear. A mechanical load was applied to the 2" ball while the top of the auto-fill tube was restrained from movement. Load was increased until the ball shattered at a load of 7869 lb. The tube remained intact throughout the test. Results indicated that the load capacity of the auto-fill tube is at least three times greater than the capacity of the shear screws. Inspection of the tested parts showed that all parts met the dimensional requirements of the manufacturing drawings.

Steady-State Conversion Tests

Testing on the second specimen float collar (SN 29679918-02) was similar to the API testing described above except that the flow rates and durations were modified to be more representative of the conditions on the Macondo well. The mud weight was increased to 14.0 ppg. Reverse flow was maintained at a nominal flow rate of 1.5 bpm for 8 hours. A choke was installed downstream of the float collar to provide additional flow resistance to prevent cavitation.

The float collar converted at a flow rate of near 3.8 bpm at a differential pressure of 305 psi. Subsequent to the conversion test, back-pressure tests and forward flow for 4 hours at 4 bpm were completed. Posttest inspection showed that all critical dimensions met Weatherford's manufacturing drawing requirements.

Testing of the third specimen float collar (SN 29679918-03) was similar to the previous conversion test except that the downstream choke was adjusted to provide additional flow resistance and the pump truck setup was modified to allow more precise control of flow rate. The float collar converted at a flow rate of 5.7 bpm with 14.0-ppg mud. Upstream pressure was 1626 psi and downstream pressure was 1105 psi, for a differential pressure of 521 psi. Weatherford's flow conversion equation predicts that, with a flow rate of 5.7 bpm and a mud density of 14.0 ppg, nominal conversion pressure would be 575 psi.

Flow Surge Conversion Tests

The next test sequence was designed to evaluate whether the float collar will convert when subjected to a surge (rapid increase) in flow resulting from the clearing of a blockage in the flow path. This scenario was simulated by adding a rupture disk downstream of the float collar that would block mud flow until pressure increased sufficiently to rupture the disk at near 3000 psi. Accumulators were also placed upstream and downstream of the float collar to act as a flow source and a sink for the flow surge.

The first flow surge tests were conducted with Weatherford float collar SN 29679918-05 with 14.0-ppg mud at a constant flow rate of about 1.0 bpm. Flow initially accumulated in the upstream accumulator and increased system pressure gradually until the rupture disk fractured. At that instant, the high pressure in the upstream accumulator forced a flow surge through the float collar until the upstream and downstream pressures became equal. The rupture disk fractured at a pressure of approximately 3036 psi, releasing a flow surge that reached a peak flow rate of 10.5 bpm. The float collar was observed to

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Page v Confidential

convert during the flow surge. The differential pressure between above and below the float collar peaked at 196 psi.

A second flow surge conversion test with an Allamon ball on the top of the float collar was conducted on Weatherford float collar SN 29679918-04. All other test parameters remained the same as the previous conversion test. For this specimen, the rupture disk fractured at a pressure of approximately 3210 psi. As before, the float collar converted in the resulting flow surge (peak flow rate of 11.5 bpm). The differential pressure between above and below the float collar peaked at 792 psi.

Second Flow Surge Tests

Another test series was designed to evaluate the durability of a converted float collar (closed flapper valve and flapper hinge) when subjected to a flow surge event subsequent to conversion (that is, a second flow surge). The test was to be performed with (1) a simulated blockage placed downstream of the float collar and (2) a blockage placed upstream of the float collar.

For the second flow surge test on the converted float collar SN 29679918-05, the rupture disk was placed downstream of the float collar. All other test setup parameters were the same as the conversion test on this specimen. System pressure was gradually increased until the rupture disk fractured at approximately 3297 psi. The peak flow rate and peak differential pressure were 10.8 bpm and 298 psi, respectively.

A second flow surge test was also conducted on the converted float collar SN 29679918-04. For this case, the rupture disk was installed upstream of the float collar. All other test setup parameters were unchanged from the conversion test on this specimen. System pressure was gradually increased until the rupture disk fractured at approximately 2680 psi. Peak flow rate after the disk fractured was 10.6 bpm; differential pressure peaked at 1536 psi.

Visual inspection of the two float collars (SN 29679918-05 and -04) subsequent to all flow surge testing did not reveal any obvious wear or damage. On float collar SN 29679918-05, the O-ring between the shear ring of the auto-fill tube and the upper valve assembly was observed to be slightly protruding into the bore of the valve.

Summary

Performance tests on five Weatherford M45AP float collars were successfully completed at the SES test facility in Waller, Texas, from 23 July to 20 October 2010. The performance tests consisted of flow endurance tests, steady-state flow conversion tests, flow-surge conversion tests, flow-surge tests on converted float collars, and mechanical failure tests on auto-fill tubes. The flow-surge tests represented the sudden clearance of a blockage in the flow path, such as a blockage at the reamer shoe.

Based on test results, the float collars appear to meet the requirements of API RP 10F for endurance testing. Test results do not indicate any performance conflicts with published Weatherford data for the M45AP float collar. Post-test inspection did not reveal any damage or anomalies that would affect the intended performance of the float collar.

SES found that, for all test scenarios executed in this program, conversion of the float collar occurred.

Stress Engineering Services, Inc.

Page vi Confidential

Table of Contents

1	Intr	oduct	ion			1
2	Equ	uipme	nt		***************************************	1
3	Tes	st Setu	p and T	est Plan	*************************	2
	3.1	API F	RP 10F F	Flow Endurance Test (SN-01)	***************************************	2
	3.2	Mech	anical F	ailure Tests		3
	3.3	Flow	Endurar	nce Test – 14-ppg Mud (SN-02)	······································	4
	3.4	Flow	Convers	ice Test – 14-ppg Mud (SN-02)ion Test (SN-03)		5
	3.5	Rehe	arsal Te	sts	······································	5
	3.6	Flow		ests (SN-04 and SN-05)		
		3.6.1 3.6.2	Second 3.6.2.1 3.6.2.2	rige Conversion Test		666
Į.	Tes	t Resi	ults	ests		7
	4.1	API F	RP 10F T	ests		7
		4.1.1	API RP 4.1.1.1 4.1.1.2 4.1.1.3 4.1.1.4 4.1.1.5 4.1.1.6 4.1.1.7	10F Flow Endurance Test (SN-01)		7778999
	4.2	Mech	anical Fa	ailure Tests		2
		4.2.1 4.2.2 Flow	Convers Auto-Fill Enduran	sion Mechanical Failure Test Tube Lower Ball Seat Mechanical Failure Test ce Test – 14-ppg Mud (SN-02)	1 1	2 4 4
		4.3.2	Back-Pr Flow En Back-Pr	Flow Test	1 1 1	5 6 6 7
	4.4		Convers	ion Test (SN-03)	1	8
		4.4.1	Convers	ion Test	1	8
	4.5	Rehea	arsal Tes	sts	······································	9
		Flow S	Surge Te	ests	2	1
		4.6.1	Flow Su 4.6.1.1 4.6.1.2 4.6.1.3	rge Tests (SN-05)		1 1 3 3
			7.0.1.7	DUON I IGSSUIC ICSL		"

	4.6.2.1 4.6.2.2 4.6.2.3 4.6.2.4 4.6.2.5	Inspection	
		Endurance Tests (SN-01)	29
		al Failure Tests	
	V-17		THE STATE OF THE S
		urance Test (SN-02)	
Annex D	Flow Conv	version Test (SN-03)	
Annex E	Rehearsal	Tests	
Annex F	Flow Surge	e Conversion Test (SN-05)	
Annex G	Flow Surge	e through Converted Float Collar (SN-05)	
Annex H	Flow Surge	e Conversion Test (SN-04)	
Annex I	Flow Surge	e through Converted Float Collar (SN-04)	
Annex J	Drawings		
Annex K	Mud Repor	rts	
Annex L	Connection	n Make/Break	
Annex M	Calibration	n	
Annex N	Photograp	ohs .	

1 Introduction

Stress Engineering Services (SES) was contracted by BP to conduct various performance tests on the Weatherford M45AP float collar. The test program was designed to evaluate the performance and design limits of various aspects of the float collar and to document its performance under test conditions similar to what SES believes (based on data provided by BP) to have been the conditions downhole in the Macondo well before, during, and after the cementing operation. As the test program and analysis of the results progressed, SES also recommended that various additional tests should be performed.

The objective of the float collar test program is to provide information to help determine:

- The performance capability of the Weatherford M45AP production casing float collar, and
- The conversion performance of the float collar under both steady-state flow and flow surge conditions.

2 Equipment

The float collar tested in this program is the Weatherford 7" Model M45AP (Figure 1) with dual valve seats including an auto-fill tube with a pre-installed 2" ball 1. The float collar casing is 7" x 32.0 ppf HCQ-125 with Hydril H513 pin and box connections. The float collar assembly is depicted in Weatherford drawing D000401284 Rev A, dated 1/18/2010. The auto-fill tube includes a 2" ball and is reported to convert (i.e., eject the auto-fill tube, thereby releasing the flapper valves to prevent reverse flow) with a flow rate of 5.7–6.8 barrels per minute (bpm) of 12.2-ppg mud with approximately 500–700 psi pressure differential across the auto-fill tube. Based on Weatherford's published conversion equation, the conversion flow rate for 14.0-ppg mud is expected to be 5.3–6.3 bpm.

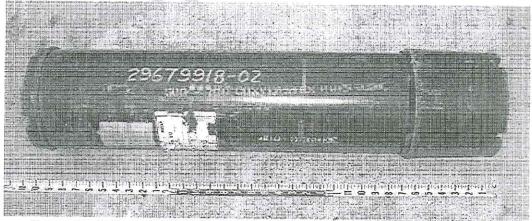


Figure 1: Photograph of Weatherford M45AP Float Collar (with thread protectors)

¹ Float collar description and drawing in document "WFT000526(L0093335):pdf" received via e-mail from Warren Winters of BP on 6/3/2010.

SES received 10 identical M45AP float collars for this test program, one of which was unassembled. The float collars are identified with the Manufacturer's work order number 29679918 and serialized sequentially as -01, -02, etc. Note that only float collars -01 through -05 were tested during this program. SES also received two extra auto-fill tube assemblies.

The reamer shoe is a Weatherford 7" Part Number 1211284. It was located 190 ft below the float collar.² The reamer shoe is not part of the float collar testing scope of work, and no reamer shoes were received by SES.

3 Test Setup and Test Plan

All testing described here was conducted at the SES test facility in Waller, Texas.

Schlumberger provided a pumping truck for the flow loop tests. The pump truck was equipped with two triplex pumps.

MI Swaco provided mud mixing services and a mud mixer. The mixer had a 100-barrel capacity mixing tank with four 1" mixing guns. The skid included a 100-hp pump motor and a centrifugal pump with an average flow capacity of 500–800 gallons per minute (gpm).

The Weatherford float collar is encased within a 2.5 ft long, 7" casing pup joint. SES added a 7" 32 ppf \times 5 ft casing pup joint on each end of the test float collars before transitioning into 2" SCH 160 pipe. In early tests, a pressure transducer was positioned approximately 2.5 ft above and below the float collar pup joint. A temperature probe for measuring mud temperature was attached about 6 ft above the float collar. A flow meter was located downstream from the float collar for measuring flow rate. Hydraulic schematics of the various flow-loop test setups are included in Annex J. Minor changes in the test setup were necessary to meet the objectives of various tests. Variations to the basic test setup, mud content, and flow characteristics are described below in the sections that describe the individual tests.

During testing, all data channels were scanned and recorded at a rate of one scan per second throughout the test. During transient tests with rapidly changing test parameters, the scan and recording rates were increased as noted on the individual tests. Data were recorded using SES's StrainDAQTM software and hardware. The StrainDAQ system comprises National Instruments and SES hardware and software. Calibration documentation for test instruments is included in Annex M.

All tests of the float collar were performed with the float collar set vertically. For each float collar specimen, the float collar and test fixture pup joints were cleaned, doped, and made up to minimum specified torque values for the connection. Make-up charts are included in Annex L.

3.1 API RP 10F Flow Endurance Test (SN-01)

The first flow test with the float collar was designed to evaluate the performance of the float equipment based on the API standard³ for this type of downhole equipment. As required by the API standard, the

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Page 2 Confidential

² "Timeline Animation for 5-25-10 Presentation.ppt" file received from BP.

flow loop was set up with the float collar in the normal vertical orientation. Mud flow was supplied from a Schlumberger pump truck. The mud was mixed by MI Swaco and intended to be weighted to 12.0–12.5 ppg, as well as to meet the requirements of API RP 10F. Since this float collar has a maximum pressure rating of 5000 psi, API prescribes that it meet the requirements for a Category III endurance test. This category defines the duration of the forward- and reverse-flow test periods.

The first phase of the test was to flow in the reverse direction at a flow rate of 3 bpm (126 gpm) for 6 hours. This is intended to simulate running the casing in the hole. The test setup is illustrated in drawing KY1751225-01-01 in Annex J.

The second phase of the test was to flow in the forward (downward) direction through the collar at sufficient flow rate to convert the auto-fill float collar into a flapper check valve. The test procedure was to slowly increase the flow rate in increments of 0.5 bpm until conversion occurred. According to Weatherford published information, the conversion flow rate for 12.0–12.5 ppg mud should be in the range of 5.6–6.8 bpm.

Subsequent to auto-fill tube conversion, a low back-pressure test is required. The back-pressure test consisted of increasing the pressure below the float collar to 100 psi with the line upstream of (above) the float collar open to atmospheric pressure. Back-pressure was then increased to 250 psi and held for 5 minutes. The test setup is illustrated in drawing KY1751225-01-02 in Annex J.

The back-pressure test is followed by forward flowing through the float collar at 10 bpm for 2 hours.

The next phase of this test was flow cycle testing. A sequence consisting of a low back-pressure test followed by flowing for 2 hr at 10 bpm was to be repeated 12 times for a total flow duration of 24 hours.

After the 24-hr flow testing, a final back-pressure test was required. This back-pressure test was to 250 psi for 5 minutes as described above.

Finally, a 5000-psi back-pressure test with a 30-min hold period was completed.

The float collar was then removed from the flow loop, broken out, and visually inspect for damage.

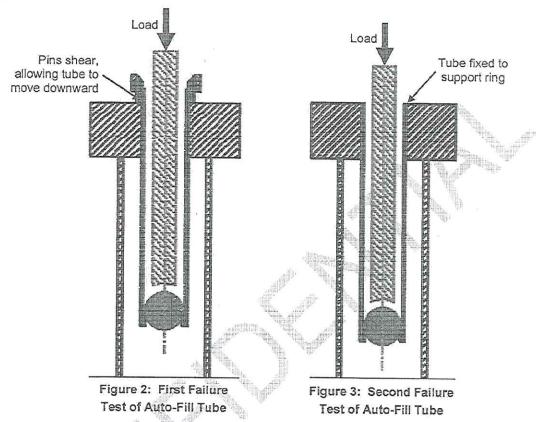
3.2 Mechanical Failure Tests

Two mechanical failure load tests were also performed (not specified by API RP 10). The first test was designed to simulate the conversion of the auto-fill tube. An extra auto-fill tube assembly was used for this test. The shear ring of the auto-fill tube assembly was supported and a mechanical load was to be applied directly to the 2" diameter ball. The load was slowly increased until the four shear screws between the shear ring and tube were observed to shear. The load was to be applied with displacement control at a rate of approximately 0.0002 inches/sec. This test setup is illustrated in Figure 2.

The second mechanical failure load test simulated the condition where the upper shear pins do not shear (for whatever reason) and the bottom end of the auto-fill tube is loaded. This test simulates a different mode of failure that might occur and leave the valve flappers locked open. The auto-fill tube from the previous failure test was supported at its upper end by bonding a support ring to the tube. A mechanical

³ API RP 10F, Recommended Practice for Performance Testing of Cementing Float Equipment, Third Edition (April 2002).

load was then to be applied directly to the 2" ball and slowly increased until failure occurred. As before, load was applied with displacement control at a rate of 0.0002 inches/sec. This test setup is illustrated in Figure 3.



3.3 Flow Endurance Test – 14-ppg Mud (SN-02)

The second flow endurance test was similar to the API RP 10F test (see Section 3.1), except that mud weight was increased to 14.0 ppg and the flow times were set to be more representative of the Macondo well conditions. The first part of this test was reverse flow through the float collar at 1.5 bpm for a duration of 8 hours. The test setup is illustrated in drawing KY1751225-01-03 in Annex J.

The second part of this test was a conversion test. Forward flow was begun through the float collar and slowly increased in increments of near 0.5 bpm until the float collar converted. The test setup is illustrated in drawing KY1751225-01-04 in Annex J.

Subsequent to the conversion test, a back-pressure test at 40 psi was to be performed, followed by a 6-hr flow test. During the flow test, flow was paused and a back-pressure test performed after each 2 hours.

3.4 Flow Conversion Test (SN-03)

This conversion test was conducted with 14.0-ppg mud. The difference in this test, as compared to the test with float collar SN-02 above, is that a choke was installed downstream of the float collar to help prevent cavitation of the flow through the float collar (which was believed to have occurred in previous tests). The choke was adjusted so that the back-pressure created by the choke was greater than the flow resistance through the float collar. The test setup is illustrated in drawing KY1751225-01-05 in Annex J. A drawing of the choke is included in Annex J.

3.5 Rehearsal Tests

The objective of the rehearsal testing was to fine-tune the setup and test procedure with flow surges prior to testing an actual float collar. These tests were conducted on a simulated auto-fill tube.

3.6 Flow Surge Tests (SN-04 and SN-05)

3.6.1 Flow Surge Conversion Test

The objective of this conversion test was to evaluate whether the float collar will convert when it is subjected to a surge (rapid increase) in flow resulting from the clearing of a blockage in the flow path. The setup included a rupture disk downstream of the float collar designed to fracture when subjected to a pressure differential of near 3000 psi. To supply the flow surge, a 262-gal accumulator was included in the flow circuit upstream of the float collar. Additionally, a 385-gal accumulator was added downstream of the rupture disk to act as a reservoir (sink) for the flow. To ensure that the pressurization rate of the accumulators was sufficiently slow to enable the test operator time to respond if needed for safety purposes, both accumulators were to first be precharged to approximately 500 psi with nitrogen. This test setup is illustrated in drawing KY1751225-01-06 in Annex J. A drawing of the rupture disk is included in Annex J.

During this test, the pump truck continuously pumped fluid at a rate of 1.0 bpm. Flow was blocked by the rupture disk, and pressure continued to build in the float collar and upstream accumulator until the pressure exceeded the fracture pressure of the rupture disk. After the disk fractured, a flow surge was sent through the float collar.

The test plan indicated that, if conversion of the float collar occurred during the flow surge, the same test was to be run on an additional float collar to confirm repeatability.

The sequence for flow surge testing was as follows:

- Close the ball valve to isolate the upsteam accumulator.
- Fill the flow circuit from the pump truck to the rupture disk with mud; vent all trapped air.
- Precharge both accumulators to approximately 500 psi with nitrogen gas.
- Slowly increase the pressure in the flow circuit to near 500 psi. Open the ball valve to connect the upstream accumulator to the flow system.

- Begin flow from the pump truck at a steady rate of 1.0 bpm. Continue until the rupture disk fractures. Continue pumping for an additional 15 seconds.
- Bleed pressure from both accumulators.
- Perform a back-pressure test on the float collar to verify that conversion has occurred.

3.6.2 Second Flow Surge Test

The next test was to evaluate the durability of the closed flapper valve and flapper hinge when subjected to a flow surge event subsequent to conversion (that is, a second flow surge). The test was to be run with two setups: (1) with the blockage placed downstream of the float collar and (2) with the blockage placed upstream of the float collar.

3.6.2.1 Second Flow Surge with Blockage Downstream

The procedure for the second flow surge test with a blockage placed downstream of the converted float collar was to be identical to the initial flow surge conversion test (see Section 3.6.1). The test setup is illustrated in drawing KY1751225-01-08 in Annex J.

3.6.2.2 Second Flow Surge with Blockage Upstream

A test was also conducted with a second flow surge with a blockage placed upstream of the converted float collar. The procedure for this testing was to be as follows:

- Close the ball valve below the float collar.
- Fill the float collar chamber between the upstream rupture disk and downstream ball valve with 14.0-ppg mud from above the float collar while purging the float collar chamber of air.
- Close the ball valve to isolate the upstream accumulator. Pressurize the upstream accumulator to 500 psi.
- Pressurize the float collar chamber to 200 psi.
- Pressurize the downstream accumulator with nitrogen to 200 psi and open the downstream ball valve.
- Continue to pressurize the downstream accumulator with nitrogen to 500 psi.
- Elevate the float collar to vertical position for testing. (Prior to flow testing, the float collar is stored horizontally to facilitate the setup of instrumentation.)
- Slowly pressurize the upstream flow line with 14.0-ppg mud to 500 psi.
- Open the ball valve to the upstream accumulator to connect it to the test system.
- Flow mud from the pump truck at the rate of 1.0 bpm until the rupture disk fractures. Continue pumping for an additional 15–30 seconds. Stop pumping and bleed all pressure from system.

The test setup for this test is illustrated in drawing KY1751225-01-09 in Annex J.

4 Test Results

4.1 API RP 10F Tests

4.1.1 API RP 10F Flow Endurance Test (SN-01)

The API flow endurance testing was conducted using Weatherford M45AP float collar SN 29679918-01 and was performed between 22 July and 2 August 2010 at the SES test facility in Waller, Texas. Charts for each phase of the API endurance test are included in Annex A.

4.1.1.1 Reverse Flow Test

Reverse flow testing was begun with float collar SN-01 on 22 July 2010. The mud used for the API flow endurance testing was a nominal 12.2-ppg mud with 2%–4% sand concentration per API RP 10F. The mud mix met the API requirements with the exception of the grain size of the sand. While API specifies a 70–200 mesh (0.075–0.211 mm diameter), the sand available ranged from about 10–325 mesh (0.044–2.00 mm) with a mean of about 50 mesh (0.297 mm). Rheology of the mud was measured before and after each test. The mud test reports are included in Annex K.

The duration of the reverse flow was 6 hr 3 min. The average recorded flow rate from the flow meter on the Schlumberger pump truck was 3.06 bpm. The SES flow meter ceased to function about 70 minutes into the test. Up until the point the flow meter failed, SES had observed excellent agreement between the SES and Schlumberger flow meters. Subsequent to the 6-hr test, the failed SES meter was inspected. It was discovered that a clump of mud may have been lodged in the meter turbine.

During the first 3 hours of the test, the differential pressure across the float collar was only about 3 psi. During the last 3 hours, the differential pressure seemed to trend to about 2 psi in the opposite direction. However, it should be noted that pressure changes of this magnitude were less than the range of accuracy of the pressure transducers. The pressure transducers upstream and downstream of the float collar were calibrated for 5000 psi within \pm 0.5% of full scale. This indicates that their accuracy is \pm 25 psi.

The data recorded for this test are shown graphically in Figure A-1 in Annex A. Make-up and break-out data for the float collar connections for all tests are included in Annex L. Calibration certificates for transducers and instrumentation are included in Annex M. Photographs of the setup for reverse-flow testing are included in Annex N (Photographs 1 through 6).

4.1.1.2 Flow Conversion Test

The flow conversion test of float collar SN 29679918-01 was conducted on 23 July 2010. The test plan was to steadily increase the flow rate through the float collar in small increments until conversion occurred. However, control of the pumping rate for this test was not as precise as desired because the pump from the mixer was set to feed the pump truck. The float collar was observed to convert during a an interval where the rate was being increased. The recorded flow rate remained steady during this period at 2.7 bpm. The flow meter exhibits some inherent damping of the flow response and possibly

some internal signal smoothing, resulting in a delay in the signal response from transient flow changes. Prior to conversion, the upstream pressure was 136 psi and downstream pressure was 19 psi. As conversion was occurring, three upstream pressure spikes were recorded at pressure levels of near 450 psi. Immediately after these pressure spikes, the upstream pressure fell to the level of the downstream pressure (about 20 psi), indicating that conversion had occurred.

Figure 4 shows pressures and flow rates during the conversion. Additional charts for the conversion test are presented in Figures A-2, A-3, and A-4 in Annex A. Photographs 7 through 11 in Annex N show the float collar after conversion.

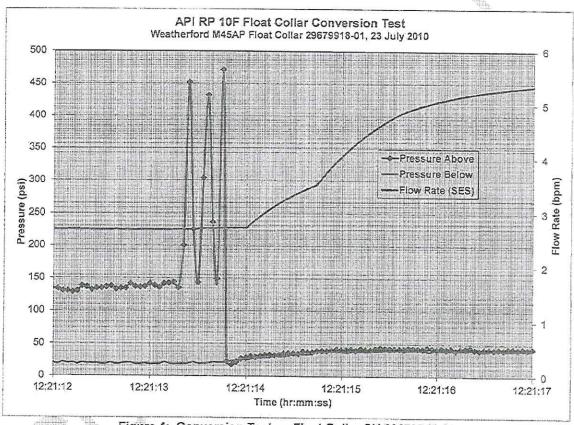


Figure 4: Conversion Test on Float Collar SN 29679918-01

4.1.1.3 Low-Pressure Back-Pressure Test

On 23 July 2010, the API 10F low-pressure back-pressure test was run on float collar SN 29679918-01 immediately after the conversion test. During the first 5 minutes of the hold period, the rate of pressure drop was 4.4 psi/min. The hold was continued for a total of 24.5 minutes. Over this interval, the average rate of pressure drop was 3.7 psi/min. Note that API does not define an allowable leak rate for the back-pressure test. The data for this test are shown in Figure A-5 in Annex A.

At the completion of this test, the float collar connection was broken out and the converted auto-fill tube and 2" ball removed. There was no apparent damage to any parts resulting from the conversion (other

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Page 8 Confidential

than the shear pins, which had sheared as expected). Dimensional inspection of the auto-fill tube and the ball showed that all features were within the tolerances shown on Weatherford's manufacturing drawings.

4.1.1.4 Flow Cycle Testing

On 26 July 2010, the API 10F flow cycle testing was begun on float collar SN 29679918-01 with cycles of 2-hr forward flow at 10 bpm followed by a low-pressure back-pressure test. On the first day, three cycles of flow and back-pressure testing were completed. The flow intervals were maintained at 10 bpm as specified. During the 5-min holds with back-pressure, the pressure decline rates were 6.1 psi/min, 11.2 psi/min, and 22.1 psi/min, respectively. Data from these tests are shown in Figures A-6, A-7, A-8, A-9, and A-10 in Annex A.

On 27 July 2010, flow cycle testing was continued. Flow cycle 4 and its associated back-pressure test were completed as specified. The pressure decline rate during the 5-min hold after the back pressure test following flow cycle 4 was 12.5 psi/min. During flow cycle 5, the pump truck malfunctioned after about 22 minutes and had to be replaced. Flow cycle 5 was paused and resumed at a later date. Results from these tests are shown in Figures A-11 and A-12 in Annex A.

4.1.1.5 Investigation Test – Back-Pressure Decline Rate

On 28 July 2010, the upper float collar box connector was broken out to allow observation of the float collar valves during additional back-pressure testing to attempt to discover the source of the leakage. Due to the cement (part of the float collar design) located above the upper valve in the float collar and the distance between the two valves of the float collar, the location of the leakage could not be determined conclusively during these tests. It was noted by the team that leakage of a given volume of fluid would produce a much larger drop in pressure in this test setup than would be expected in the field. This behavior is due to the relatively small total fluid volume in the test setup. Results from these investigation tests are shown in Figures A-13 and A-14 in Annex A.

4.1.1.6 Flow Cycle Testing (Resumed)

On 29 July 2010, the float collar connection was made up and flow cycle testing resumed. The balance of the 2-hr flow test for flow cycle 5 was completed along with its back-pressure test. Flow cycle 6 and its back-pressure test were also completed successfully. For flow cycles 5 and 6, the pressure decline rates during the 5-min holds with back pressure were 16.8 psi/min and 22.5 psi/min, respectively. Results from these tests are shown in Figures A-15, A-16, and A-17 in Annex A.

On 30 July 2010, flow cycles 7, 8, and 9 were completed. During flow cycle 7, the SES flow meter apparently failed. Prior to that time, the team had compared flow rates measured by the SES flow meter to those by the SLB flow meter on the pump truck, and had noted excellent agreement. Therefore, testing was continued with only the SLB flow meter being recorded. The pressure decline rate for the back-pressure tests after flow cycles 7, 8, and 9 were 18.4 psi/min, 31.1 psi/min, and 28.7 psi/min, respectively. Results from these tests are shown in Figures A-18 through A-23 in Annex A.

On 2 August 2010, flow cycles 10, 11, and 12 were completed successfully. The pressure decline rates during the 5-min holds with back-pressure were 9.6 psi/min, 23.2 psi/min, and 27.3 psi/min, respectively.

After the 12 flow cycles and back-pressure tests were completed, a back-pressure test to 5000 psi was specified in the test plan. Accordingly, back-pressure was increased to 5000 psi and held for 30 minutes. The pressure decline rate during the high-pressure test was 31.8 psi/min.

At the conclusion of the 30-minute hold period, the team performed a simple pressure maintenance test to attempt to quantify the leakage volume rate. Back-pressure was again increased to 5000 psi. The pump was set to continue pumping fluid into the float collar such that a relatively constant pressure was maintained for about 8 minutes. Based on the pump stroke rate required to maintain pressure (~4 strokes/min) and known fluid volume per pump stroke (0.20 in³/stroke), the leakage rate from the float collar at 5000 psi was estimated as about 0.8 in³/min. The pump used for the back-pressure tests was a Maximator model MTPS60-W-L300-2H-2OUT-C. Results from flow cycles 10–12 and the final back-pressure test are shown in Figures A-24 through A-29 in Annex A.

Table 1 summarizes the data from the 12 flow cycle tests. Total flow time was 24.4 hr at an average flow rate of 10.0 bpm. The average fluid temperature during the flowing time was 150°F.

Table 2 and Figure 5 summarize the pressure decline rate during back-pressure testing of Float Collar SN 29679918-01.

4.1.1.7 Inspection

Visual inspection of the float collar subsequent to the flow cycle endurance testing did not reveal any obvious wear. However, the visual inspection was limited since the valves are still enclosed within the 7" casing. Photographs 81 and 82 (Annex N) show float collar SN 29679918-01 after testing.

Dimensional inspection was limited to the tested auto-fill tube and ball. All critical dimensions met Weatherford's manufacturing drawing requirements.

Table 1: Summary of Flow Cycle Testing

	Start	/ Stop			Average				
Flow Cycle	Date	Time	Duration	Flow Rate	Pressure Above	Pressure Below	Temp	Data File	
	mm/dd/yr	h:mm:ss	hr	bpm	psi	psi	°F	## 1	
1	7/26/10	10:01:45	2.02	9.9	116	80	126	4004070 0444	
1000	7/26/10	12:02:50	2.02		110			1601072-01-4	
2	7/26/10	12:42:18	2.02	9.9	91	77	148	1601070.01.1	
	7/26/10	14:43:23	2.02		91			1601072-01-4	
3	7/26/10	15:01:46	2.02	10.0	76	73	155	1601072-01-4	
	7/26/10	17:03:00	2.02						
4	7/27/10	8:03:50	2.03	10.0	00	70	137	1601072-01-5	
**************************************	7/27/10	10:05:32	2.00	10.0	83	78			
5	7/27/10	11:02:52	2.12	10.0	85	74	142	1004070.04.5	
	7/27/10	11:24:22						1601072-01-5	
	7/29/10	12:06:06						1601072-01-6	

	Start	/ Stop	1		Ave	rage		Data File
Flow Cycle	Date	Time	Duration	Flow Rate	Pressure Above	Pressure Below	Temp	
	mm/dd/yr	h:mm:ss	hr	bpm	psi	psi	°F	
*:	7/29/10	13:51:59				2000	Control of the contro	Ann Ewelles Miles
6	7/29/10	14:16:37	2.02	10.0	80	70		
ŭ	7/29/10	16:17:31	2.02	10.0	80	72	157	1601072-01-6
7	7/30/10	07:38:08	2.03	10.0	85	00	nia	
***	7/30/10	09:39:42	2.03	10.0	65	80	147	1601072-01-7
8	7/30/10	09:56:30	2.01	10.1	89	70		The service of the se
	7/30/10	11:57:23	2.01	10.1	89	76	160	1601072-01-7
9	7/30/10	12:39:43	2.03	10.1	82	342	VOICE TO THE PARTY OF THE PARTY	
	7/30/10	14:41:35	2.00	10.1	02	.57	162	1601072-01-7
10	8/2/10	10:36:16	2.02	10.1	88	79	139	1601072-01-8
	8/2/10	12:37:30	2.02			79		
11	8/2/10	13:02:00	2.03	10.1	-12 Table 1	**************************************		
	8/2/10	15:03:47	2.00	10.1	85	75	157	1601072-01 - 8
12	8/2/10	15:30:14	2.05	10.0	92	74		
	8/2/10	17:33:14	2.00	10.0	83	71	166	1601072-01-8
1	otal / Averag	je j	24.40	10.0	86.9	74.2	150	

Table 2: Summary of Back-Pressure Tests during Flow Cycling

	Date		Beginning			Ending	Decline	The second secon	
Cycle		Time	Pressure	Temp	- Time	Pressure	Temp	Rate	Data File
	mm/dd/yr	h:mm:ss	psi	°F :	h:mm:ss	psi	°F	psi/min	
1	7/23/10	12:39:24	274	114	12:44:24	252	113	4.4	1601072-01-3
2	7/26/10	12:29:56	287	131	12:34:56	257	130	6.1	1601072-01-4
3	7/26/10	14:52:13	305	153	14:57:13	249	150	11.2	1601072-01-4
4	7/26/10	17:13:35	388	128	17:18:35	278	124	22.1	1601072-01-4
5	7/27/10	10:45:11	279	129	10:50:11	217	127	12.5	1601072-01-5
6	7/29/10	14:02:11	345	151	14:07:11	261	148	16.8	1601072-01-6
7	7/29/10	16:32:35	349	148	16:37:35	237	145	22.5	1601072-01-6
8	7/30/10	9:45:32	376	151	9:50:32	284	146	18.4	1601072-01-7
9	7/30/10	12:09:02	365	155	12:14:02	210	151	31.1	1601072-01-7
10	7/30/10	14:54:09	351	155	14:59:09	208	151	28.7	1601072-01-7
11	8/2/10	12:49:30	339	144	12:54:30	291	141	9.6	1601072-01-8

Stress Engineering Services, Inc.

Page 11 Confidential

	Date	Beginning				Ending	Decline	dan Alam Salah dan sa	
Cycle		Time	Pressure	Temp	Time	Pressure	Temp	Rate	Data File 1601072-01-8
	mm/dd/yr	h:mm:ss	psi	°F	h:mm:ss	psi	°F	psi/min	
12	8/2/10	15:13:42	359	156	15:18:42	243	153	23.2	1601072-01-8
13	8/2/10	17:38:09	333	165	17:43:09	197	160	27.3	1601072-01-8
14	8/2/10	17:47:38	5084	157	18:17:38	4131	135	31.8	1601072-01-8

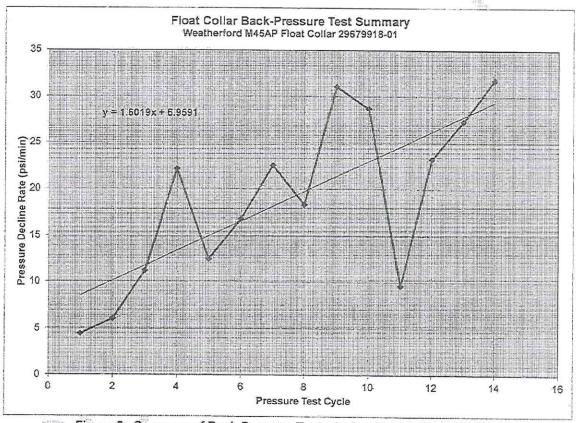


Figure 5: Summary of Back-Pressure Tests during Flow Cycling of SN-01

4.2 Mechanical Failure Tests

4.2.1 Conversion Mechanical Failure Test

The mechanical failure testing of the auto-fill tube was conducted in a 20,000 lb (20 kip) MTS load frame on 23 July 2010. Prior to conversion of the float collar, the auto-fill tube is maintained in position by four shear screws located 0.50" below the upper end of the tube. Load was applied to the 2" ball at the bottom of the auto-fill tube (see Figure 2) at a constant displacement rate of 0.000083 in/sec. The peak load observed was 2420 lb at an associated displacement of 0.112". A second slight drop in load (~1660 lb) was observed at a displacement of 0.150"; a third slight drop in load (~840 lb) occurred at a displacement of 0.163". Subsequent to these drops in load, the frictional load of the tube dragging

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Page 12 Confidential

through the shear ring after shearing off the screws remained in the range of 550–670 lb for an additional displacement of about 0.21". The load then fell to zero after a total displacement of the auto-fill tube of near 0.6". Results from this test are shown in Figure 6 and in Annex B. Figure 7 shows the auto-fill tube, shear pins, and the shear ring after conversion of the auto-fill tube. Additional photographs of the conversion failure test are presented in Annex N (Photographs 12–17).

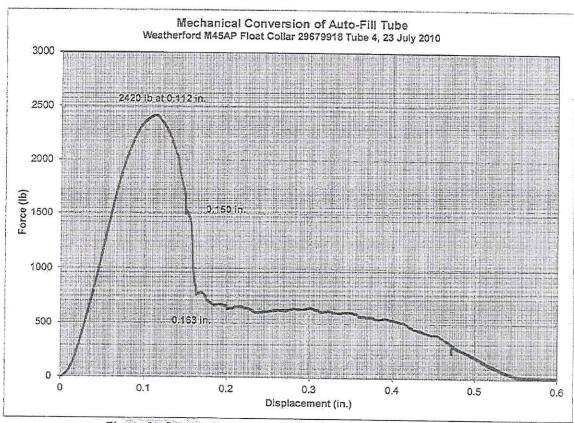


Figure 6: Conversion Mechanical Failure Test of Auto-Fill Tube

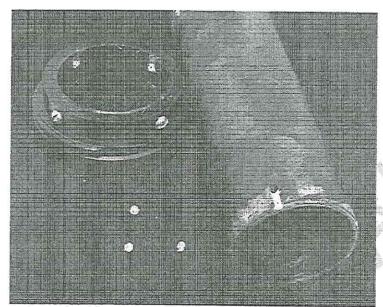


Figure 7: Photograph of Auto-Fill Tube after Mechanical Conversion Test

4.2.2 Auto-Fill Tube Lower Ball Seat Mechanical Failure Test

For the second failure test, the top of the auto-fill tube used for the first failure test was bonded to a metal ring using Loctite® Hysol® E-120P epoxy⁴. The tube and ball were mechanically loaded using the same load frame as the previous test. For this test, load was applied directly to the 2" ball at a displacement rate of 0.000166 in/sec. The peak load was 7869 lb at a displacement of 0.161". After peaking, the load immediately dropped to zero. The test article was then disassembled, and visual inspection revealed that the 2" ball had shattered. The test mandrel used to load against the ball provided a line contact loading between the ball and mandrel. This load condition may have contributed to the shattering of the ball. Results from this test are shown in Figure B-2 in Annex B.

It was found that, when directly loading the bottom of the auto-fill tube through the 2" ball, the load to fail the ball was at least 3.25 times greater than the load to shear the shear screws.

Dimensional inspection of the auto-fill tube, shear ring, and ball showed that all features met Weatherford's manufacturing drawings. Additional photographs of the lower ball seat mechanical failure test are presented in Annex N (Photographs 18–22).

4.3 Flow Endurance Test - 14-ppg Mud (SN-02)

The flow endurance testing on float collar SN 29679918-02 was similar to the API endurance testing on SN 29679918-01 (see Section 4.1) except with the test parameters adjusted to more closely match the mud and drilling conditions of the Macondo well. Mud weight was increased from 12.0 to 14.0 ppg. The sand was also changed with the intent of more closely matching the API RP 10F requirements for 70–200 mesh. All other mud parameters remained the same as the previous test. Data from the mud reports are included in Annex K.

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4.3.1 Reverse Flow Test

Reverse flow testing on the float collar was completed on 3 September 2010. For this test, a choke was added in the flow loop immediately above the float collar to provide downstream flow resistance. The choke was set to 72/64" for this test. The flow loop setup is illustrated in drawing KY1751225-01-03 in Annex J.

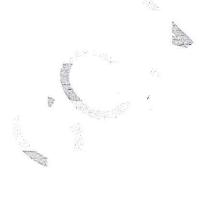
Reverse flow was maintained at a nominal flow rate of 1.5 bpm for 8 hours. A rain storm occurred during this test and the electrical connector for the pressure transducer became wet. As a consequence, the transducer signal was lost for a couple of hours. During the rain, mud temperature also dropped from ~150° to ~140°F. These changes were not considered critical, and testing was continued for the 8-hour period. Charts illustrating this test are included in Annex C in Figures C-1 through C-5. The test setup for these reverse-flow tests is shown in Photographs 23–26 in Annex N.

4.3.2 Conversion Test

The flow loop was then re-configured for the float collar conversion test (as illustrated in drawing KY1751225-01-04 in Annex J) with a choke placed below the float collar. The same choke setting (72/64") was used, as well as the same mud.

The conversion test was run on 8 September 2010. The team attempted to slowly increase the flow rate from the pump truck until the float collar converted. However, control of the flow rate was less precise than desired because the pump from the mixer was flowing through and over-powering the pump truck. As conversion was occurring, the flow resistance decreased, which resulted in an increased flow rate from the pump truck.

The test data show that the float collar converted at a flow rate of near 3.82 bpm with a differential pressure of 305 psi. Charts illustrating this test are included in Annex C in Figures C-6 through C-8. Figure C-9 in Annex C shows the flow resistance pressure versus flow rate from this conversion test.



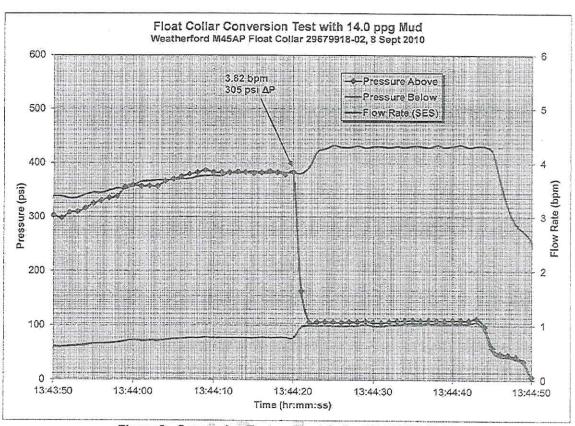


Figure 8: Conversion Test on Float Collar SN 29679918-02

After these data were reviewed, it was believed that cavitation may have still been occurring downstream of the auto-fill tube, which could contribute to a lower conversion flow rate than expected. Therefore, the choke was adjusted to provide additional back-pressure during conversion in the next float collar test.

4.3.3 Back-Pressure Test

A back-pressure test was performed on the float collar with a 5-min hold at 40 psi. Pressure below the float collar was observed to drop about 2 to 3 psi/min over the 5-min hold. After the hold, SES attempted to measure the approximate volume of fluid lost during the hold. The system pressure was recharged back to 40 psi while the number of pump strokes was counted. Calculation indicated that the float collar lost about 0.2 in³ of fluid over the hold period. A chart illustrating this back-pressure test is included in Annex C in Figure C-10. A summary of the back-pressure test results is presented in Table 3.

4.3.4 Flow Endurance Test

Following the back-pressure test, 14.0-ppg mud was pumped through the converted float collar SN 29679918-02 at a flow rate of approximately 4.1 bpm for 2 hours. Pressure above and below the float collar remained in the range of 90–100 psi throughout the test. Results from this endurance test are included in Annex C in Figure C-11. A summary of the flow testing is included in Table 4.

4.3.5 Back-Pressure Test

Following the flow endurance test, another back-pressure test was performed on the float collar SN 29679918-02 at 40 psi and 250 psi. The float collar appeared to be leaking approximately 0.8 in³ of fluid over the 5-min hold periods at 40 psi and at 250 psi. Note that API RP 10F does not specify a leakage criteria for back-pressure tests. Data from these tests are shown in Annex C in Figure C-12. A summary of these results is listed in Table 3.

4.3.6 Inspection

Visual inspection of the float collar SN 29679918-02 subsequent to the flow endurance testing did not reveal any obvious wear or damage. However, visual inspection was limited since the valves are still enclosed within the 7" casing. Photograph 83 (Annex N) shows float collar SN 29679918-02 after testing.

Dimensional inspection was limited to the auto-fill tube and ball. Inspection showed that all critical dimensions met Weatherford's manufacturing drawing requirements.

Subsequent to all testing, the auto-fill tube and ball were shipped to the Presidential Oil Spill Commission. The float collar was then sectioned, photographed, and inspected. Photographs taken after sectioning are included in Annex N (Photographs 87–113).

Table 3: Summary of SN 29679918-02 Back-Pressure Tests

	Date	Date Beginning				Ending.	Decline			
Cycle	and the second of the second	Time	Pressure	Temp	Time	Pressure	Temp	Rate	Data File	
	mm/dd/yr	h:mm:ss	psi	°F	h:mm:ss	psi	°F	psi/min		
	9/8/10	14:19:29	39	107	14:24:29	27	105	2.4		
1	9/8/10	14:25:11	44	105	14:30:11	30	103	2.8	1601072-02 BackPress1	
	9/8/10	14:31:57	47	103	14:36:57	37	102	2.0		
2	9/8/10	17:08:35	41	118	17:13:35	4	113	7.5	1601072-02	
_	9/8/10	17:19:17	252	110	17:24:17	165	107	17.4	BackPress1	
	9/9/10	13:46:24	40	132	13:51:24	27	129	2.6	1601072-02 BackPress2	
3	9/9/10	13:53:46	265	126	13:58:46	139	123	25.2		
	9/9/10	14:03:03	4966	121	14:05:03	4838	119	25.7	DackFlessz	

Table 4: Summary of SN-02 Flow Testing

Flow Cycle	Start	Stop	Time					
	Date	Time	Duration	Flow Rate	Pressure Above	Pressure Below	Temp	Data File
	mm/dd/yr	h:mm:ss	- hr	bpm	psi	psi	°F	
Rev	9/8/10	9:13:21	8.07	1.5	7	11	143	1601072-02 Reverse Flow
	9/8/10	17:17:30	0.07					
1	9/8/10	14:50:06	2.04	4.5	95	00	400 -	1601072-02
	9/8/10	16:52:44	2.04			90	126	BackPress1
2	9/9/10	11:12:34	2.10	4.1	95	04	142	1601072-02
-	9/9/10	13:28:38	2.10			91		BackPress2

4.4 Flow Conversion Test (SN-03)

The third flow conversion test was conducted with SN 29679918-03 on 10 September 2010. This test was similar to the previous conversion test (with SN 29679918-02) except that the downstream choke was adjusted to provide additional flow resistance and the pump truck was set to draw from the reservoir on the pump truck rather than from the mixer supplying the pumps. The flow downstream of the float collar was further choked to prevent cavitation across the float collar (which was believed to be occurring). Pumping from the reservoir on the pump truck enabled more precise control of the flow rate.

Prior to testing this float collar, testing of the mud revealed that the sand was coarser than had been specified. The sieve test showed that the sand was about 40–230 mesh (0.063–0.420 mm diameter). The sand was then sifted to eliminate the coarsest sand. Subsequent testing indicated that the sand was then about 70–270 mesh (0.053–0.210 mm diameter). Data from the mud reports are included in Annex K. Photographs of a typical test setup similar to that used for these tests are shown in Annex N (Photographs 27–47).

4.4.1 Conversion Test

The flow loop setup used for the conversion test is illustrated in drawing KY1751225-01-05 in Annex J. The downstream choke was adjusted to 50/64" to provide additional and more stable flow resistance. Due to the dynamic nature of the conversion event, data were recorded at a higher scan rate of 77 scans per second during this test.

Flow rate through the float collar was slowly increased in increments of 0.5 bpm until conversion occurred. With the increased choke resistance downstream of the float collar (to suppress cavitation), pressures above and below the float collar were higher than in previous conversion tests.

Conversion occurred at a flow rate of 5.71 bpm with 14.0-ppg mud (Figure 9). Upstream pressure was 1626 psi and downstream pressure was 1105 psi, for a differential pressure of 521 psi. Weatherford's flow conversion equation predicts that, with a flow rate of 5.71 bpm and a mud density of 14.0 ppg, nominal differential pressure at conversion would be 575 psi.

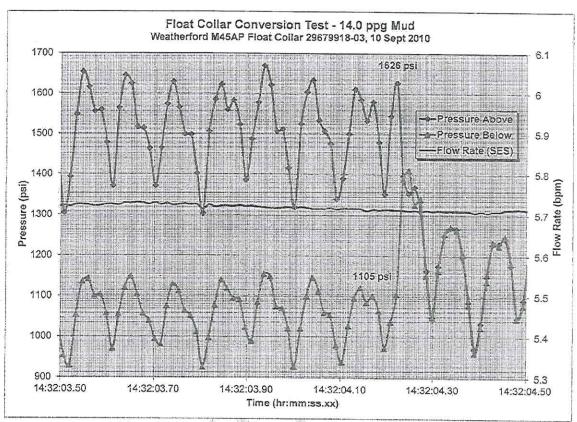


Figure 9: Conversion Test on Float Collar SN 29679918-03

4.4.2 Inspection

Visual inspection of float collar SN 29679918-03 subsequent to the flow conversion testing did not reveal any obvious wear or damage. However, the visual inspection was limited since the valves are still encased within the 7" casing. Photograph 84 (Annex N) shows float collar SN 29679918-03 after testing.

Dimensional inspection was limited to the tested auto-fill tube and ball. Inspection indicated that all critical dimensions met Weatherford's manufacturing drawing requirements.

4.5 Rehearsal Tests

Prior to conducting the first flow surge test on a float collar, SES designed and constructed a special tool that simulates an auto-fill tube in a float collar prior to conversion. This simulated float collar tool was designed to allow evaluating the differential pressure across the tool while flowing through the tube. It also provided the opportunity for conducting preliminary testing to evaluate the test setup for the blockage tests without having to destroy a float collar. This special test tool is illustrated in drawing KY1751225-02 in Annex J and in Photographs 48–50 in Annex N.

Initial testing of the simulated float collar included steady-state flow testing similar to the conversion testing of float collar SN 29679918-03. Rehearsal testing was completed on 30 September and 1

October 2010. With 14.0-ppg mud, the flow rate was slowly increased in approximately 0.5 bpm increments up to near 7 bpm while pressure was recorded upstream and downstream of the tool.

The first test was run without a choke in the flow circuit. The second test included a choke downstream of the simulated float collar with a choke setting of 46/64". Results from the first test are shown in Figures E-1 and E-2 in Annex E; results from the second test are shown in Figures E-3 and E-4 in Annex E. Photographs of the test setup and are presented in Annex N (Photographs 27–50).

The flow resistance pressure versus flow rate from these two special tests compares favorably to results from previous conversion tests on actual float collars. Results for the tests on the simulated float collar and during of the previous three float collars are compared to the predicted resistance from Weatherford data in Figure 10.

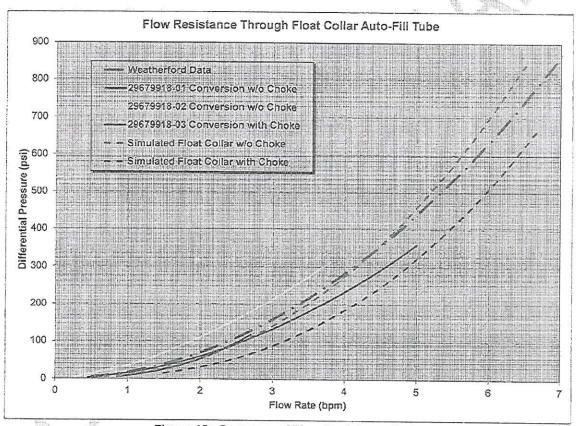


Figure 10: Summary of Flow Resistance Tests

The third test on the simulated float collar was designed to evaluate the test setup for the flow surge tests, during which a sudden clearance of blockage downstream of the float collar will generate a rapid increase in flow through the float collar. A rehearsal of this test was desired prior to testing on an actual float collar. A rupture disk with a nominal pressure rating of 2928 psi was placed downstream of the simulated float collar. A 262-gal accumulator was placed upstream of the simulated float collar and a 385-gal accumulator was placed downstream of the rupture disk. A schematic of this test setup is shown in drawing KY1751225-01-06 in Annex J with the simulated tool being used instead of a float collar.

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Page 20 Confidential

Both accumulators were precharged with nitrogen gas to about 500 psi prior to testing. The 14.0-ppg mud was flowed at a rate of 1.0 bpm from the pump truck into the upstream accumulator until pressure built up to the fracture pressure of the rupture disk. After the disk fractured, a sudden flow surge was generated through the simulated float collar auto-fill tube, with a peak flow of approximately 8 bpm. Results from this rehearsal flow surge test are shown in Figures E-5 through E-9 in Annex E.

This flow surge test rehearsal clearly demonstrated that a flow surge could be generated with a peak flow rate that was equal to or greater than the steady-state flow rate necessary for conversion of the float collar, but less than the modeled peak flow rate of the Macondo well. The flow surge tests were then undertaken to document whether this exhibited flow surge would force conversion of the float collar.

4.6 Flow Surge Tests

The Weatherford float collar is designed to convert as a result of downward force on the auto-fill tube and ball causing the pins to shear, which permits the auto-fill tube to flow out of the float collar valves and allows the flappers to close. This force on the auto-fill tube is generated by hydrodynamic resistance caused by flow through the tube and out of the two holes near the bottom of the tube. It is believed that this flow and force can be generated from either steady-state flow or from a flow surge. A flow surge can be created when pressure is built up in the float collar due to a blockage and is suddenly released, causing a rapid increase in flow (a surge). This flow-surge scenario is the basis for this series of tests. According to the test plan, if conversion was observed to occur from the first flow surge test, the same test was to be run on an additional float collar to verify repeatability.

Flow surge tests were conducted on Weatherford M45AP float collar SN 29679918-04 and SN 29679918-05 between 8–20 October 2010.

4.6.1 Flow Surge Tests (SN-05)

4.6.1.1 Flow Surge Conversion Test

The first flow surge test used Weatherford float collar M45AP SN 29679918-05. The test fluid was 14.0-ppg mud. A rupture disk was included in the flow loop downstream of the float collar with a stated fracture pressure of 2928 +201/-147 psi. Both the upstream and downstream accumulators were initially precharged with nitrogen to about 500 psi. The precharge gas from the downstream accumulator was blocked by the downstream side of the rupture disk. This setup results in an effective fracture pressure of the rupture disk of approximately 2928 + 500 = 3428 psi. The test setup is shown schematically in drawing KY1751225-01-06 in Annex J. Photographs of the burst disk assembly are presented in Annex N (Photographs 57–60)

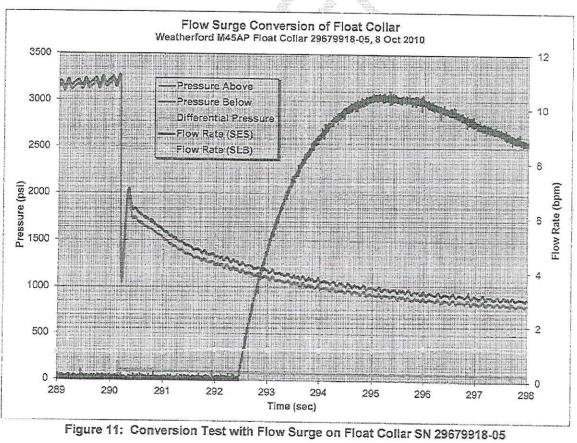
Data were recorded at a high acquisition rate of 1000 scans per second throughout the test. This scan rate was higher than the previous conversion test to ensure that all transient events were captured. The flow rate from the Schlumberger pump truck was recorded at the standard rate of 1 scan per second.

After both accumulators were precharged, the flow loop through the float collar down to the rupture disk was slowly pressurized with mud to 500 psi. The ball valve on the upstream accumulator was then opened to connect it to the system. The pump truck then started flowing the mud at a constant flow rate of about 1.0 bpm throughout the test period. The flow from the pump initially accumulated in the upstream accumulator and increased system pressure gradually until the rupture disk fractured. At that

instant, the high pressure from the upstream accumulator forced a flow surge through the float collar until the upstream and downstream pressures equalized.

The rupture disk fractured at a pressure of approximately 3036 psi, as measured from the downstream pressure transducer at the float collar. The float collar was observed to convert during the resulting flow surge. Figure 11 shows recorded pressures above and below the float collar at the time of conversion. The above and below pressures peaked at 3232 psi and 3036 psi, respectively, at time 290.2 seconds, at which point the disk fractured and pressure began to drop. Additional charts from this test are shown in Annex F.

The SES flow meter was a turbine flow meter positioned below the float collar. As shown in Figure 11, the recorded flow rate peaked at about 10.4 bpm near time 295 seconds, about 5 seconds after the conversion of the float collar auto-fill tube. This recorded peak occurred approximately 5 seconds following the conversion of the float collar auto-fill tube. Conversion occurred during the sudden spike and drop of differential pressure across the flow collar, and was confirmed upon disassembly of the float collar post-test. The differential pressure between above and below the float collar peaked at 197 psi. The offset in time between conversion and measured flow rate is likely caused by the design of the flow meter. The meter exhibits some inherent damping of the flow response and possibly some internal signal smoothing. As a result, the actual peak flow surge may have been higher than 10.4 bpm and probably occurred sooner after the disk fractured.



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Page 22 Confidential

4.6.1.2 Back-Pressure Test

Subsequent to the conversion test, pressure in both the upstream and downstream accumulators was bled to zero and the lines above the float collar were vented to atmospheric pressure in preparation for a back-pressure test on the float collar. The valve in the flow line below the float collar was closed following the conversion test prior to venting accumulator pressures to retain the mud in the flow cavity below the float collar. Back-pressure tests to 40-psi and 250-psi were performed on the float collar with a 5-minute hold period at each pressure level. Recorded pressure loss was less than 1.5 psi/min at 40 psi and about 30 psi/min at 250 psi (Figure F-6 in Annex F).

4.6.1.3 Second Flow Surge Test with Blockage Downstream

The same float collar and mud, and an identical specification rupture disk were used to conduct a second flow surge test (i.e., a flow surge after the float collar had converted) on 12 October 2010. Data were recorded at a faster rate of 3000 scans per second throughout the test to capture sufficient detail for any high-speed transient events. Flow rate from the Schlumberger pump truck was recorded at a rate of 1 scan per second.

The flow loop was modified from the setup for first flow surge test by removing two 4-ft sections of piping and two Chiksan unions from between the upstream accumulator and float collar to reduce frictional flow losses. A schematic of the test setup is shown in drawing KY1751225-01-7 in Annex J.

As before, the upstream and downstream accumulators were precharged with 500 psi of nitrogen gas and the float collar cavity filled with mud prior to flow testing. Pressure was gradually increased until the rupture disk fractured at approximately 3297 psi, as measured from the downstream pressure transducer at the float collar. Figure 12 shows the recorded pressures at the time of conversion. Pressures above and below the float collar peaked at 3282 psi and 3297 psi, respectively, at time 180.9 seconds. At that instant, the disk fractured and pressure began to drop. The differential pressure between the downstream transducer and downstream reservoir was 2741 psi at the time the disk fractured. The differential pressure between upstream and downstream of the float collar reached a peak of 298 psi. Additional charts from the test are shown in Annex G.

As shown in Figure 12, the measured flow peaked at approximately 10.8 bpm at about 4.5 seconds after conversion of the auto-fill tube. As described for the first flow surge test above, the design of the flow meter includes inherent damping of its response and possibly some internal signal smoothing. As a consequence, the actual peak flow surge may have been higher than 10.8 bpm and probably occurred sooner after the disk fractured.

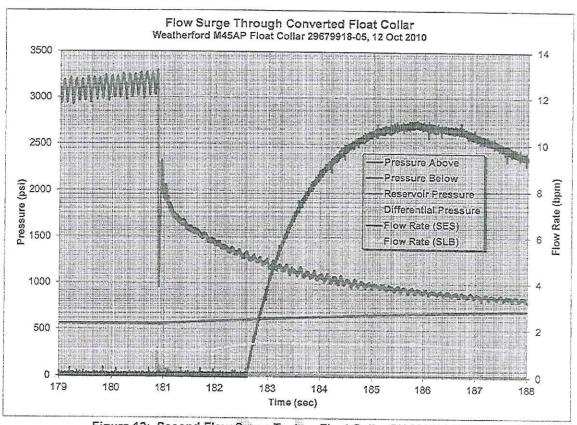


Figure 12: Second Flow Surge Test on Float Collar SN 29679918-05

4.6.1.4 Back-Pressure Test

Subsequent to the second flow surge test on the converted float collar, the pressure in both the upstream and downstream accumulators was bled to zero and the lines above the float collar vented to atmospheric pressure in preparation for the back-pressure test. As before, 40-psi and 250-psi back-pressure tests were performed on the float collar with a 5-minute hold period at each pressure level. Recorded pressure loss was less than 0.1 psi/min at 40 psi and about 0.8 psi/min at 250 psi. Results of the back-pressure test are shown in Figure G-6 in Annex G.

4.6.1.5 Inspection

Visual inspection of the float collar subsequent to flow surge testing did not reveal any obvious wear or damage. However, the visual inspection was limited since the valves are still enclosed within the 7" casing. One observation noted was that the O-ring located between the shear ring of the auto-fill tube and the upper valve assembly was slightly protruding into the bore of the valve over approximately a 1" section. The rupture disk is a multi-section disk that splits upon fracture and opens up the flow path. However, the fingers did not open completely to provide a full bore flow path and thus added additional frictional flow resistance. Photograph 86 (Annex N) shows float collar SN 29679918-05 after testing.

Dimensional inspection was limited to the tested auto-fill tube and ball. Inspection showed that all critical dimensions met Weatherford's manufacturing drawing requirements.

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Page 24 Confidential

4.6.2 Flow Surge Tests (SN-04)

4.6.2.1 Flow Surge Conversion Test

A blockage flow surge test with an Allamon ball⁵ on the top of the float collar was conducted on 15 October 2010 using Weatherford M45AP float collar SN 29679918-04. The mud used for this flow surge test was weighted to 14.0 ppg. The rupture disk in the flow loop downstream of the float collar had a stated fracture pressure of 2928 +201/-147 psi. The upstream and downstream accumulators were initially precharged with nitrogen to about 500 psi. Since the precharge gas from the downstream accumulator is blocked by the downstream side of the rupture disk, this arrangement results in an effective fracture pressure of the rupture disk of approximately 2928 + 500 = 3428 psi. A schematic representing the test setup is shown in drawing KY1751225-01-08 in Annex J. Photographs of the Allamon ball after the conversion test are presented in Annex N (Photographs 51–56).

Data were recorded at a rate of 3000 scans per second throughout the test. A high scan rate was used to provide detail sufficient to capture transient events. The flow rate and pump pressure from the Schlumberger pump truck were recorded at a rate of 1 scan per second.

After both accumulators were precharged, the flow loop through the float collar down to the rupture disk was slowly pressurized with mud to 500 psi. The upstream accumulator was then connected to the system by opening its ball valve. The pump truck then started flowing mud at a constant flow rate of about 1.0 bpm. The flow from the pump initially accumulated in the upstream accumulator and increased system pressure gradually until the rupture disk fractured at approximately 3210 psi (as measured from the downstream pressure transducer at the float collar). At that instant, the high pressure from the upstream accumulator forced a flow surge through the float collar until the upstream and downstream pressures equalized.

The float collar converted in the resulting flow surge. Figure 13 shows the recorded pressure above and below the float collar at the time of conversion. The above and below pressures peaked at 3205 psi and 3210 psi, respectively, while the downstream accumulator pressure was 447 psi. At that moment (time = 611.676 seconds), the disk fractured and pressure began to drop. Within 0.010 seconds, six spikes in differential pressure (between the pressure transducers above and below the float collar) were recorded above 500 psi, with a maximum peak of 792 psi (Figure 14). Additional data from this test are shown in Annex H.

⁵ The Allamon ball is a 1.625" diameter brass ball used in the casing diverter sub above the float collar. The ball was expected to be on top of the float collar by the time of the ninth conversion attempt. The ball is manufactured by Allamon Tool Company, Inc., www.allamontool.com.

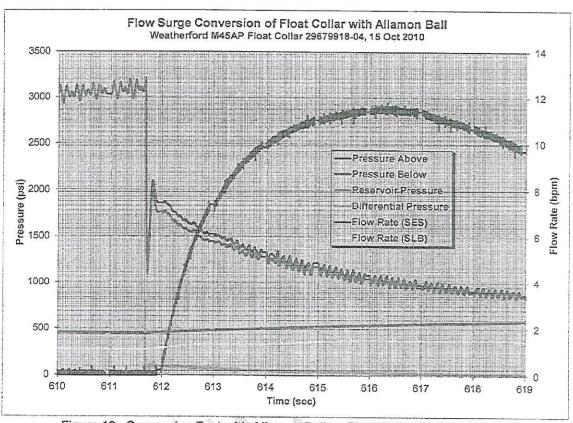


Figure 13: Conversion Test with Allamon Ball on Float Collar SN 29679918-04

As shown in Figure 13, the recorded flow surge peaked at approximately 11.5 bpm. This recorded peak occurred approximately 4.5 seconds after conversion of the auto-fill tube. The design of the flow meter includes some inherent damping of the flow response and possibly some internal signal smoothing. As a result, the actual peak flow surge may have been higher than 11.5 bpm and probably occurred sooner after the disk fractured.

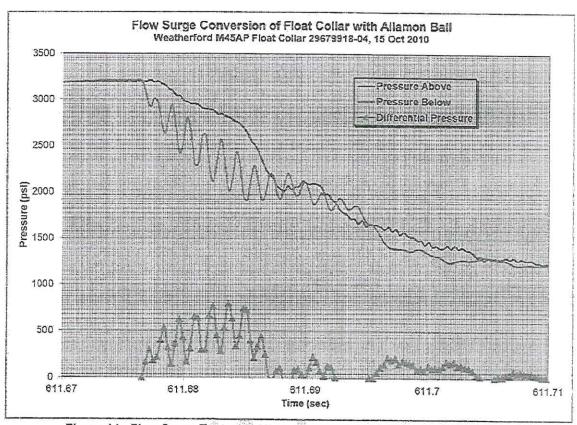


Figure 14: Flow Surge Test with Allamon Ball on Float Collar SN 29679918-04 (note spikes in differential pressure)

4.6.2.2 Back-Pressure Test

Subsequent to the conversion test, the pressure in both the upstream and downstream accumulators was bled to zero and the lines above the float collar were vented to atmospheric pressure in preparation for the back-pressure test. The valve in the flow line below the float collar was closed prior to venting accumulator pressures to retain the mud in the flow cavity below the float collar. Back-pressure tests to 40-psi and 250-psi were performed on the float collar with a 5-minute hold period at each pressure level. Recorded pressure loss was less than 1 psi/min in both cases. Results of this back-pressure test are shown in Figure H-6 in Annex H.

4.6.2.3 Second Flow Surge Test with Blockage Upstream

For the second flow surge test of float collar SN 29679918-04, the rupture disk was installed above the float collar to represent a blockage upstream. With this change in the flow loop, an additional U-tube section of piping had to be added downstream of the float collar to ensure that the float collar cavity was completely filled with mud prior to the flow test. A schematic of the test setup is shown in drawing KY1751225-01-09 in Annex J. Photographs of the equipment are shown in Annex N (Photographs 57–80).

The same mud and an identical specification rupture disk were used for the test. Data were recorded at a high scan rate of 3000 scans per second throughout the test.

The flow loop and float collar cavity were initially filled with mud down to the ball valve in front of the downstream accumulator, and air purged from the system. Both the upstream and downstream accumulators were then precharged to approximately 500 psi with nitrogen, and the ball valve isolating the downstream accumulator was opened. The flow loop to the rupture disk was slowly pressurized with mud to approximately 500 psi, at which time the ball valve isolating the upstream accumulator was opened. The pump truck then began flowing mud at a steady rate of about 1.0 bpm. Flow from the pump initially accumulated in the upstream accumulator, which caused the fluid pressure to increase. Eventually, pressure exceeded the capacity of the rupture disk, and it fractured. The differential pressure between the above and below transducers peaked at 1536 psi at the time of rupture. At this instant, the high pressure from the upstream accumulator forced a flow surge through the float collar until the upstream and downstream pressures equalized (Figure 15).

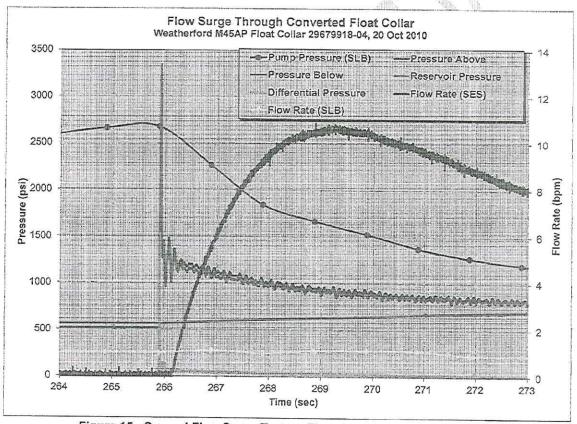


Figure 15: Second Flow Surge Test on Float Collar SN 29679918-04 with Blockage above Float Collar

4.6.2.4 Back-Pressure Test

Subsequent to the second flow surge test, the pressure in both the upstream and downstream accumulators was bled to zero and the lines above the float collar were vented to atmospheric pressure in

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Page 28 Confidential

preparation for the back-pressure test. The valve in the flow line below the float collar was closed prior to venting accumulator pressures to retain the mud in the flow cavity below the float collar. Back-pressure tests to 40-psi, 250-psi, and 5000-psi were performed on the float collar with a 5-minute hold period at each pressure level. There was no recorded pressure loss at 40 psi, about 6.5 psi/min at 250 psi, and about 7.6 psi/min at 5000 psi. A chart showing these results is presented in Figure I-6 in Annex I.

4.6.2.5 Inspection

Visual inspection of the float collar (SN-04) subsequent to the flow surge testing sequence did not reveal any obvious wear or damage. However, visual inspection was limited since the valves are still enclosed within the 7" casing. The rupture disk is a multi-section disk that splits upon fracture and opens up the flow path. However, it was noted that the fingers did not open completely to provide a full bore flow path, and thus added additional frictional flow resistance. Photograph 85 (Annex N) shows float collar SN 29679918-04 after testing.

Dimensional inspection was limited to the tested auto-fill tube and ball. Inspection showed that all critical dimensions met the manufacturing drawing requirements.

5 Summary

Performance tests on Weatherford M45AP float collars were successfully completed at the Stress Engineering Services test facility in Waller, Texas from 23 July to 20 October 2010. The performance tests consisted of flow endurance tests, steady-state flow conversion tests, flow-surge conversion tests, flow-surge tests on converted float collars, and mechanical failure tests on auto-fill tubes. The flow-surge tests represented the sudden clearance of a blockage in the flow path (such as a potential blockage at the reamer shoe).

Results of testing of the float collar appeared to meet the requirements of API RP 10F for endurance testing. Test results did not indicate any performance conflicts with published Weatherford data on the M45AP float collar. Post-test inspection did not reveal any damage or anomalies that would affect the intended performance of the float collar.

SES found that, for all test scenarios executed in this program, conversion of the float collar occurred.

Table 5 provides a summary listing of all tests along with test dates, sample identification, and data file names.

Table 5: List of Tests, Samples, and Data Files

	and Data i led			
Test Date	Test Description	Test Sample	Date File	
7/22/2010	Reverse Flow	SN 29679918-01	1601072-01-1 Endurance	
7/23/2010	Conversion	SN 29679918-01	1601072-01-2 Endurance	
7/23/2010	Back-Pressure Test	SN 29679918-01	1601072-01-3 Endurance	
7/26/2010	Flow cycles 1 – 3 and back-pressure tests	SN 29679918-01	1601072-01-4 Endurance	

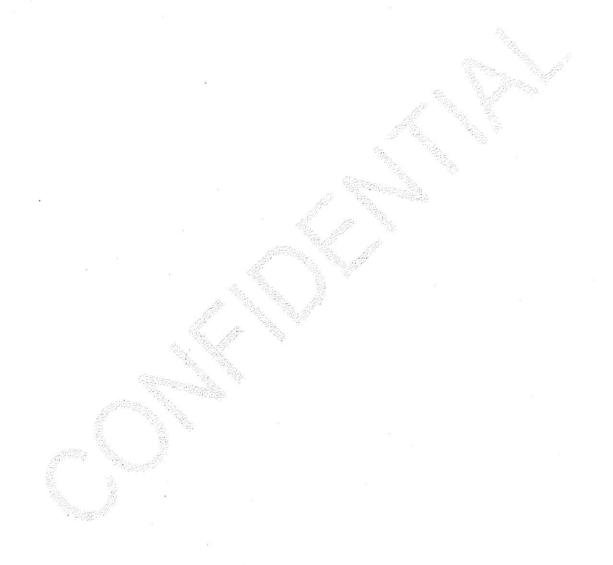
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Page 29 Confidential

Test Date	Test Description	Test Sample	Date File
7/27/2010	Flow cycles 4 – 5 and back-pressure tests	SN 29679918-01	1601072-01-5 Endurance
7/28/2010	Back-pressure investigation test	SN 29679918-01	1601072 7-28-10
7/29/2010	Flow cycles 5 & 6 and back-pressure	SN 29679918-01	1601072-01-6 Endurance
7/30/2010	Flow cycles 7 – 9 and back-pressure	SN 29679918-01	1601072-01-7 Endurance
8/2/2010	Flow cycles 10 - 12 and back-pressure	SN 29679918-01	1601072-01-8 Endurance
7/23/2010	Mechanical failure test on upper shear pins of auto-fill tube	Auto-fill tube sample 4	1601072_tube4_toppinshear
7/26/2010	Mechanical failure test on lower ring of auto-fill tube	Auto-fill tube sample 4	1601072_tube4_bottomshear
9/3/2010	Reverse flow	SN 29679918-02	1601072-02 Reverse Flow
9/8/2010	Conversion	SN 29679918-02	1601072-02 Conversion
9/8/2010	Flow cycle 1 and back-pressure tests	SN 29679918-02	1601072-02 BackPress1
9/9/2010	Flow cycle 2 and back-pressure test	SN 29679918-02	1601072-02 BackPress2
9/10/2010	Conversion	SN 29679918-03	1601072-03 Conversion
9/30/2010	Flow resistance w/o choke	Simulated test tool	1601072 Bikge Rehearsal
10/1/2010	Flow resistance w/ choke	Simulated test toll	1601072 Blkge Rehearsal Day 20
10/5/2010	Flow surge resistance	Simulated test tool	1601072-1 ToolBlkg
10/8/2010	Conversion	SN 29679918-05	1601072-05 Blockage_Conv
10/8/2010	Back-pressure test	SN 29679918-05	1601072-05 Blkg_BPress
10/12/2010	Second surge test	SN 29679918-05	1601072-05-3 Surge
10/13/2010	Back-pressure test	SN 29679918-05	1601072-05-8 BPressure
10/15/2010	Conversion with Allamon ball on FC	SN 29679918-04	1601072-04 Conversion
10/15/2010	Back-pressure test	SN 29679918-04	1601072-04 BPress
10/20/2010	Second surge test	SN 29679918-04	1601072-04-3 Surge Flow
10/20/2010	Back-pressure test	SN 29679918-04	1601072-04-3 BPress



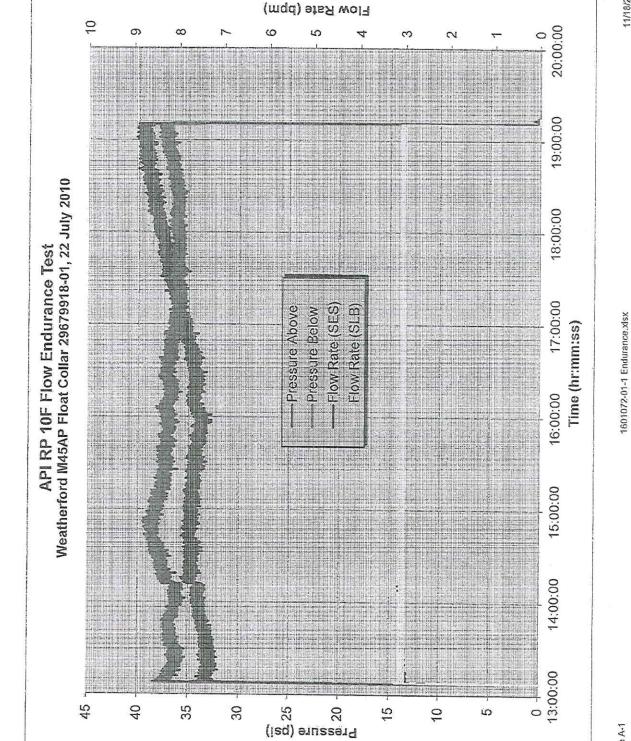
Annex A API Flow Endurance Tests (SN-01)



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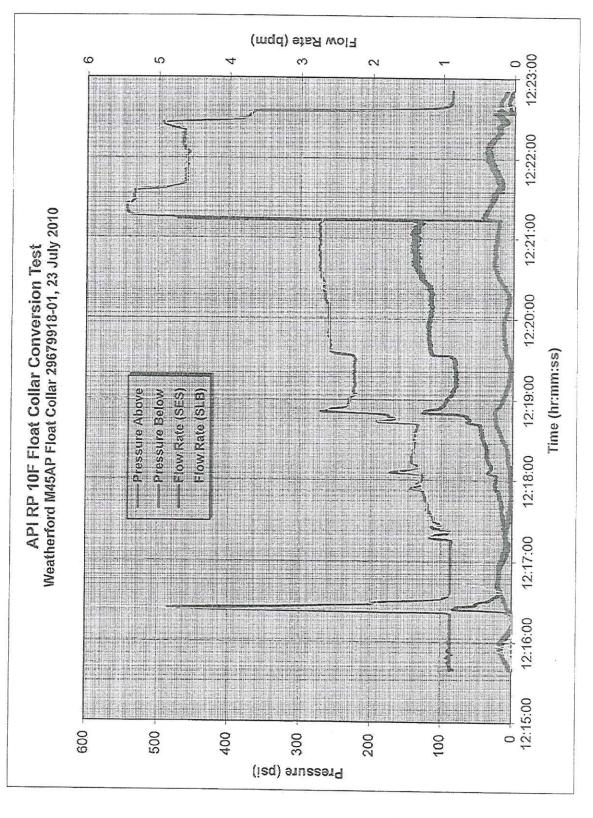
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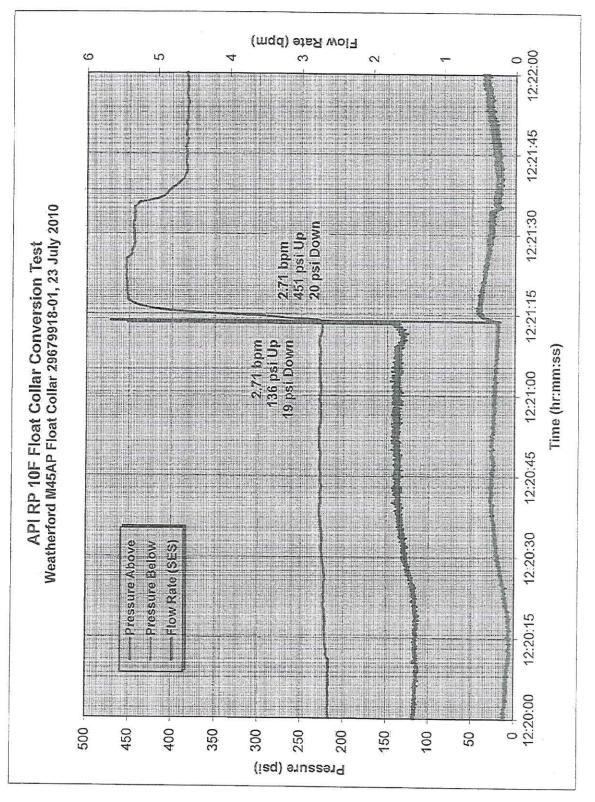
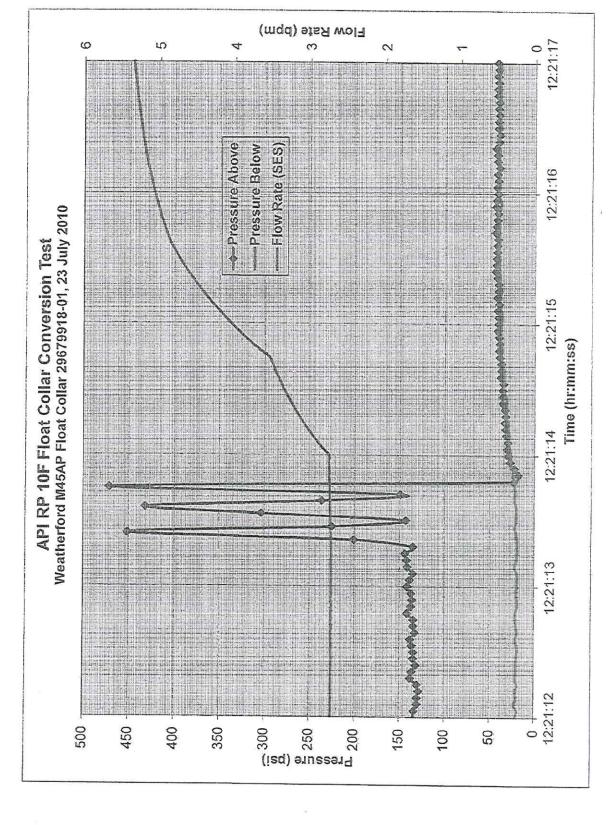
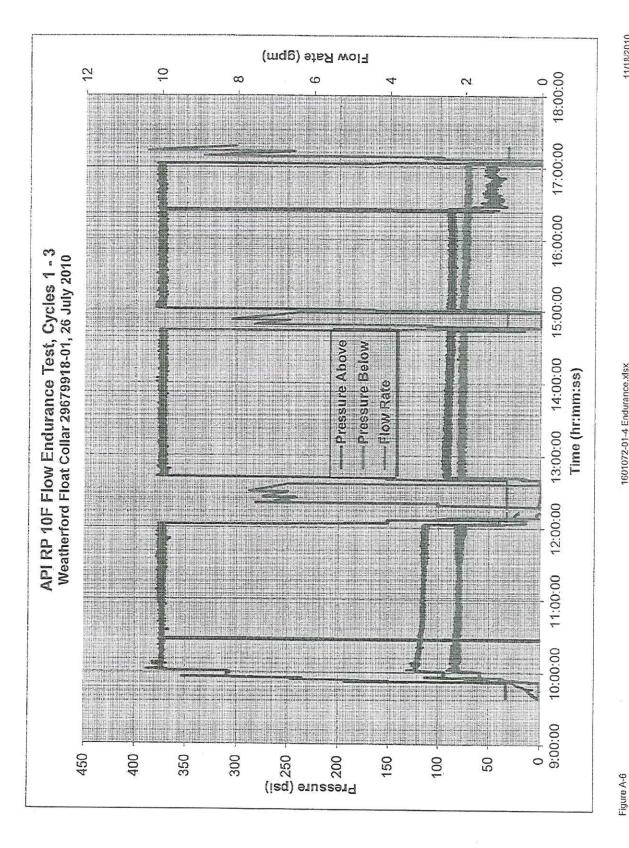


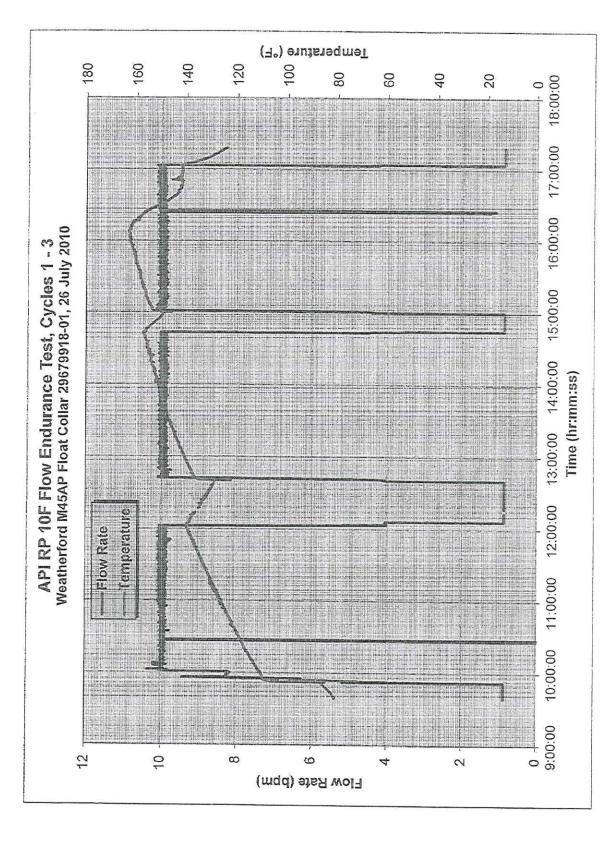
Figure A-3





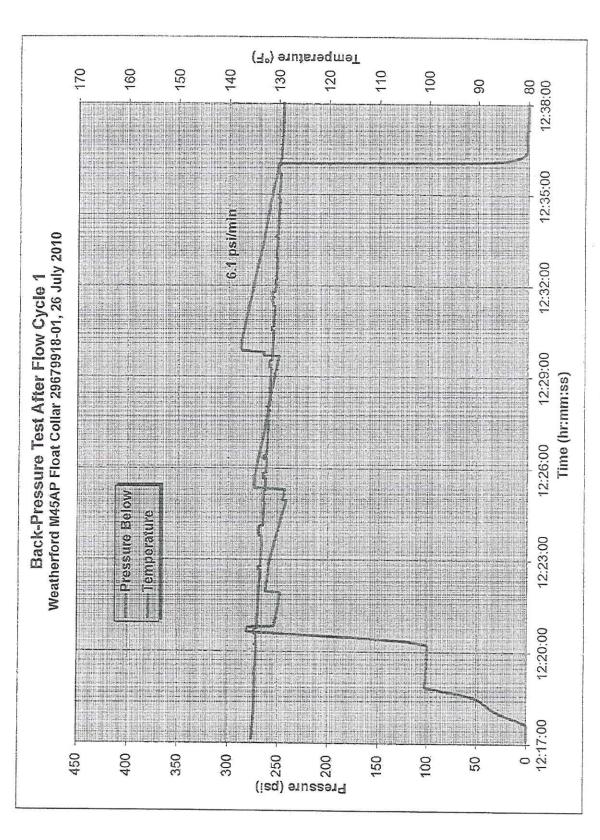






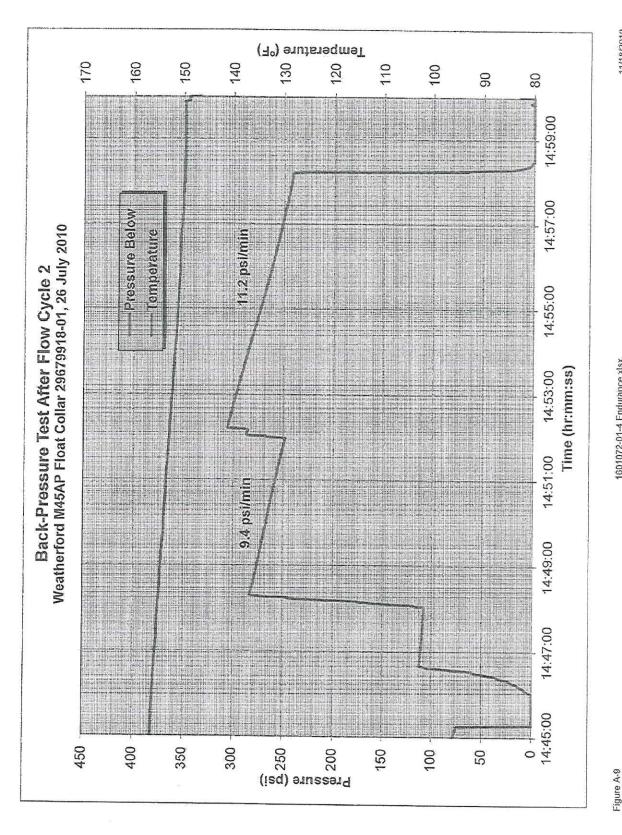






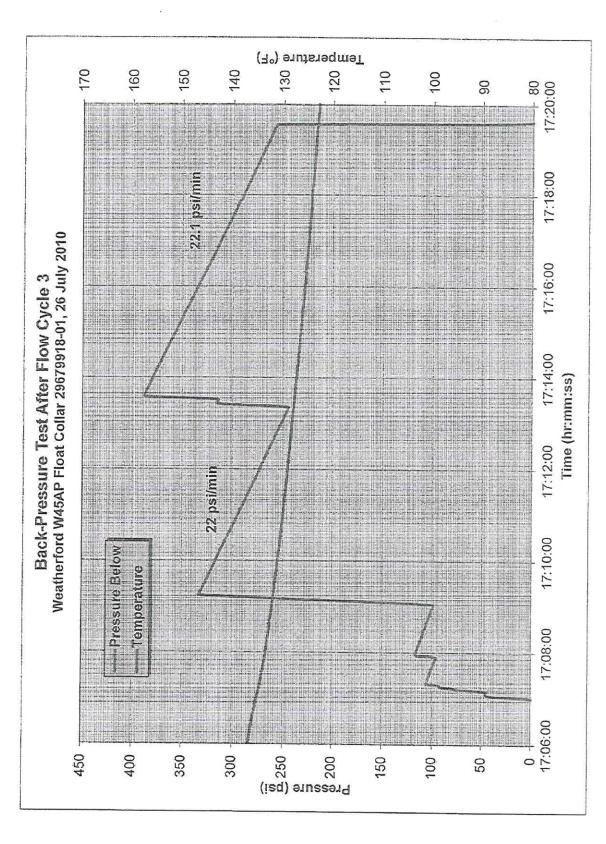




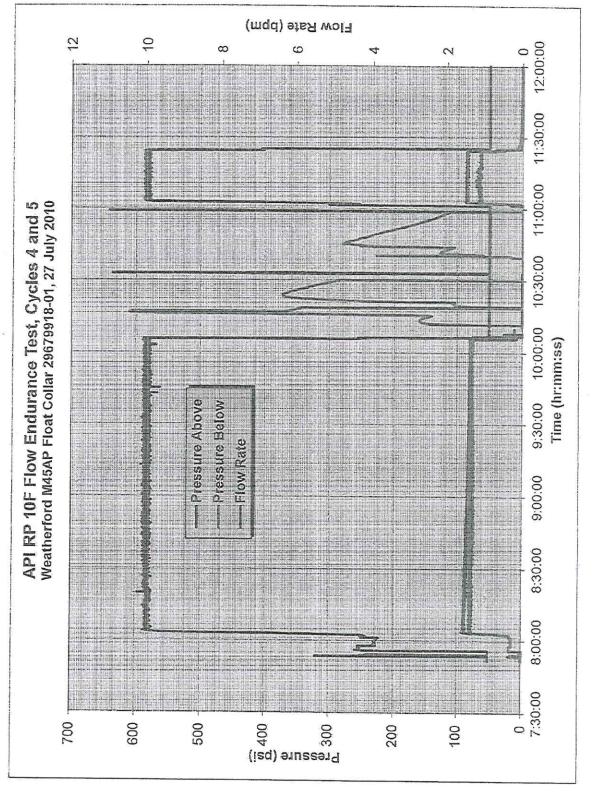




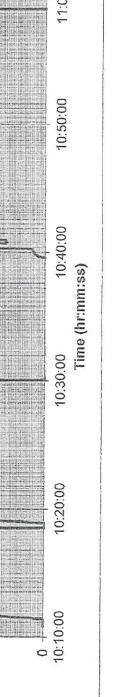


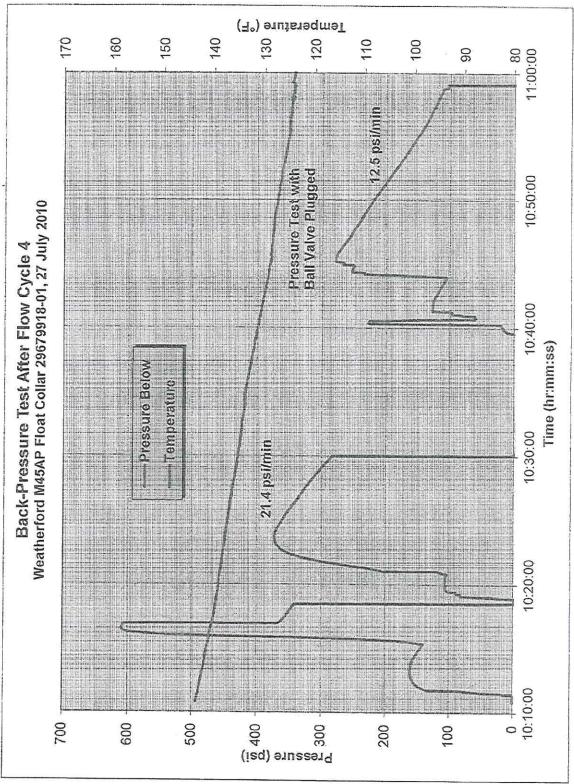






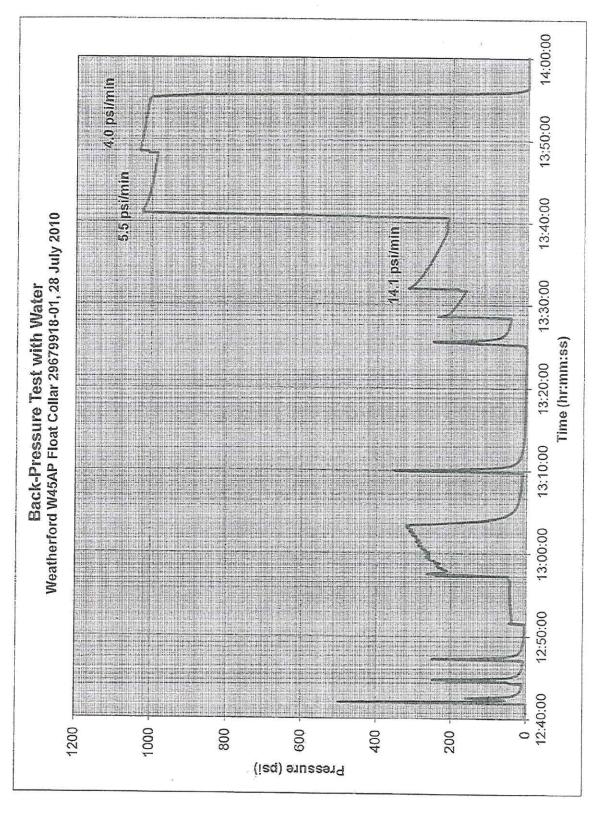






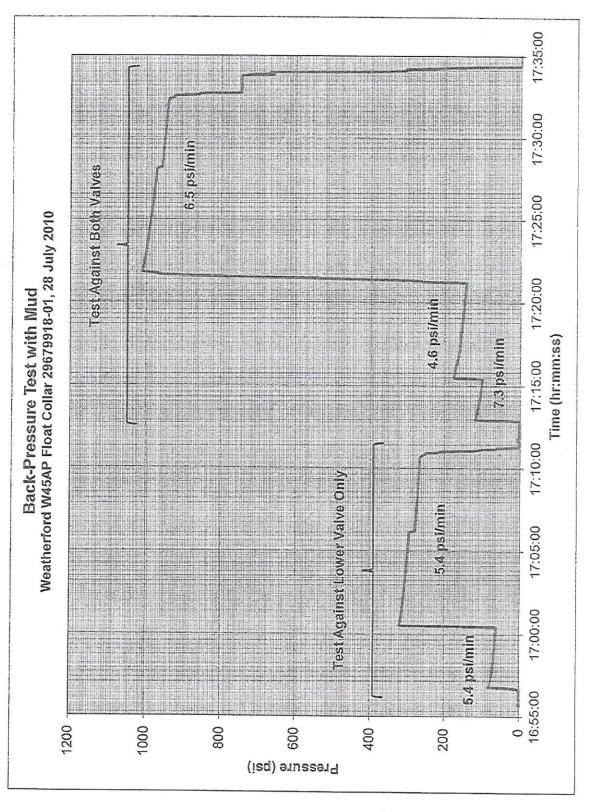


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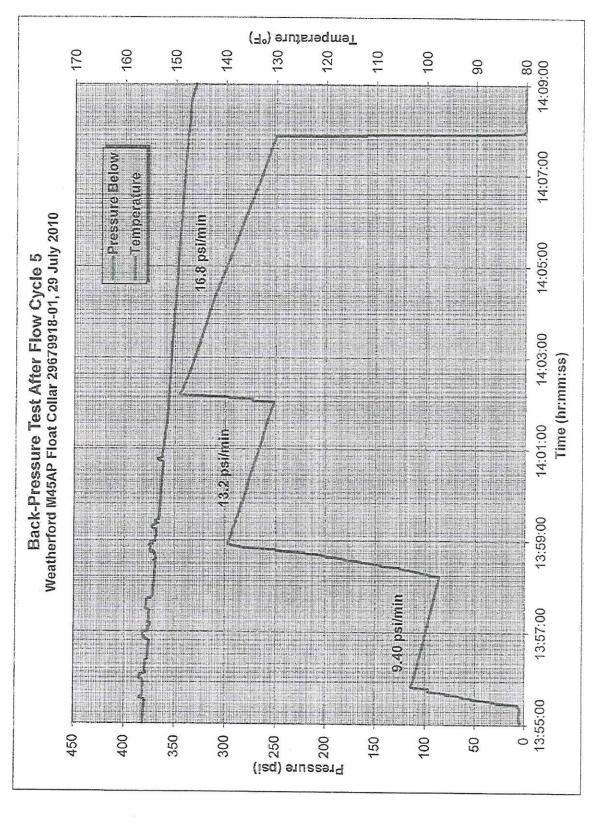


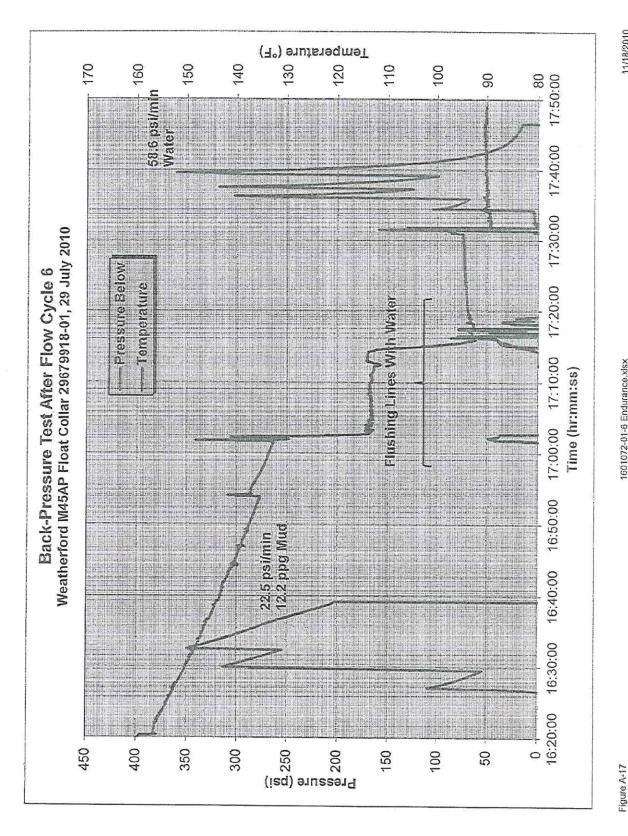
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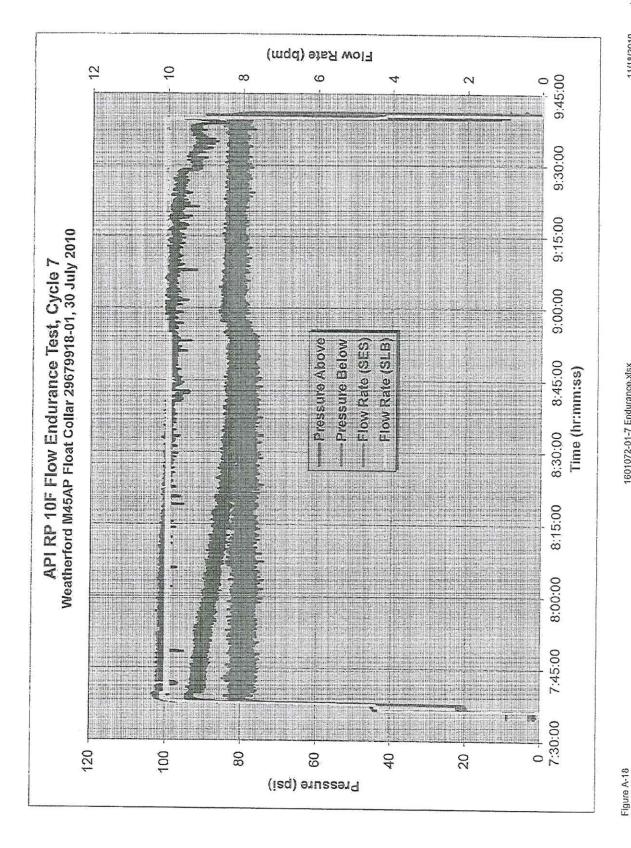




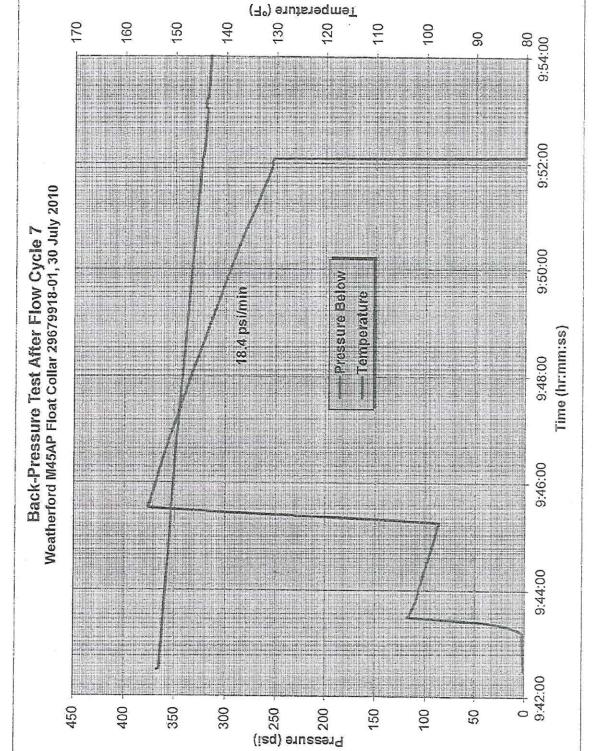






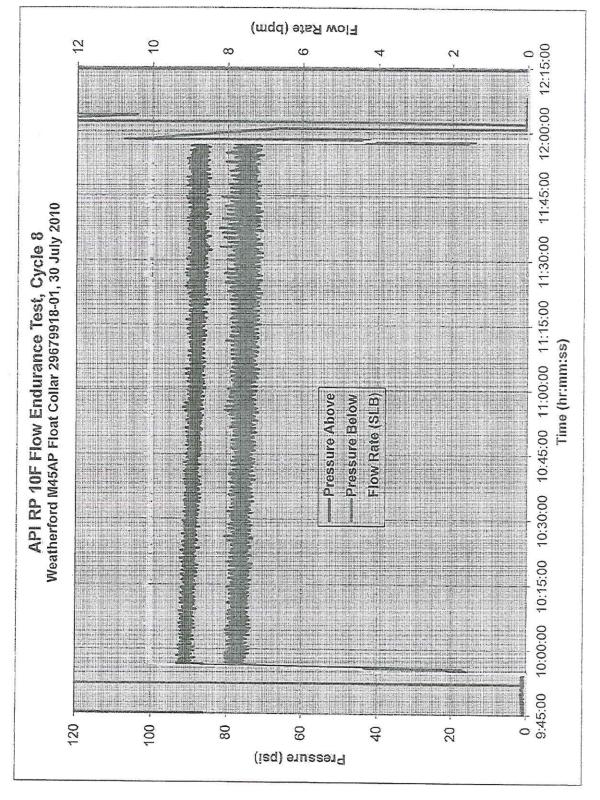








1601072-01-7 Endurance,xlsx





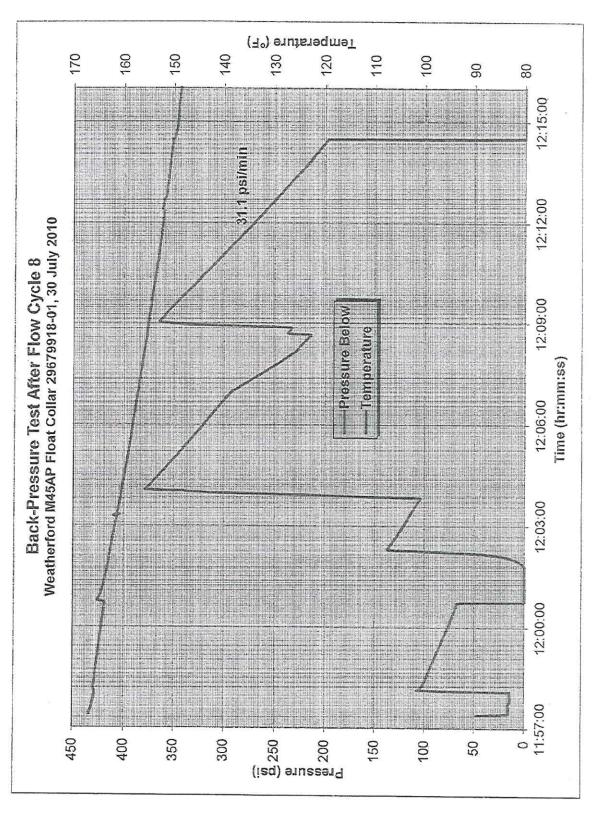


Figure A-21



1601072-01-7 Endurance,xlsx

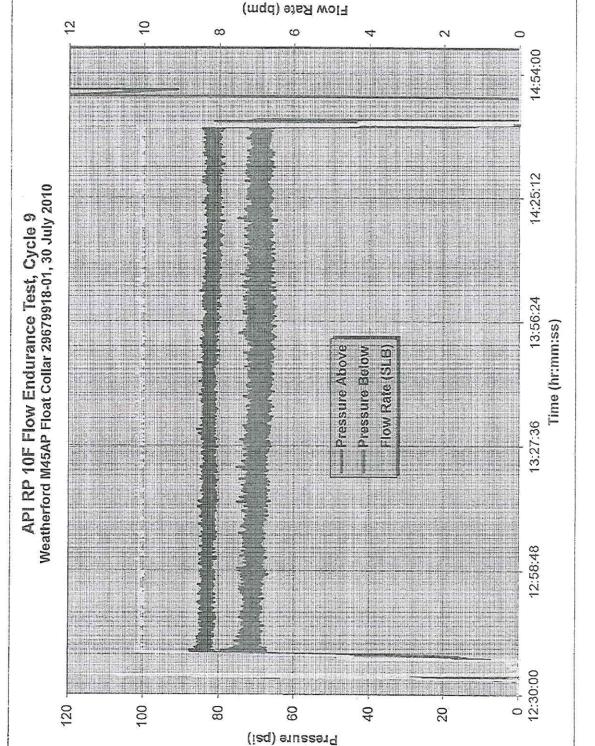
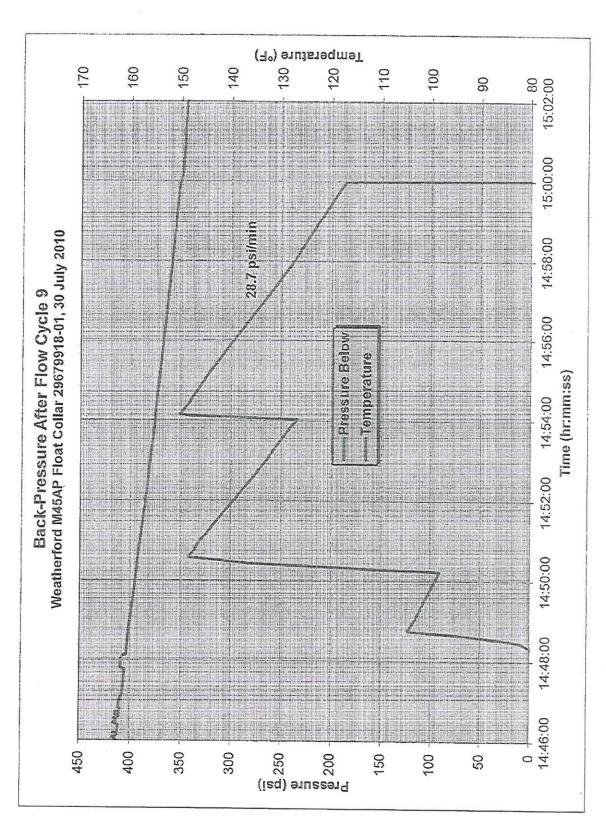


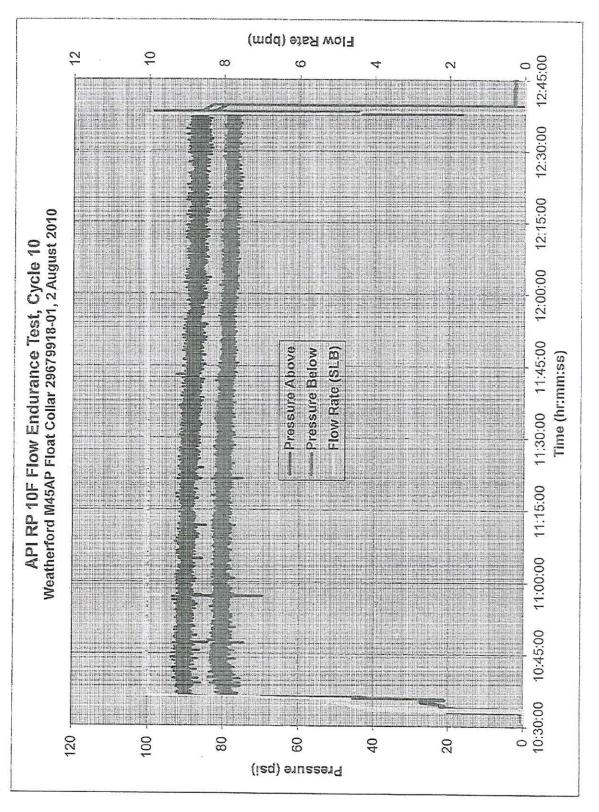
Figure A-22

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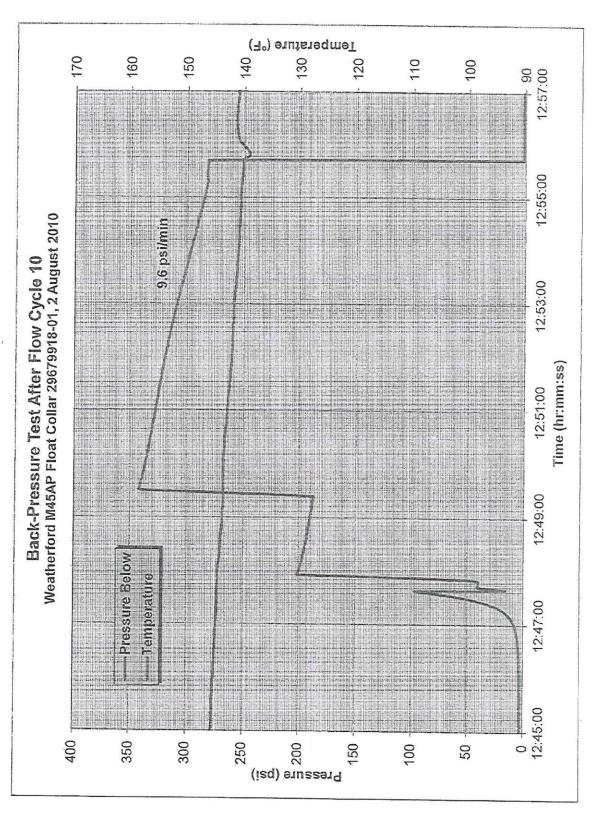




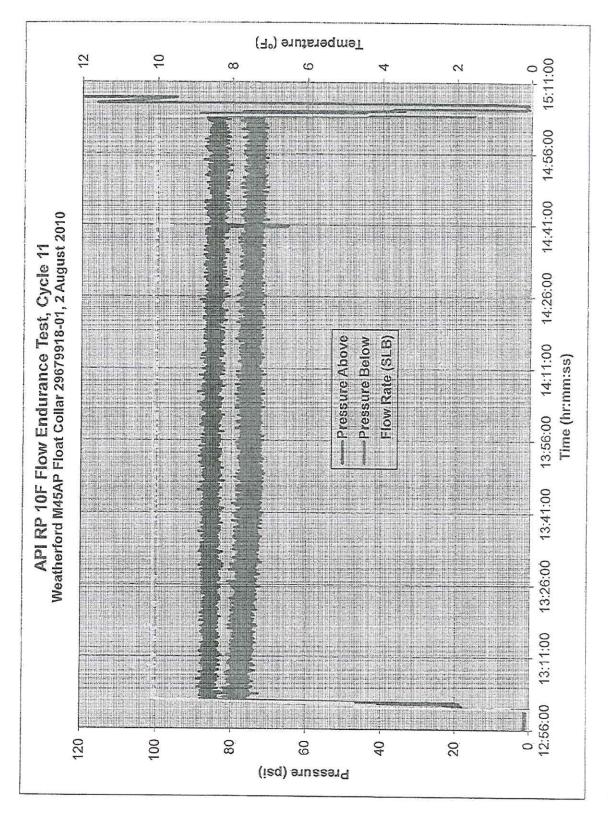






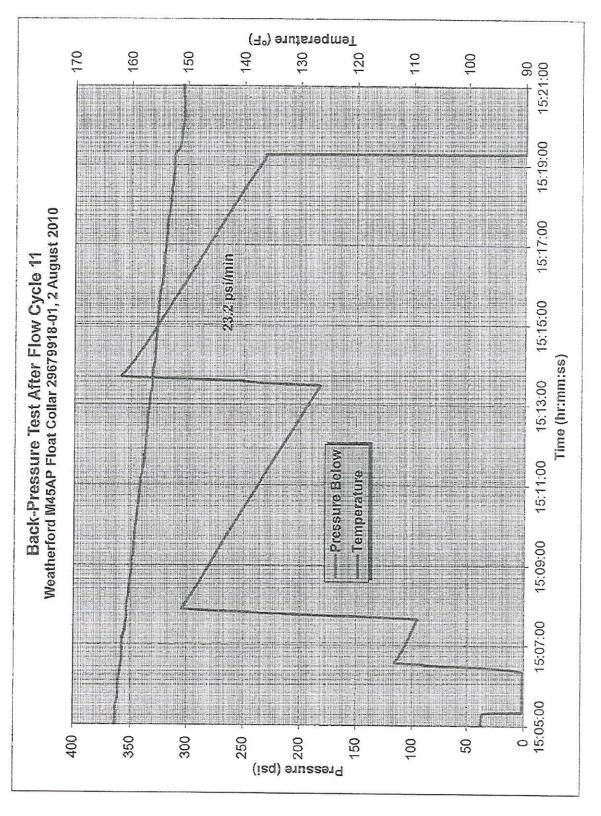




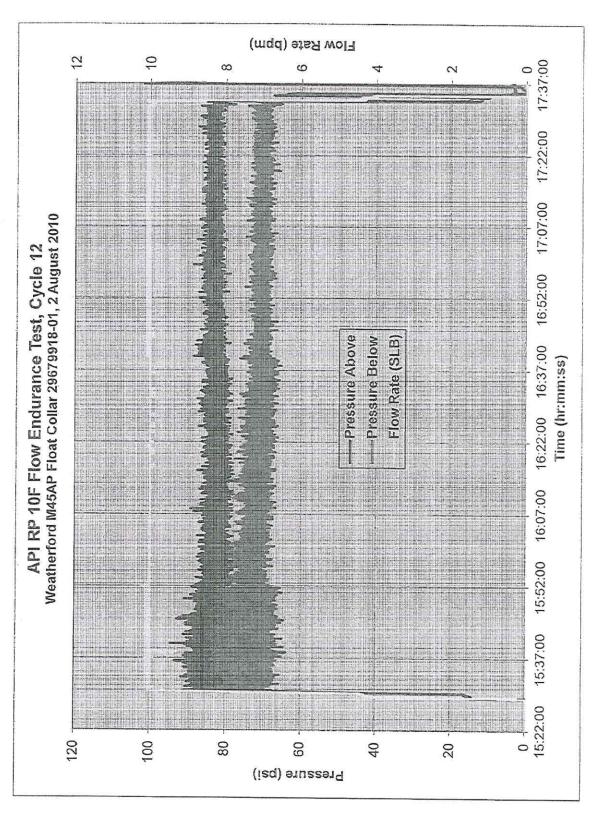


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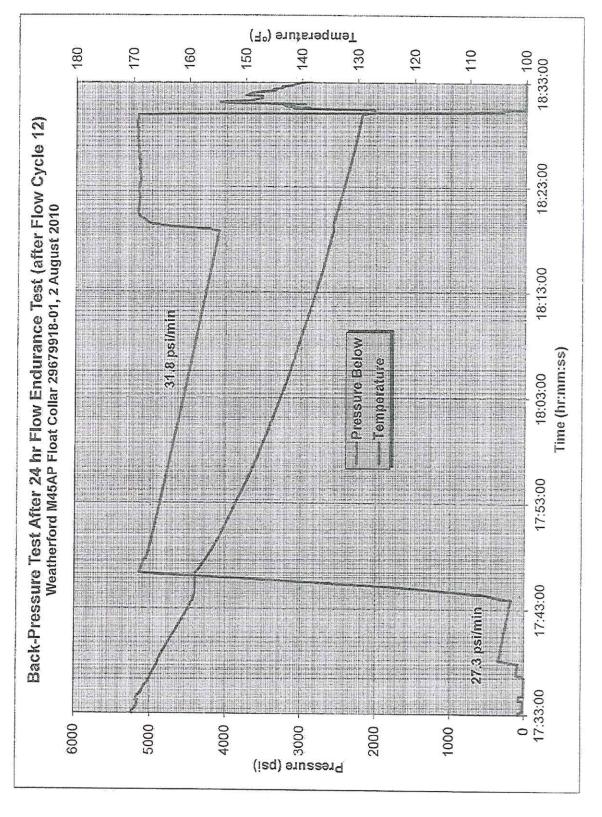










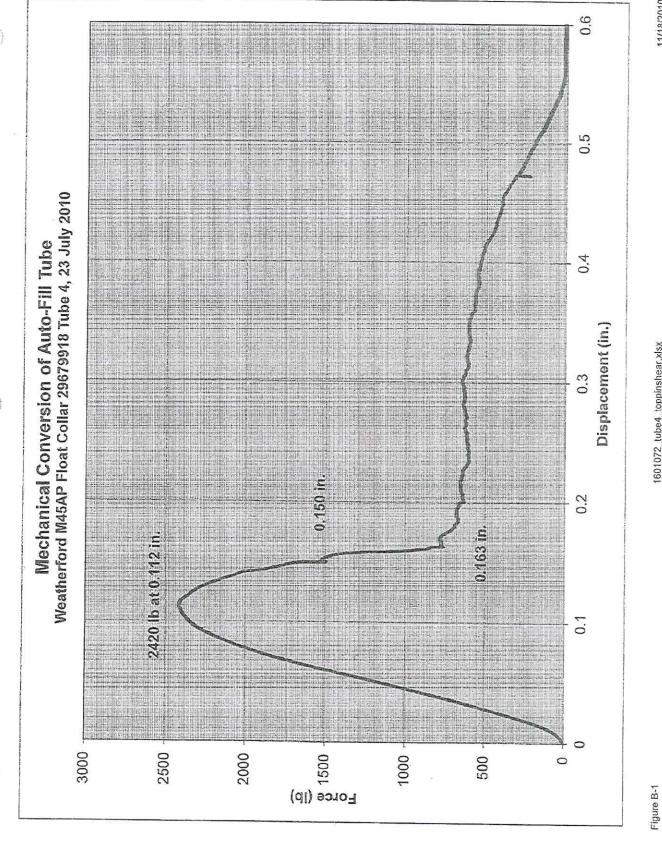


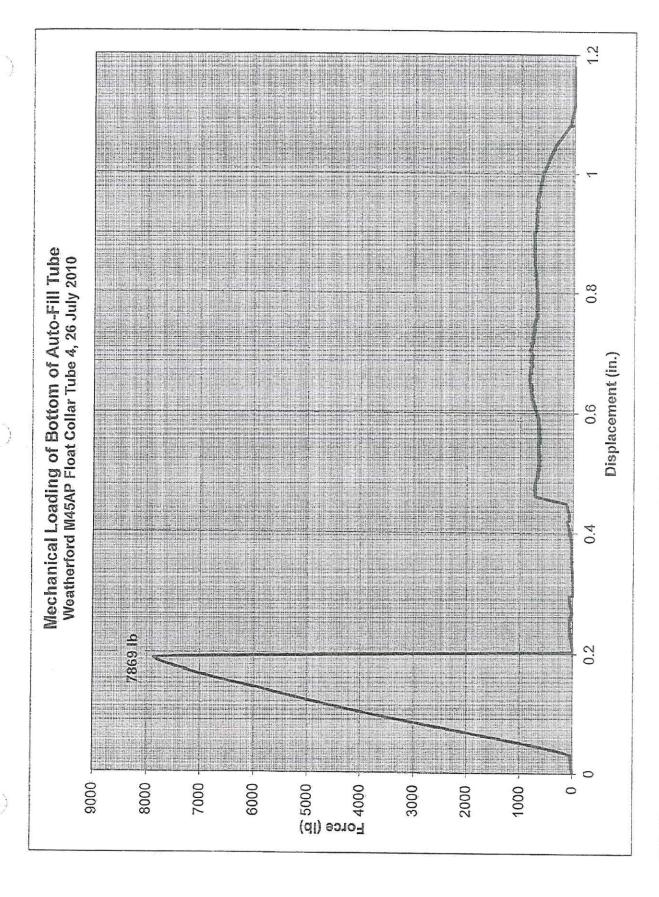
Annex B Mechanical Failure Tests



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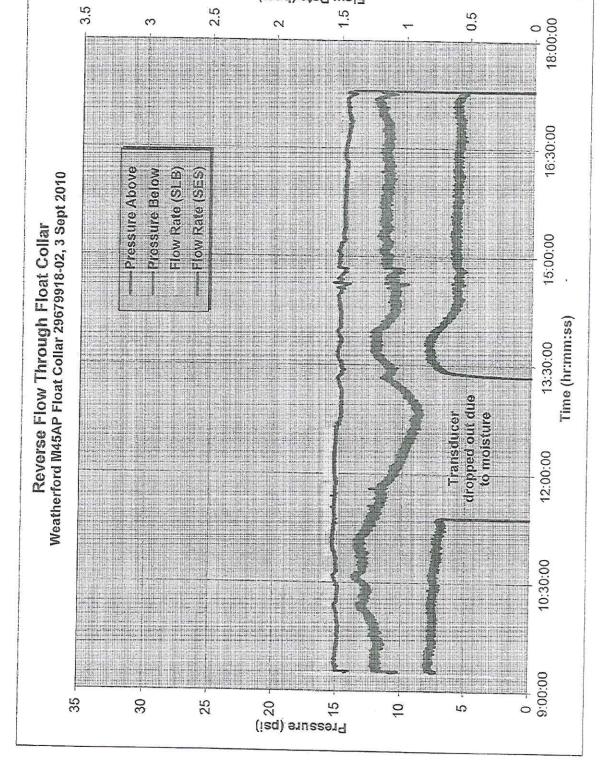




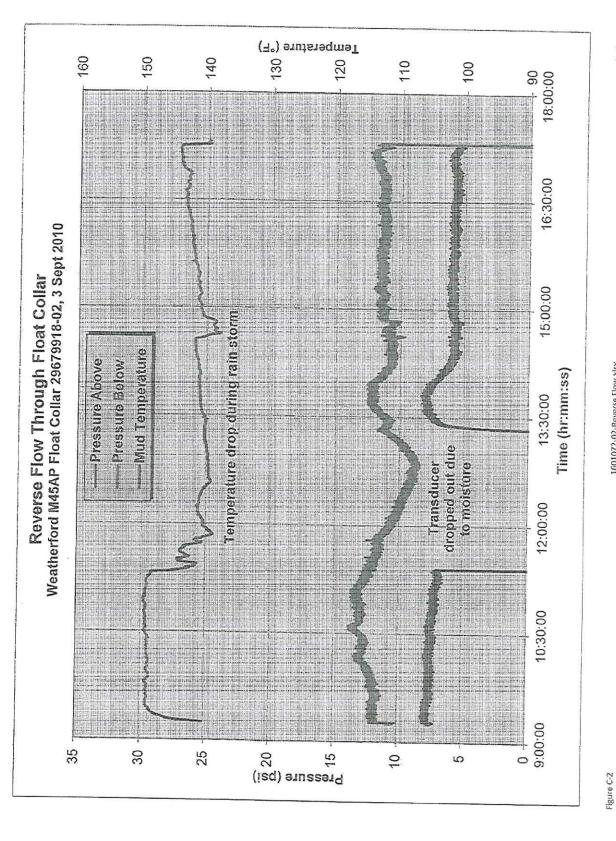
Annex C Flow Endurance Test (SN-02)





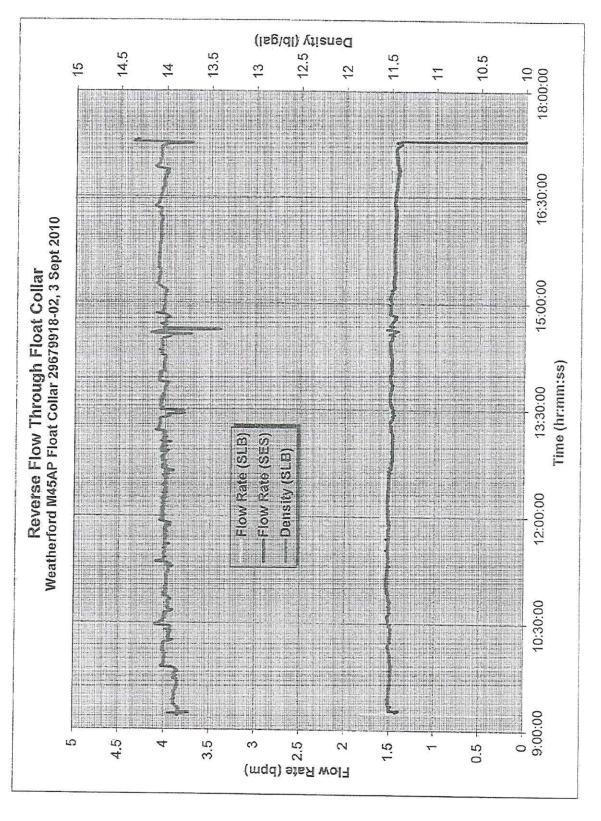


Flow Rate (bpm)



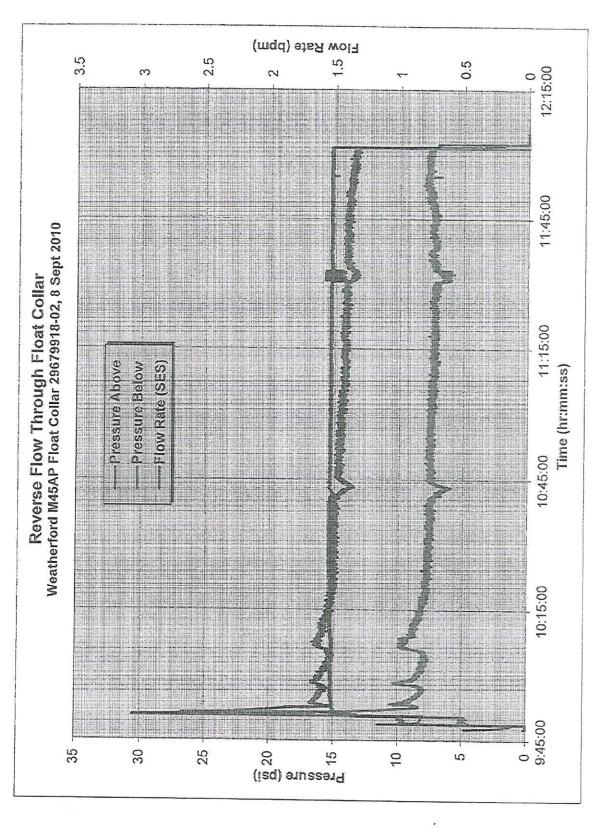


1601072-02-Reverse Flow.xisx





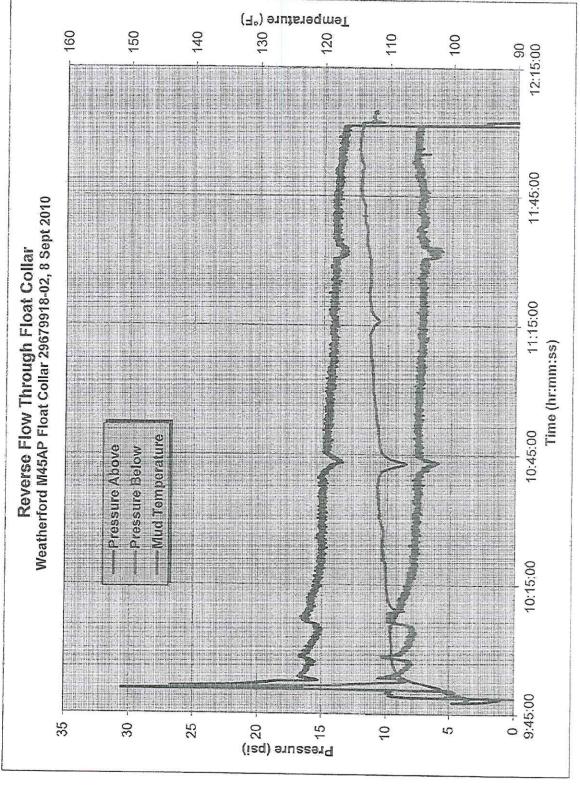
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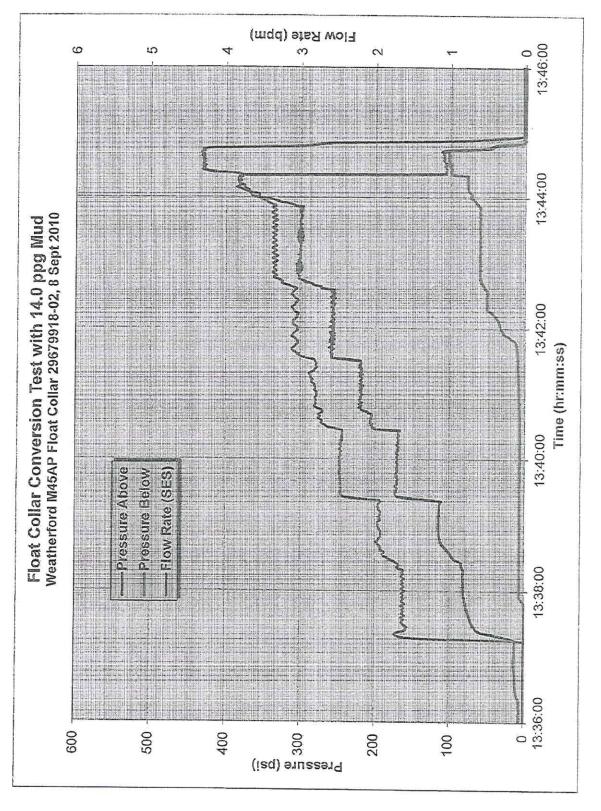


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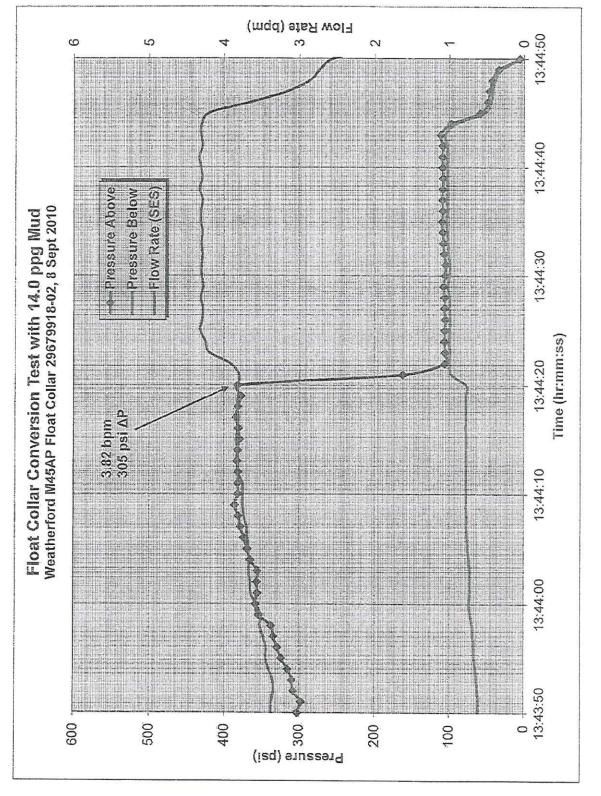


1601072-02-Conversion.xlsx



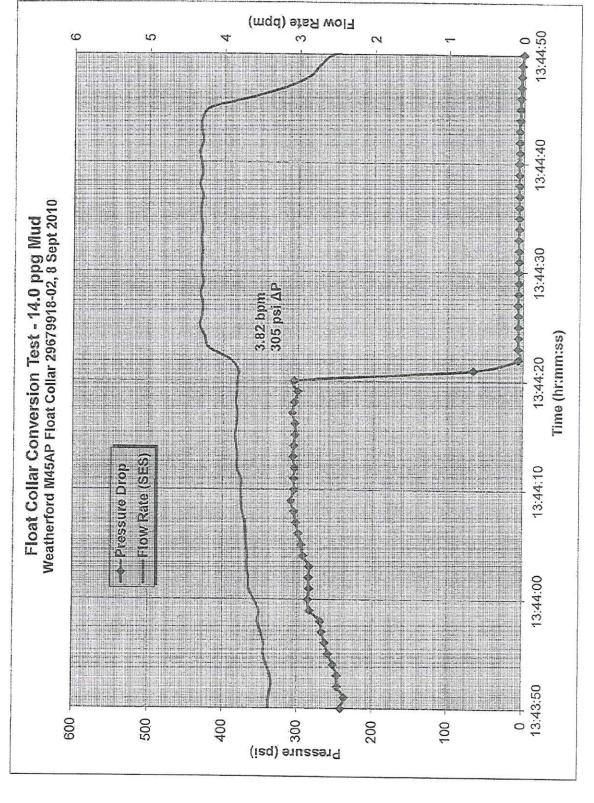


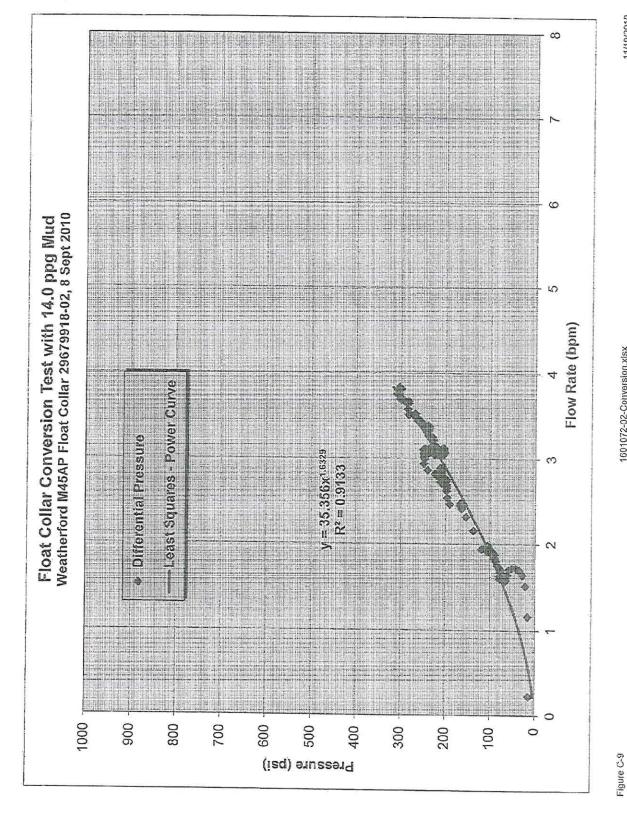
1601072-02-Conversion.xlsx





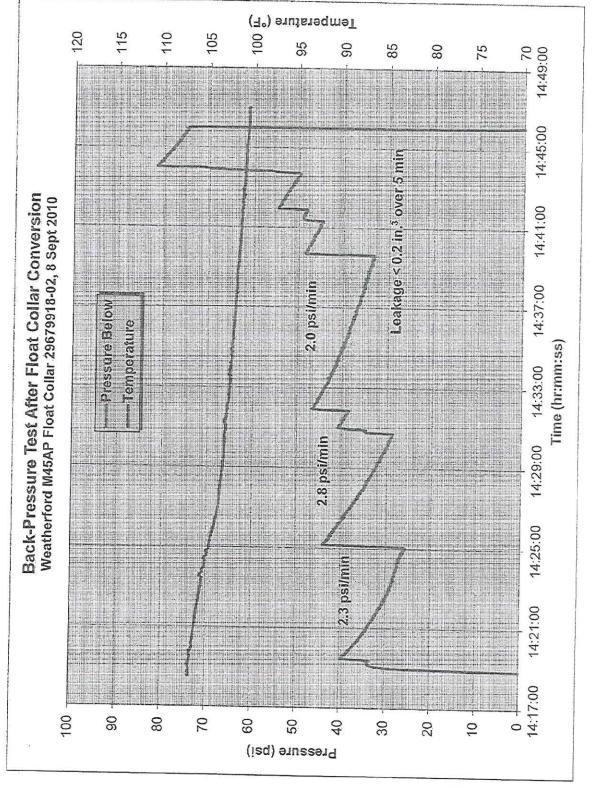






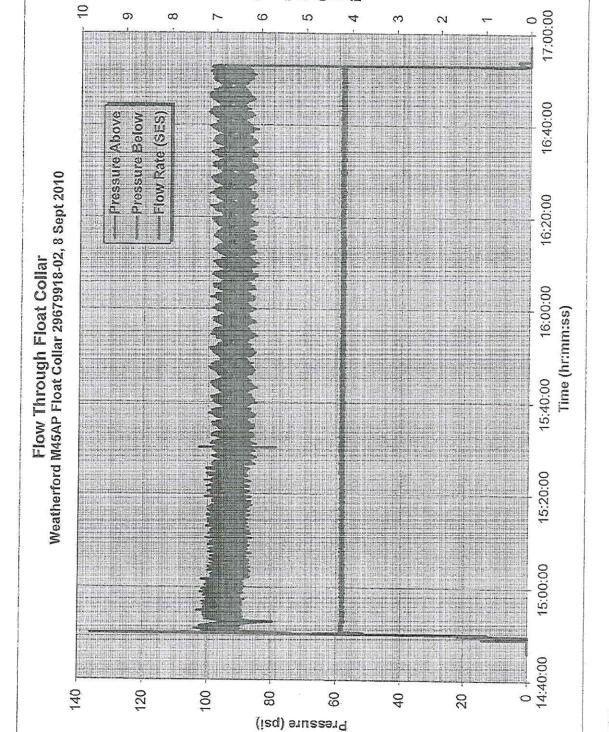








1601072-02-BackPress1.xlsx



Flow Rate (bpm)



1601072-02-BackPress1.xlsx

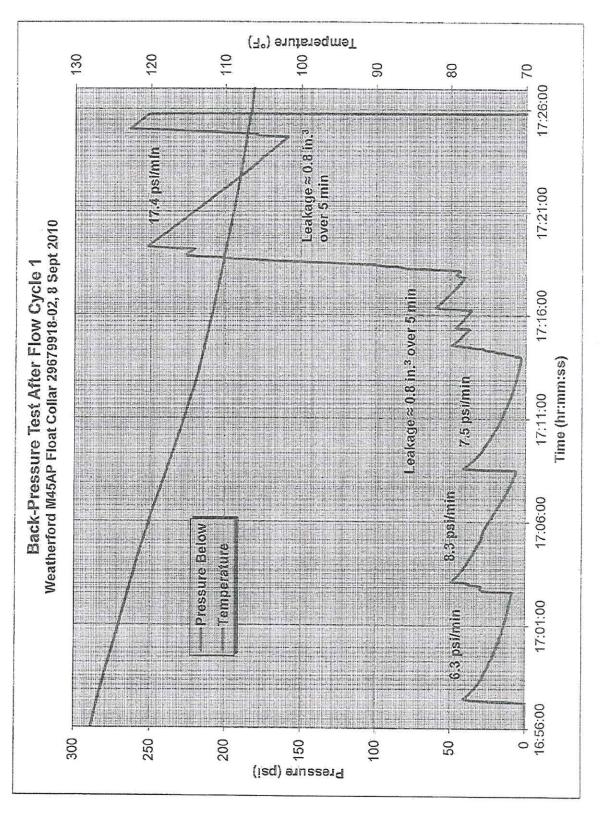
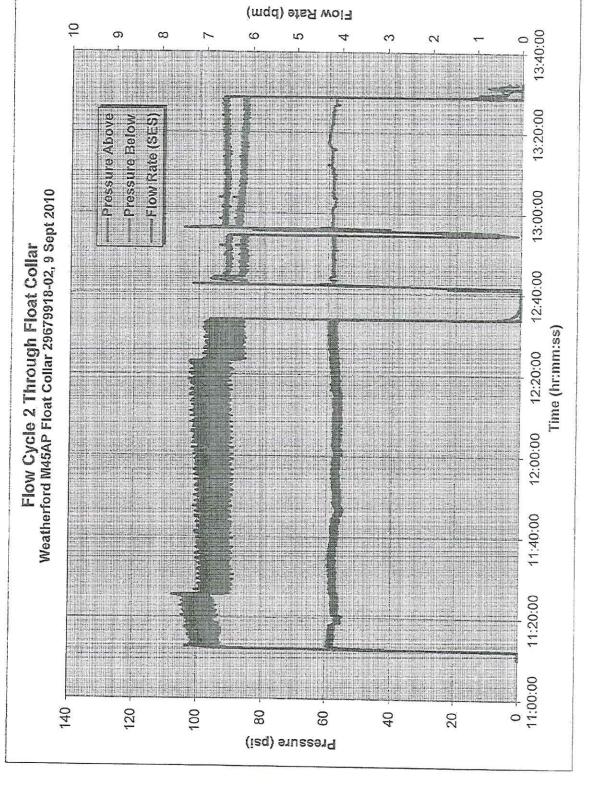


Figure C-12

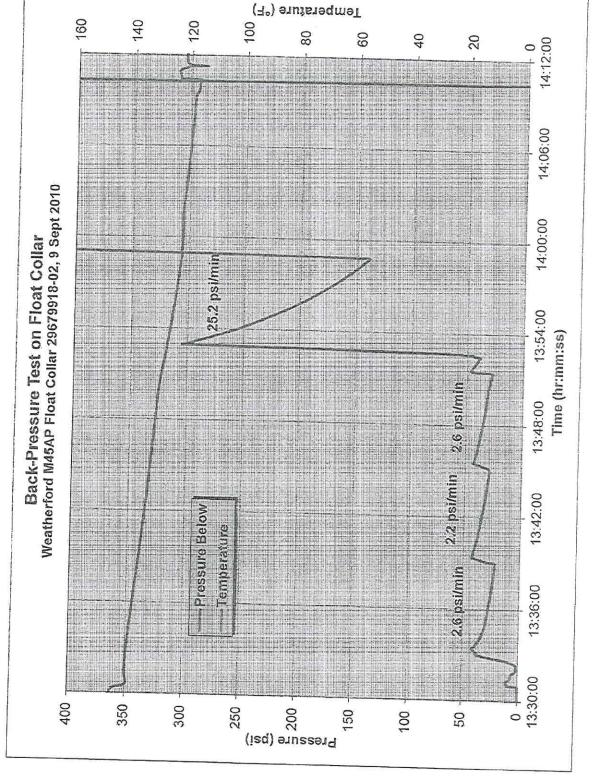






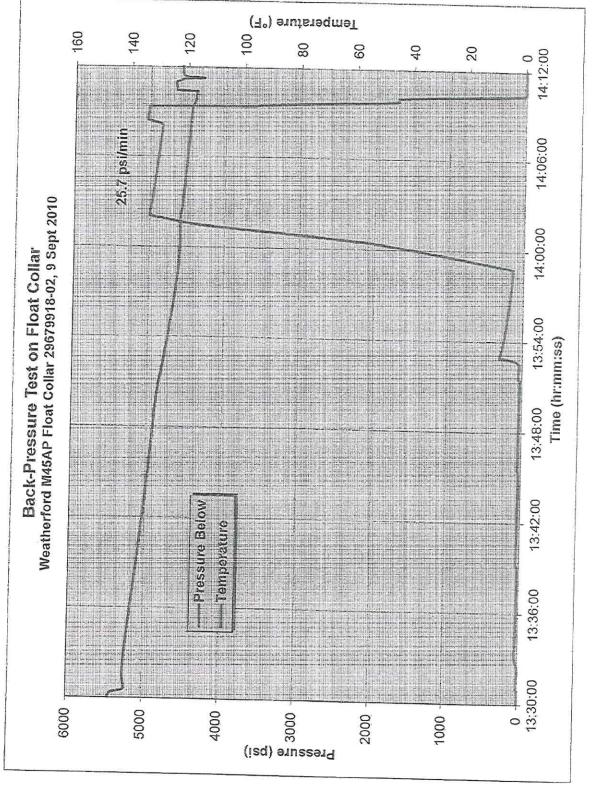






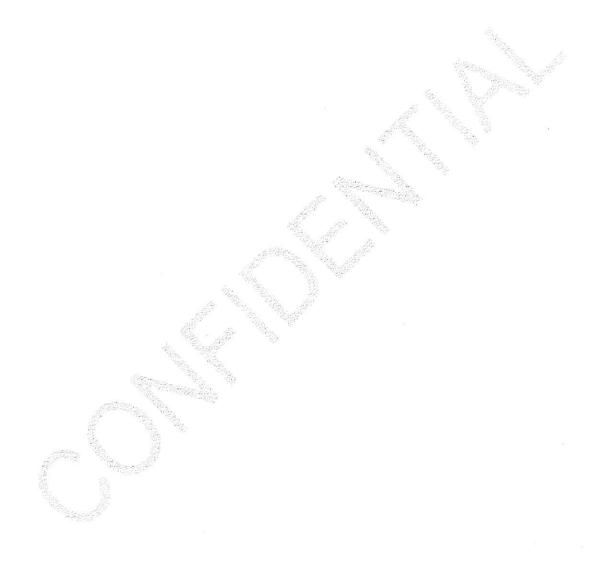






D

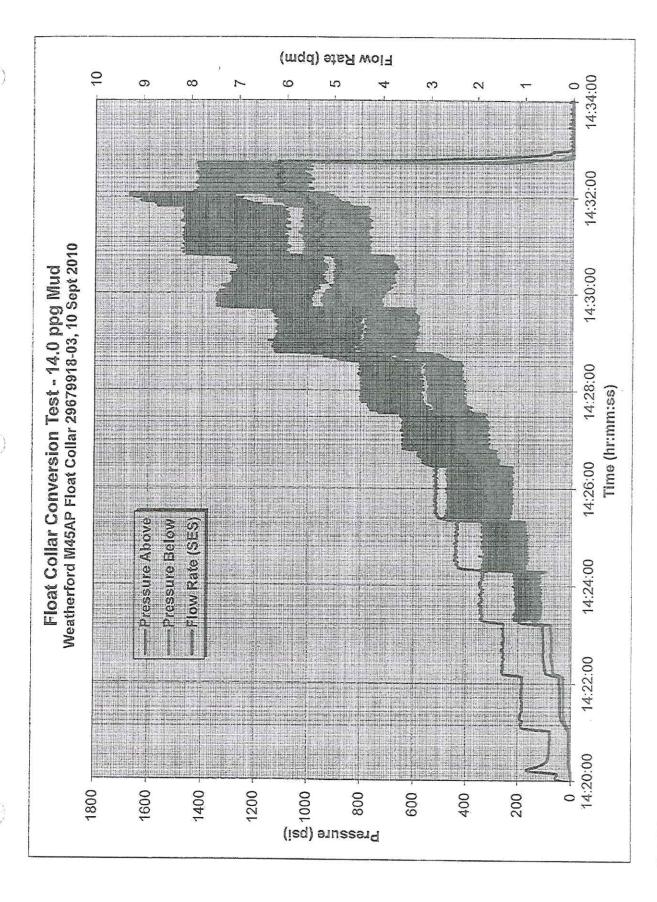
Annex D Flow Conversion Test (SN-03)



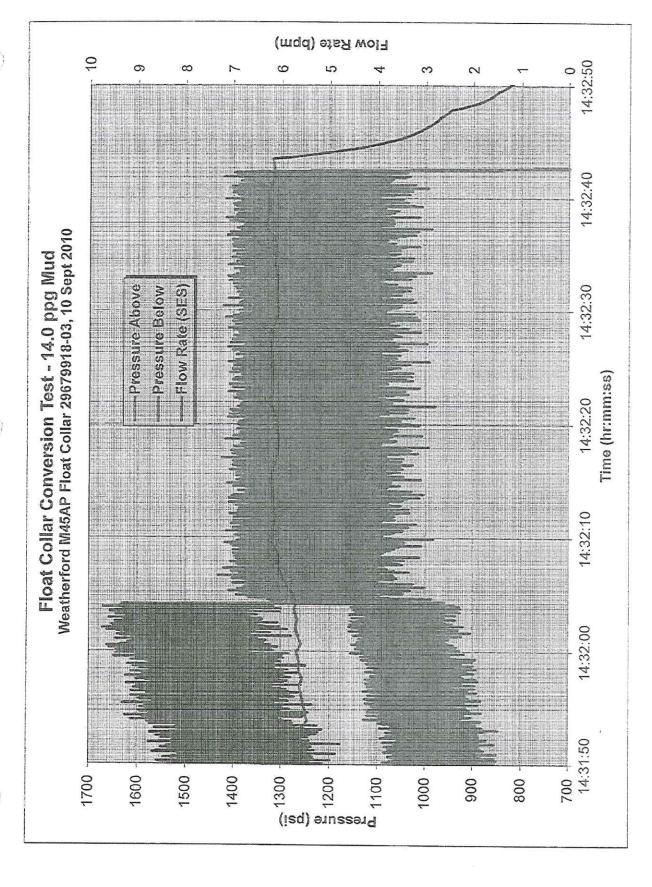
Stress Engineering Services, Inc.

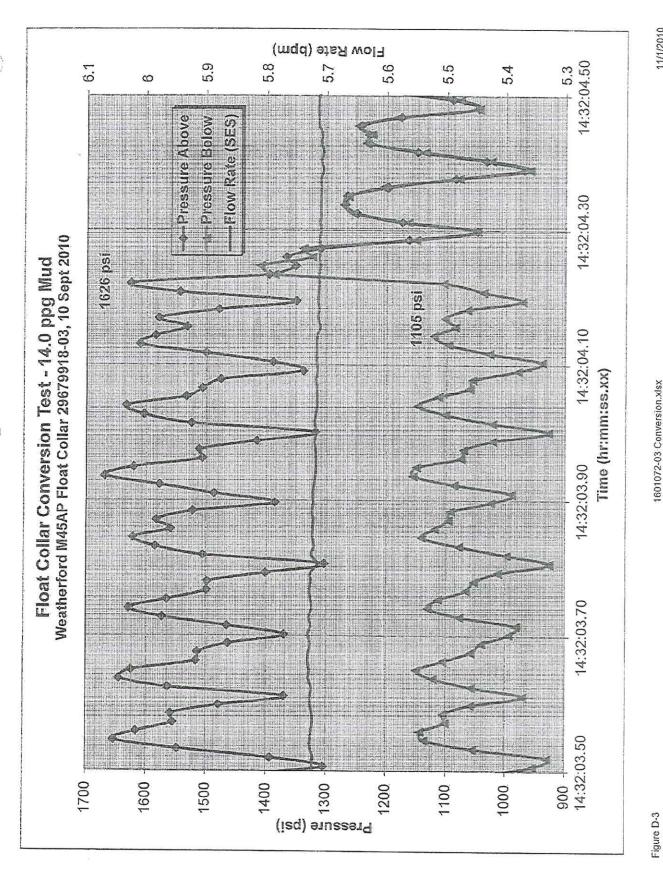
Confidential

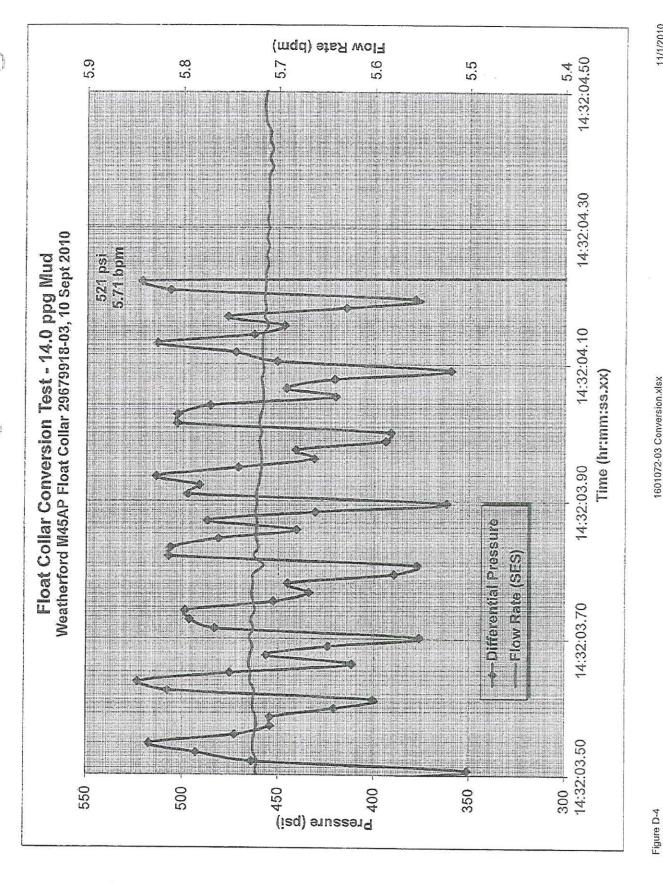
Report No.: PN 1751225

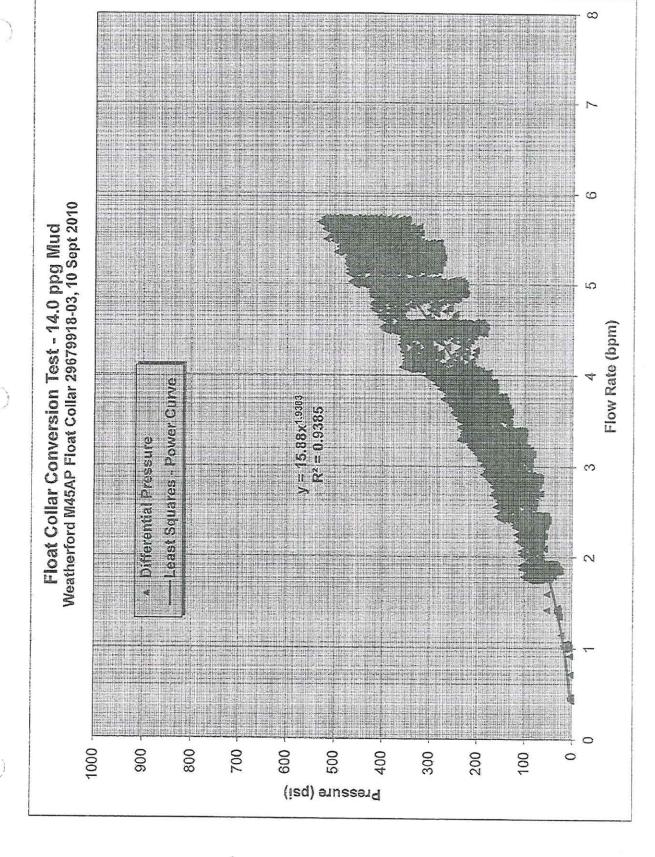












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Annex E Rehearsal Tests



Stress Engineering Services, Inc.

Confidential

Report No.: PN 1751225

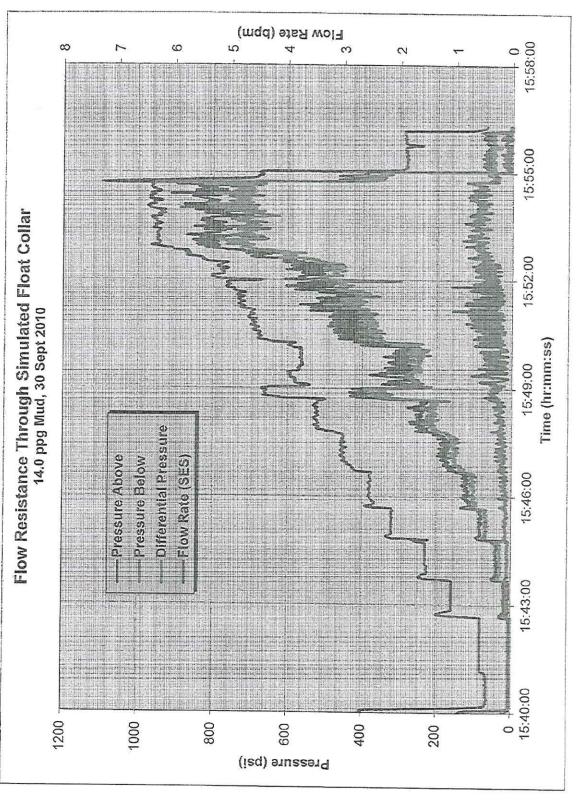
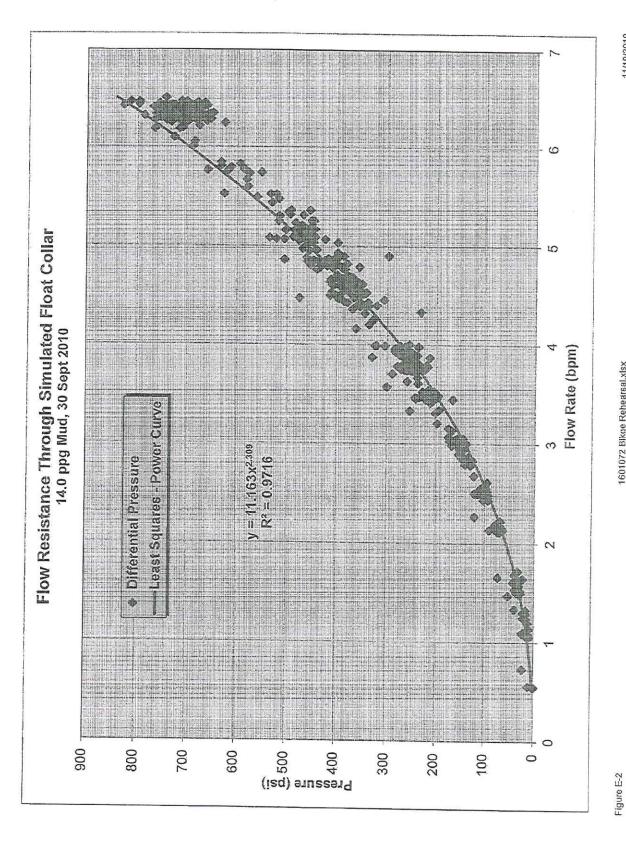
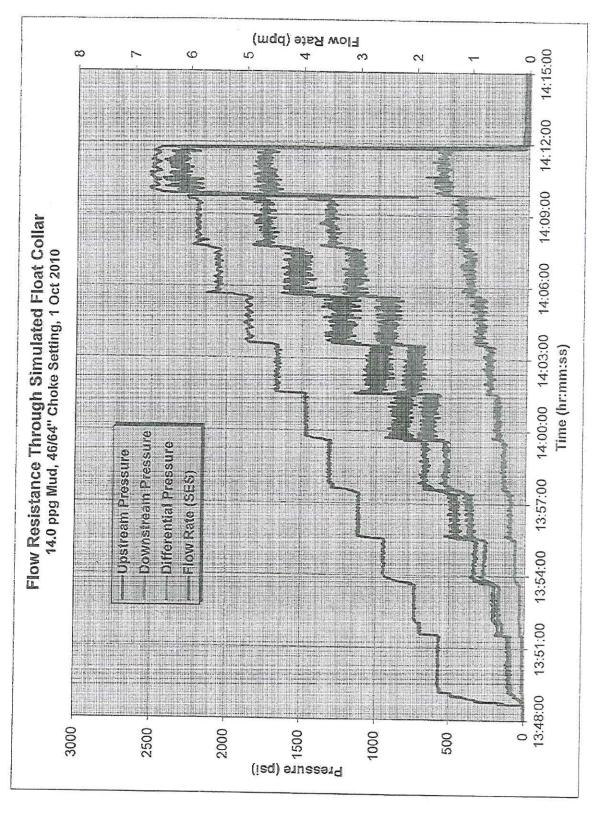
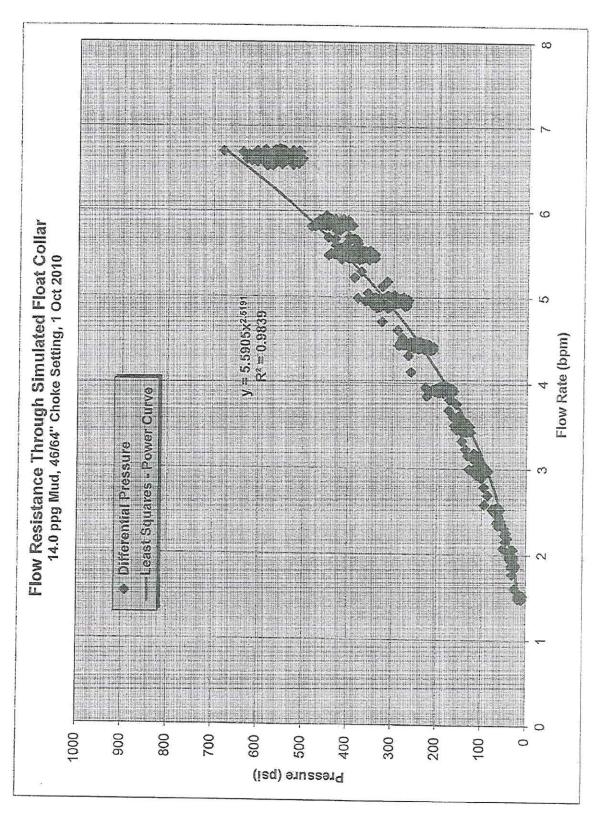


Figure E-1







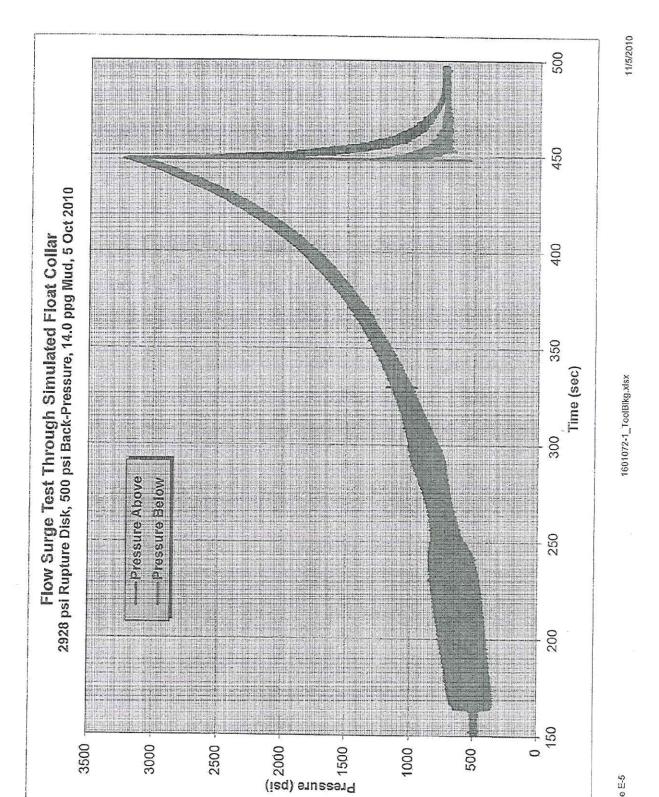


Figure E-5



1601072-1_ToolBlkg.xisx

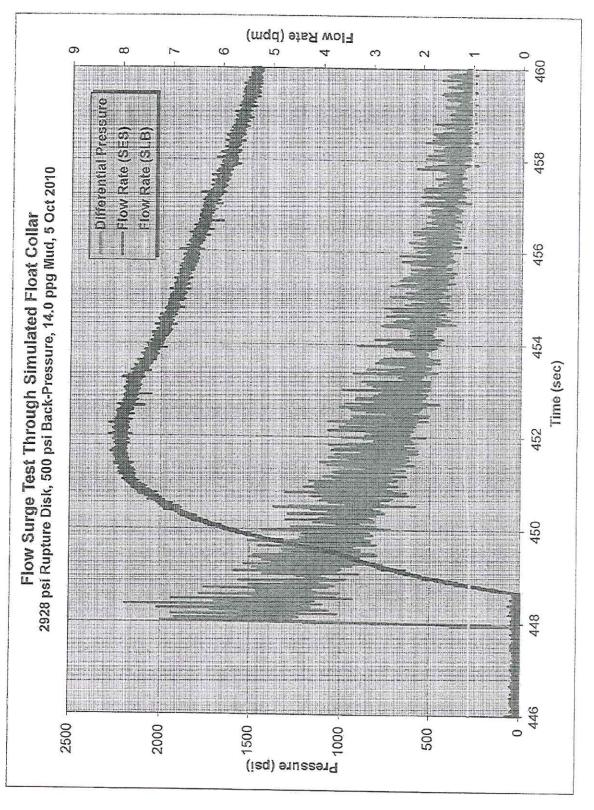
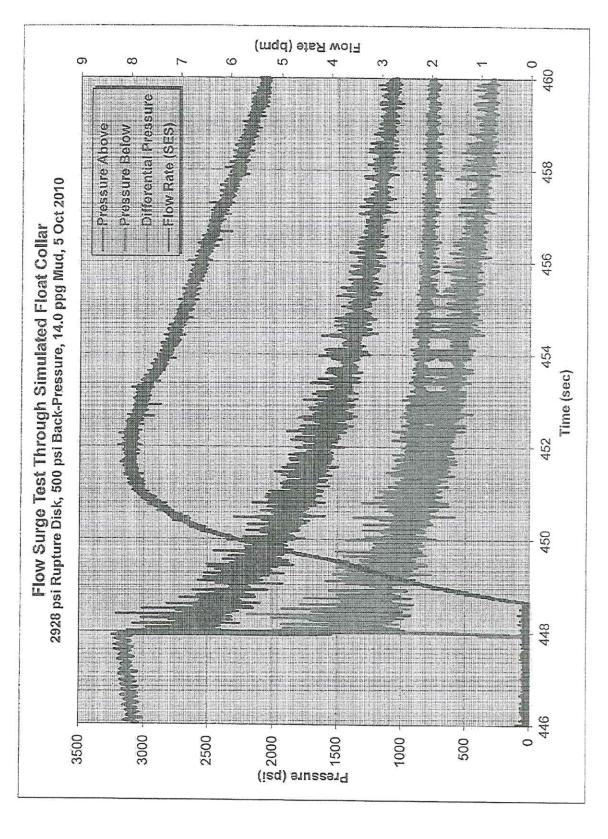


Figure E-6

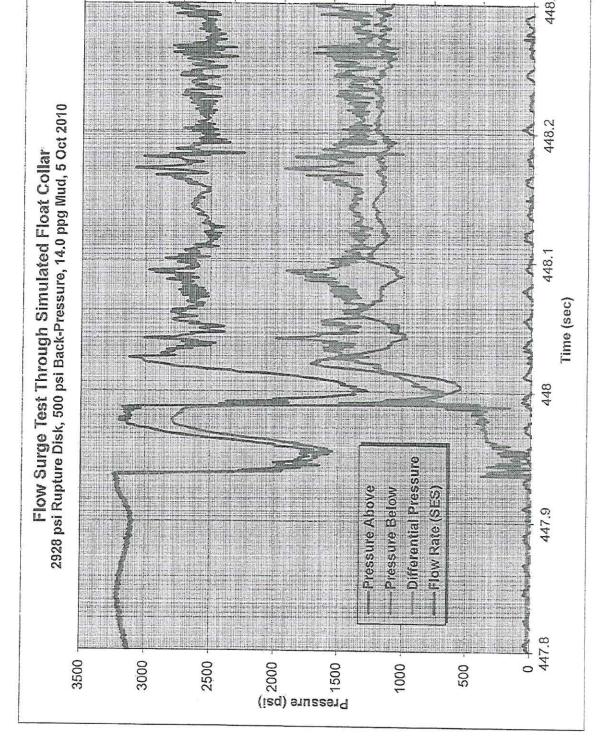












ο 4 Flow Rate (bpm)

6



1601072-1_TeolBlkg:xlsx

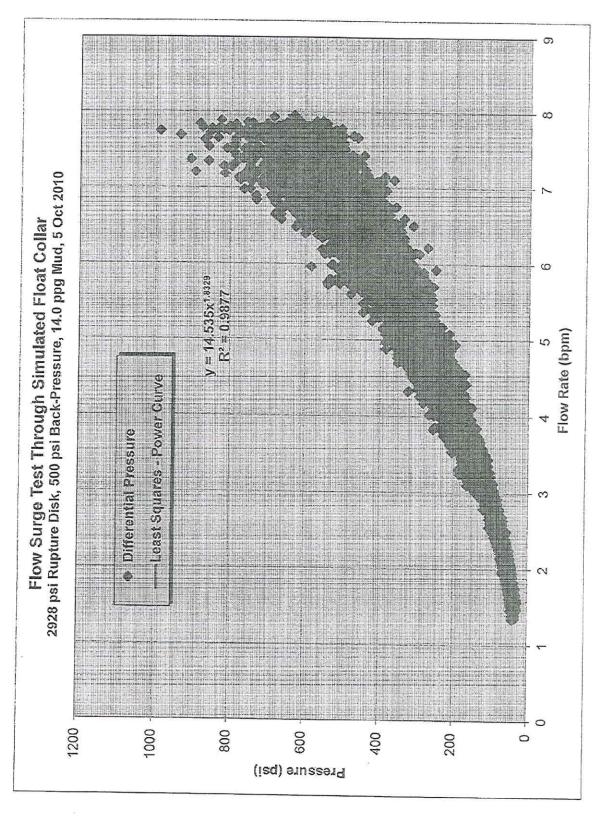


Figure E-9

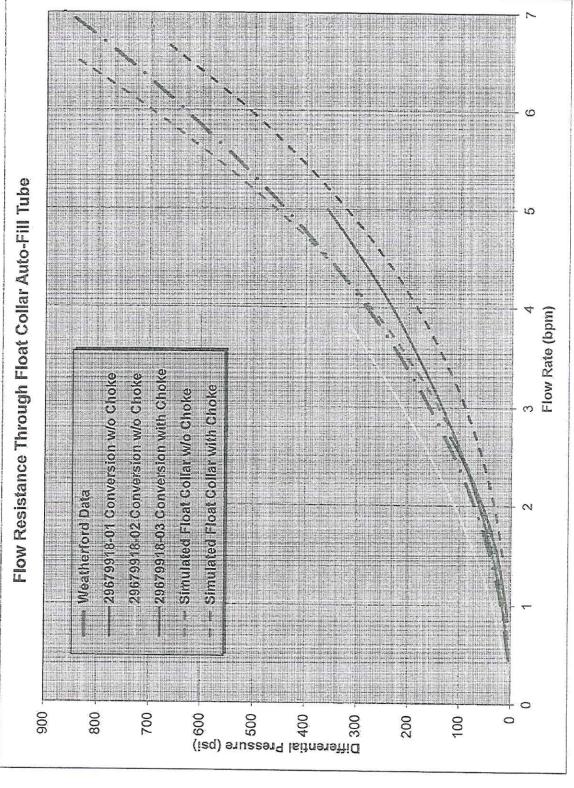


Figure E-10

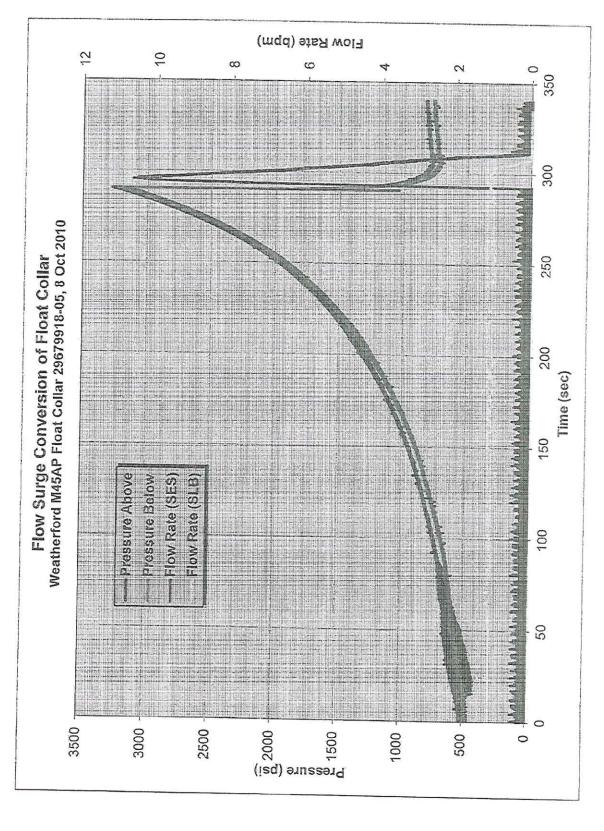


Annex F Flow Surge Conversion Test (SN-05)



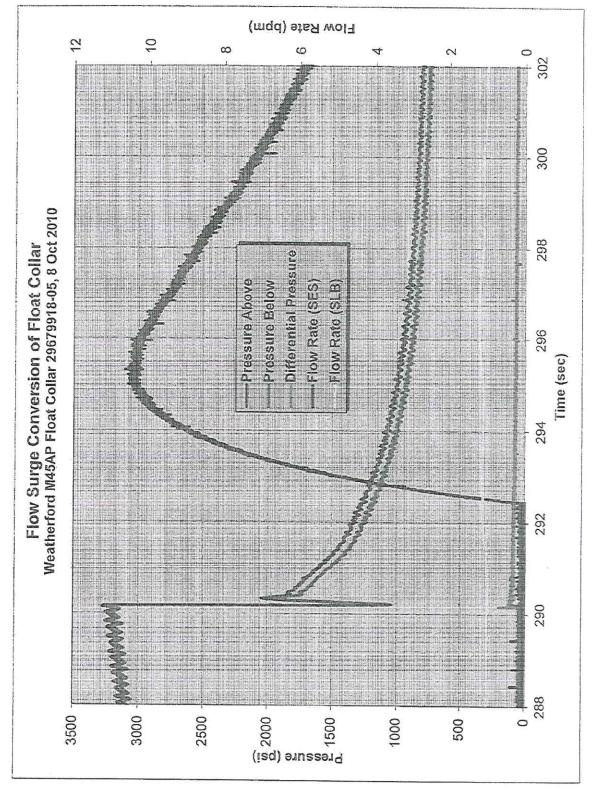
Stress Engineering Services, Inc.

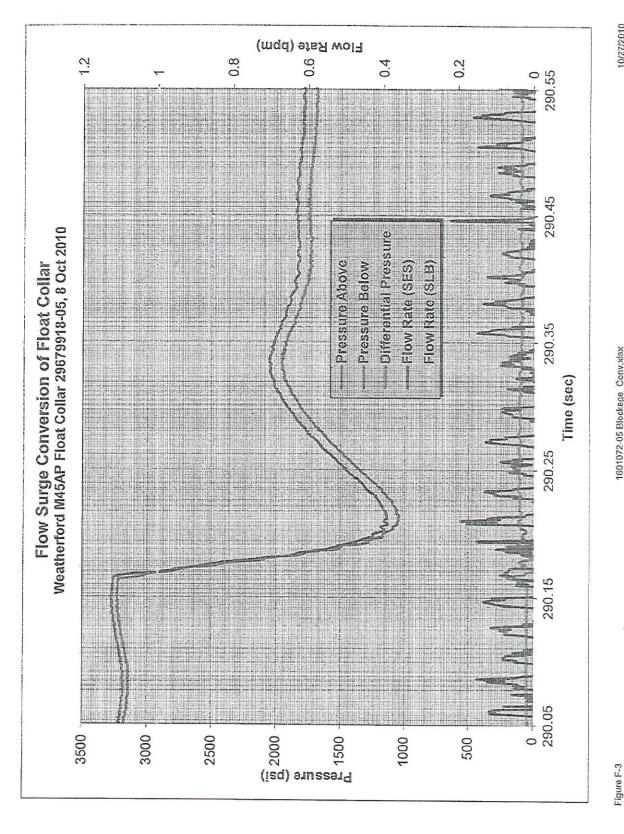
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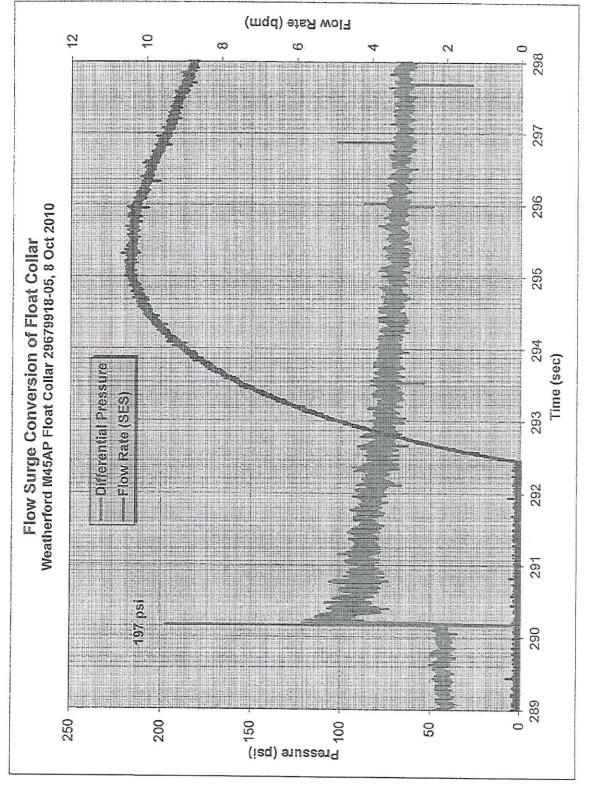






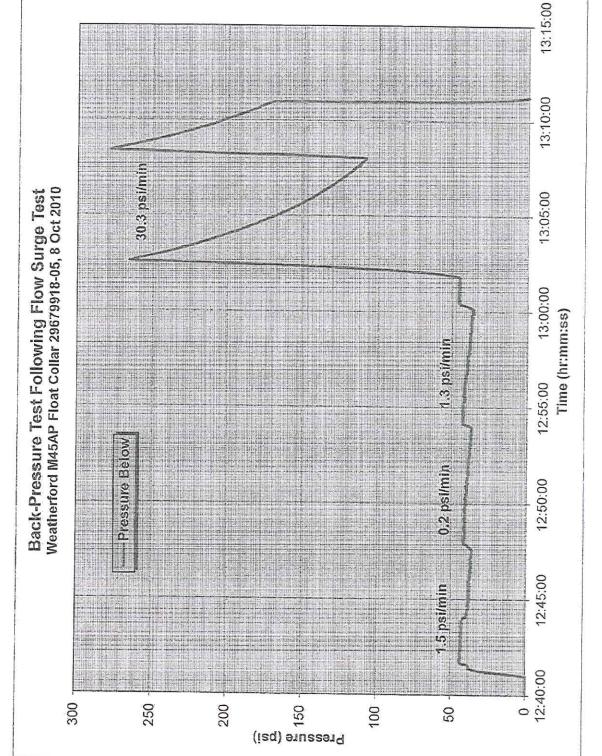








1601072-05 Blkg_BPress.xlsx



G

Annex G Flow Surge through Converted Float Collar (SN-05)

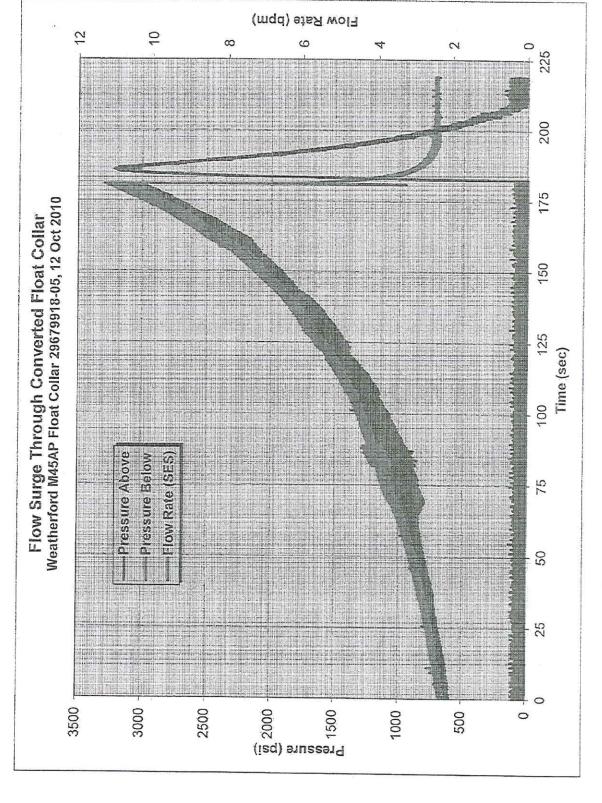


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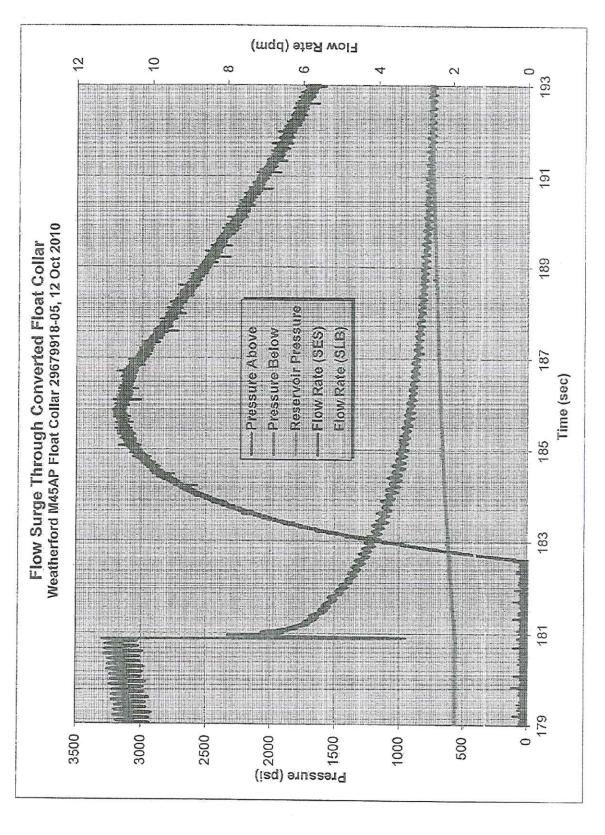
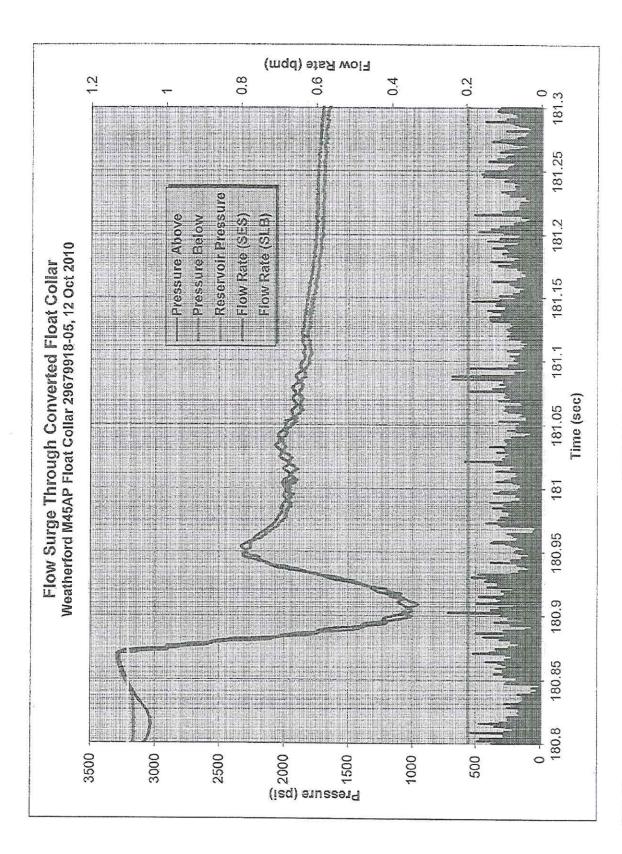


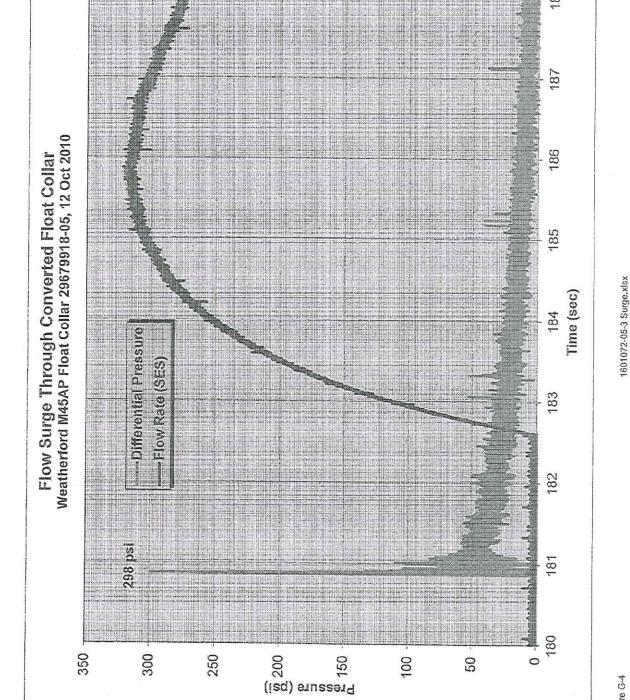
Figure G-2











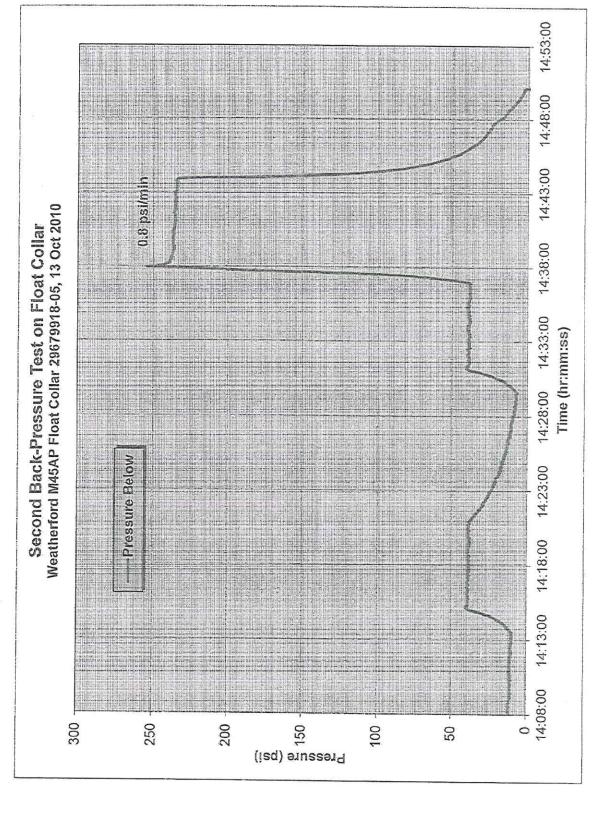
Flow Rate (bpm)

12

10

Figure G-4

Figure G-5



H

Annex H Flow Surge Conversion Test (SN-04)

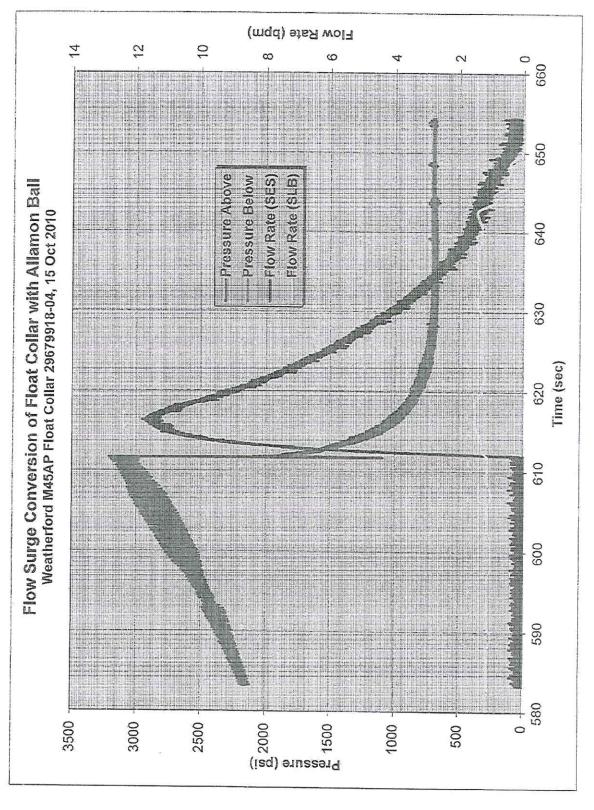


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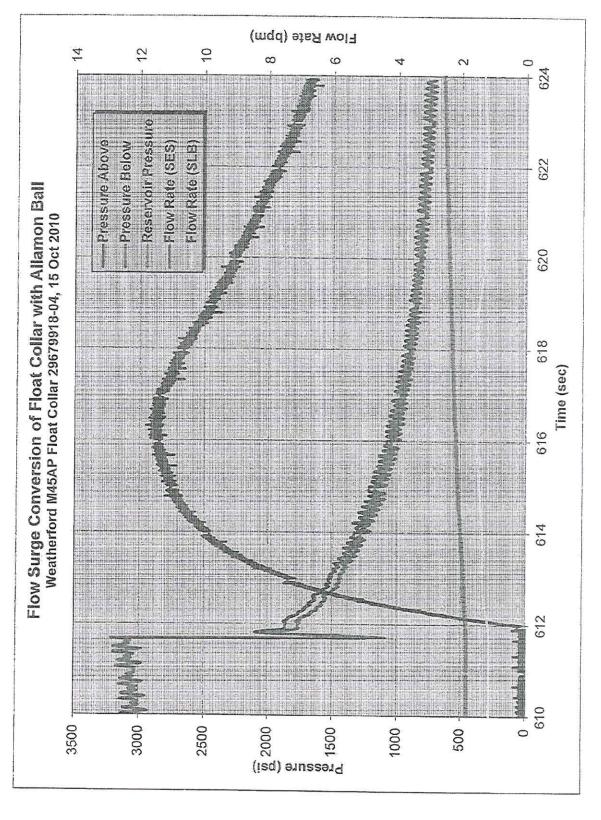


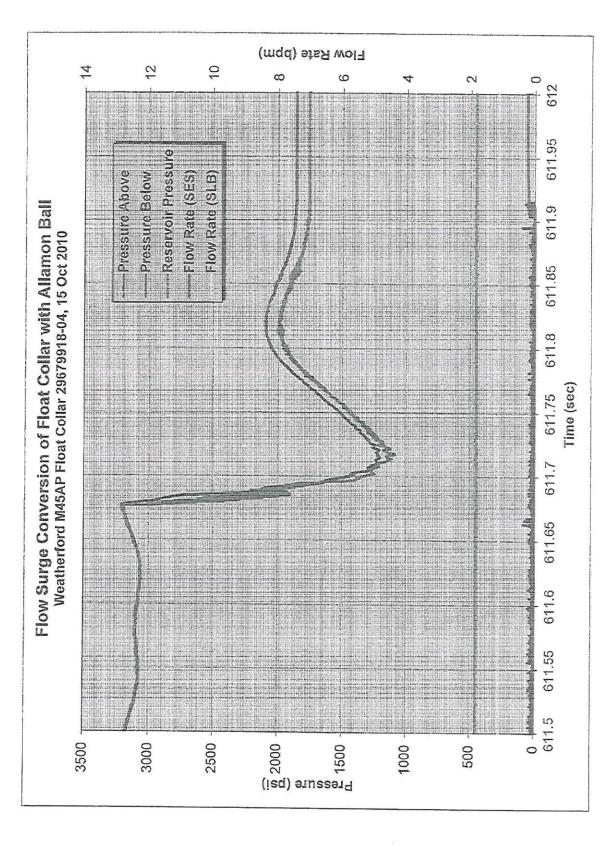






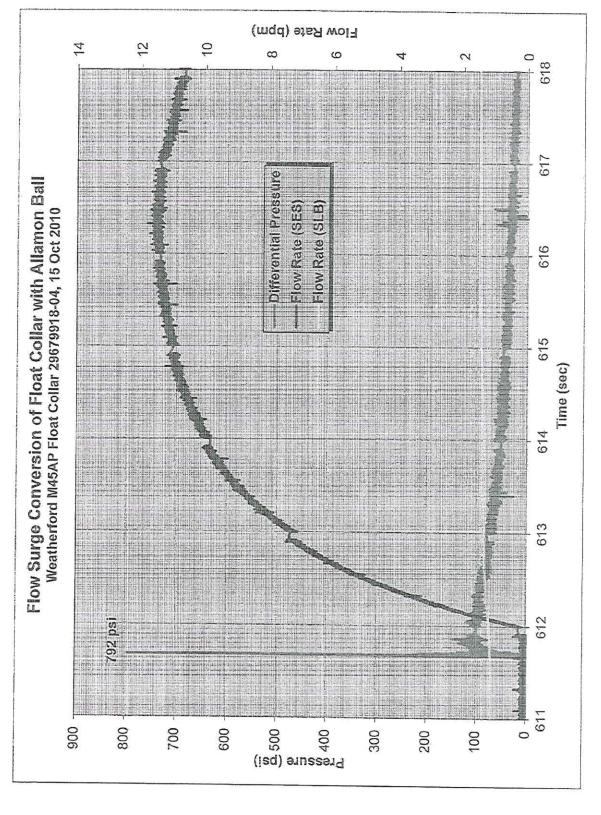


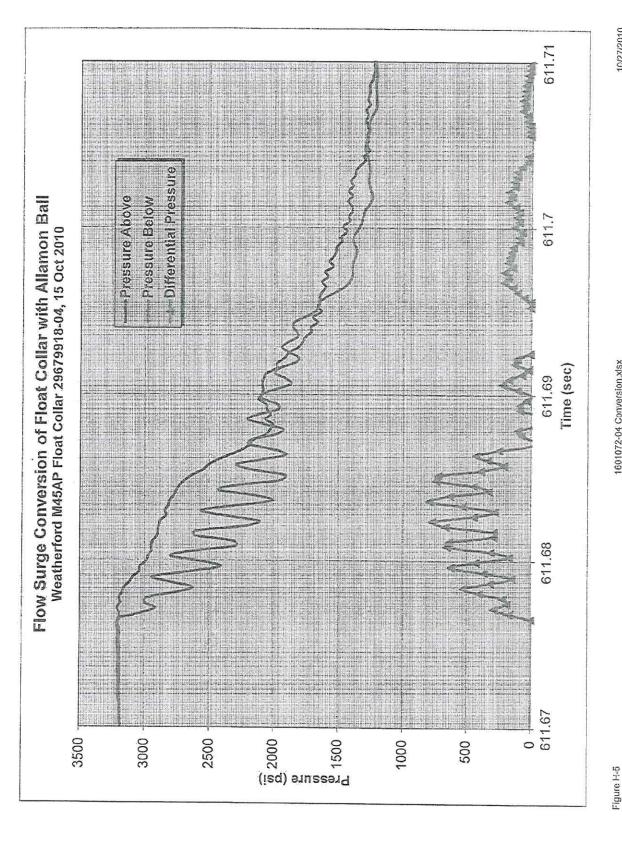




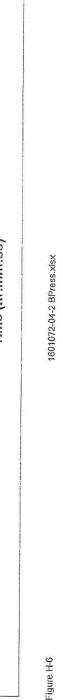


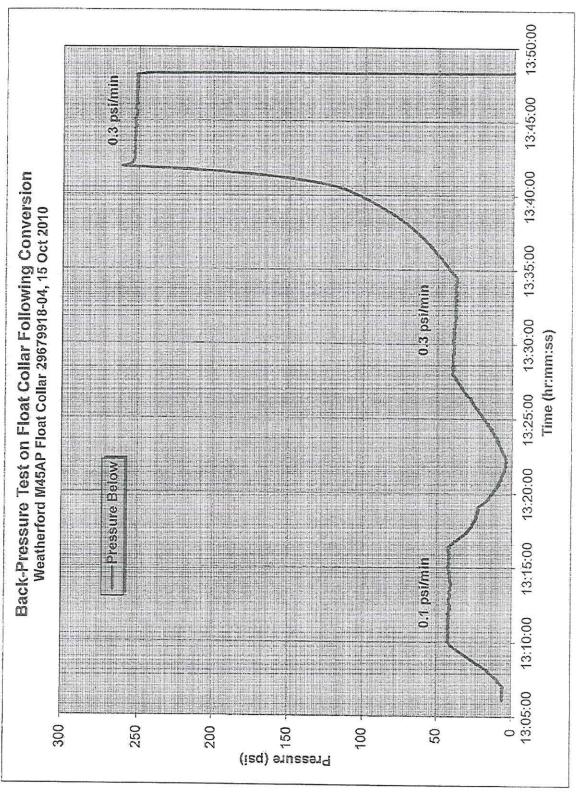














Annex I Flow Surge through Converted Float Collar (SN-04)

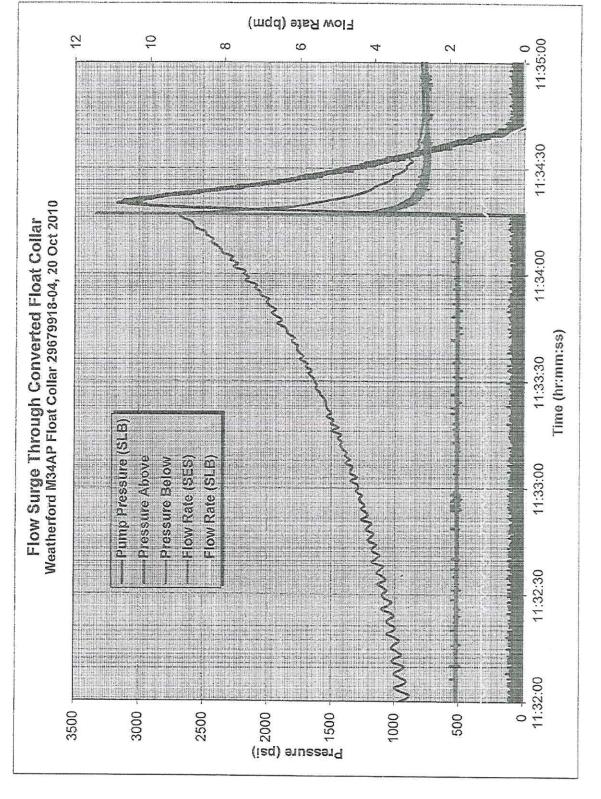


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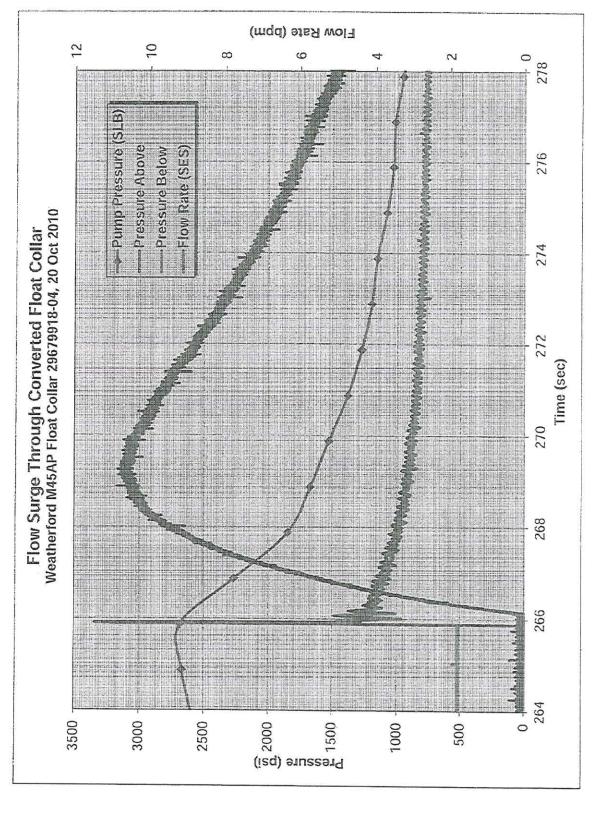






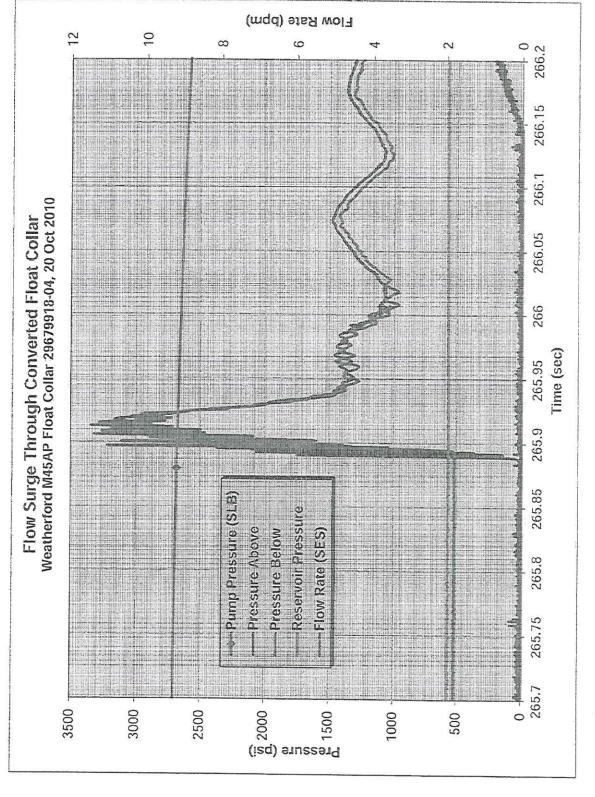


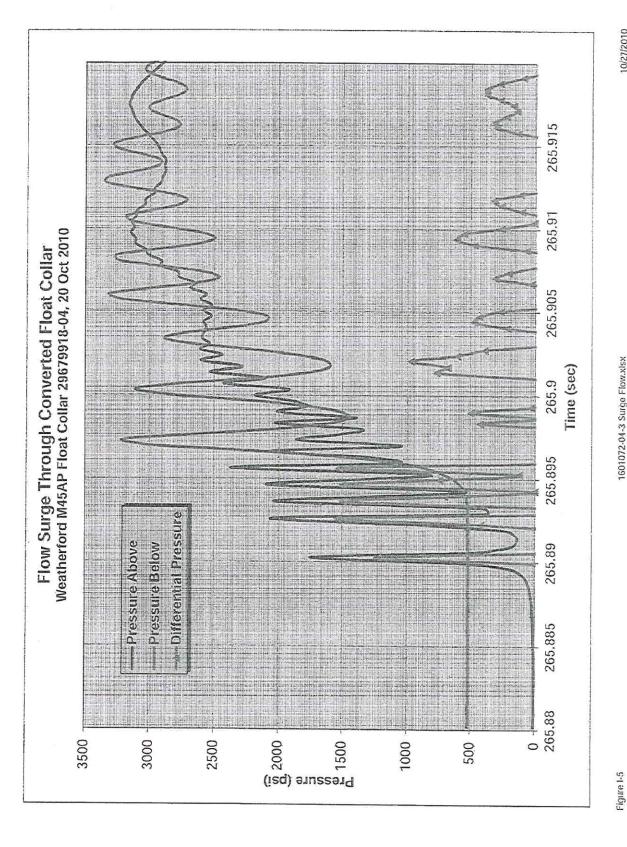






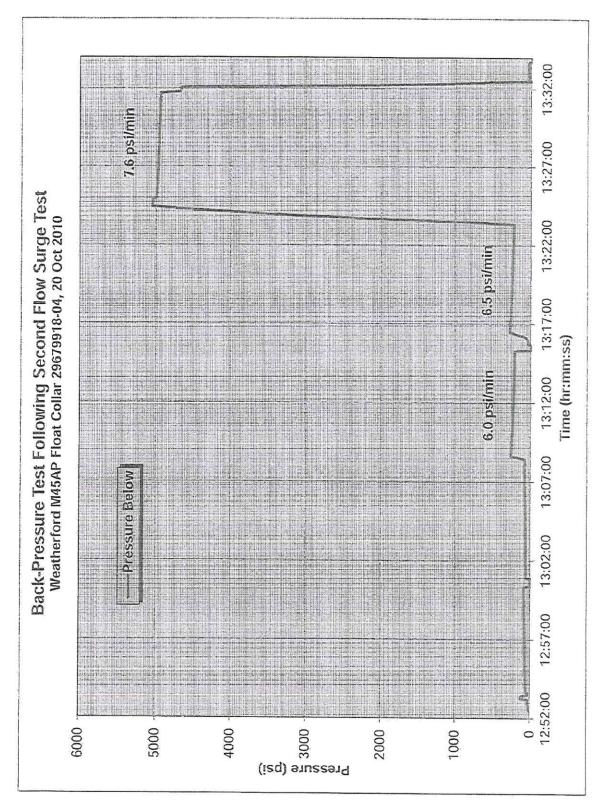








1601072-04-3 bpress.xlsx



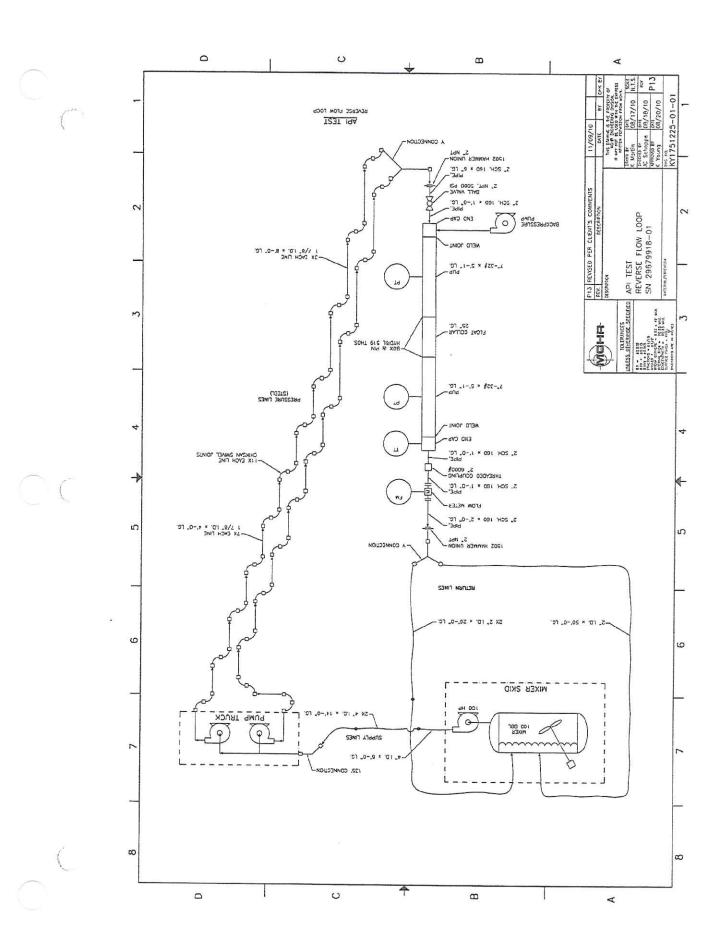


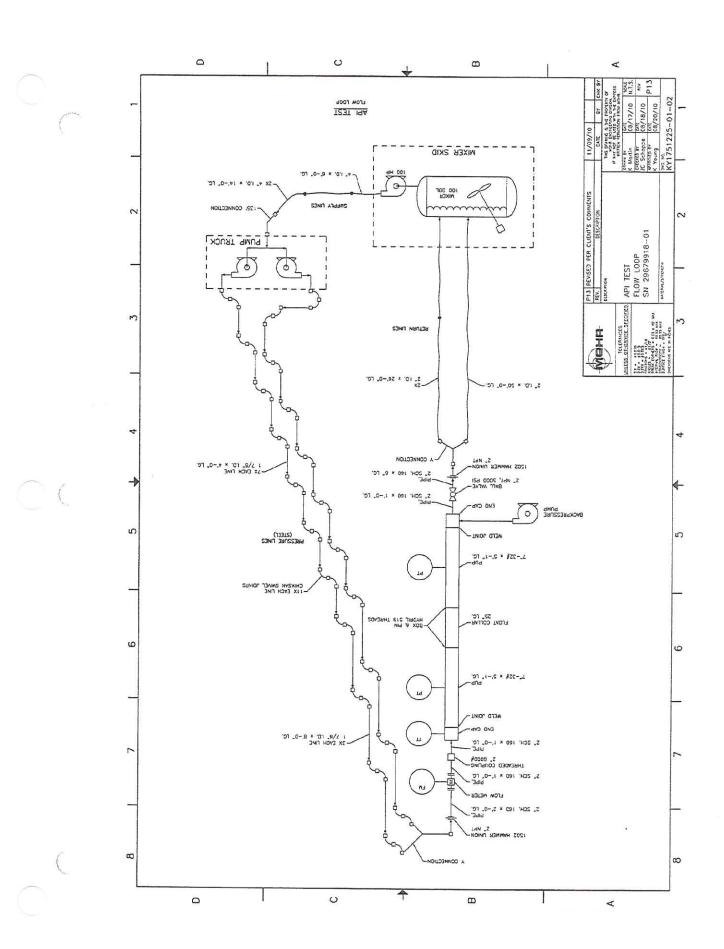
Annex J Drawings

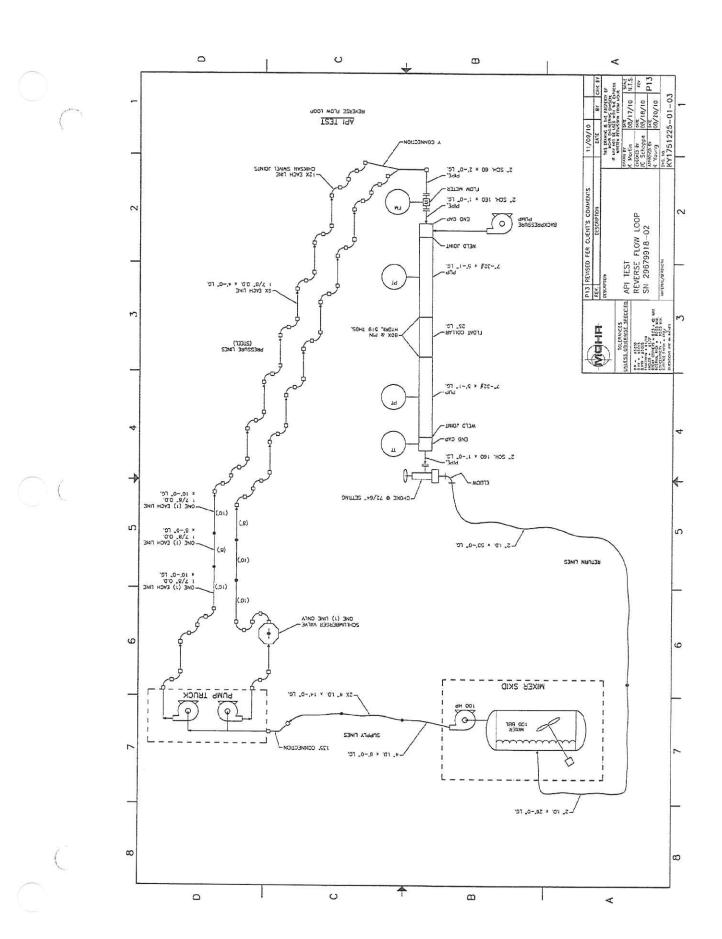


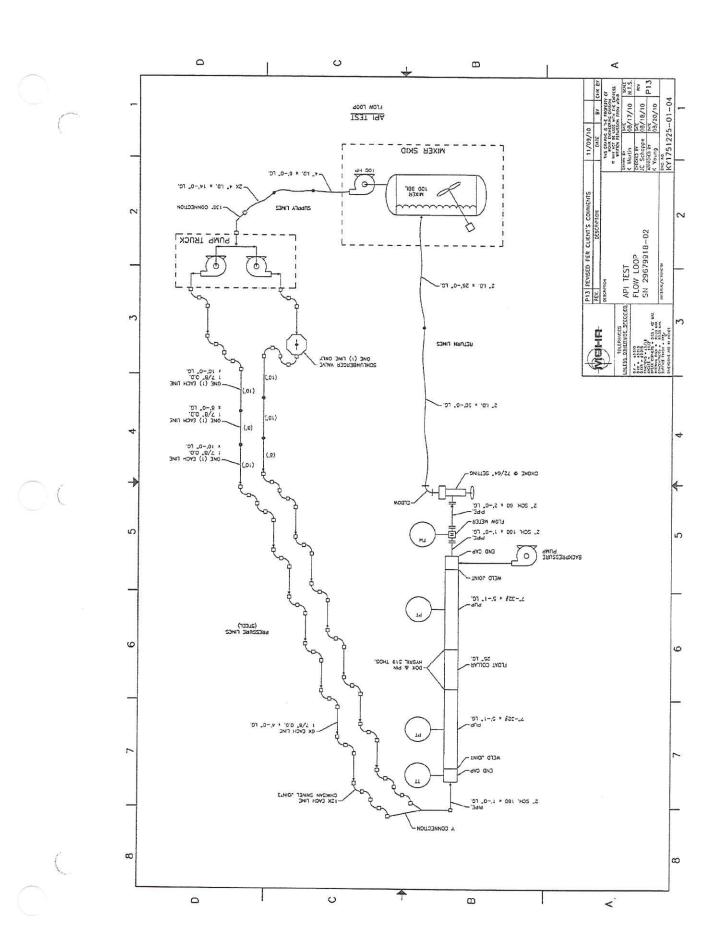
Stress Engineering Services, Inc.

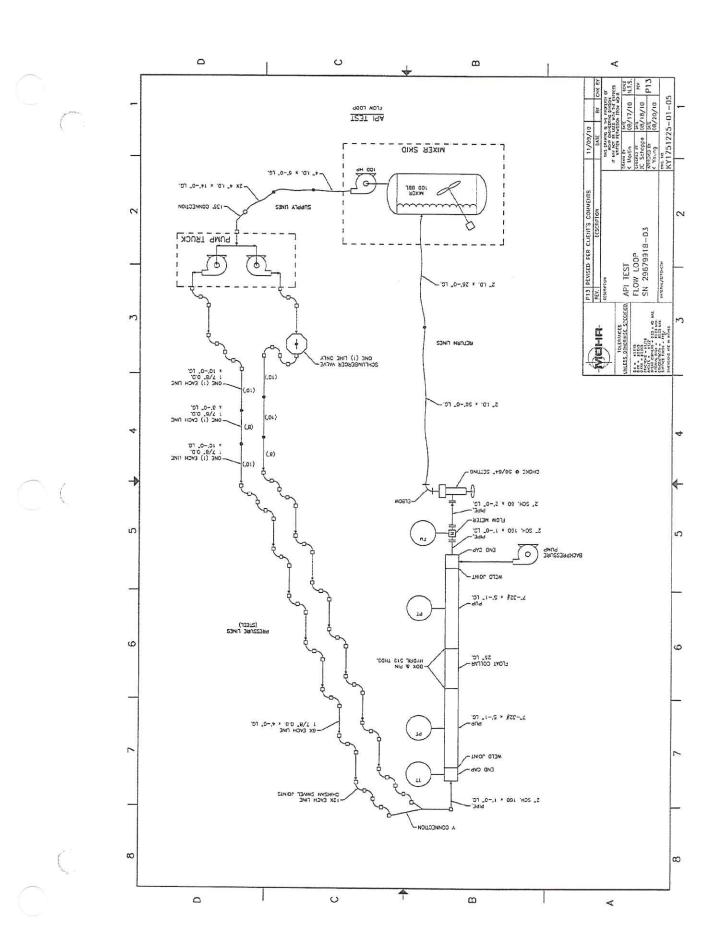
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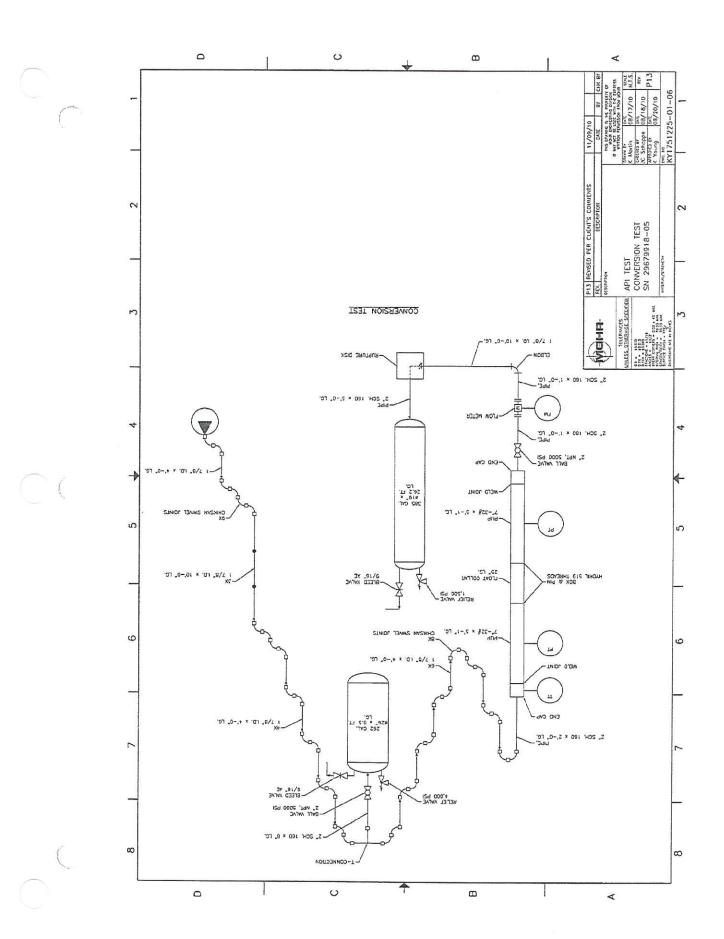


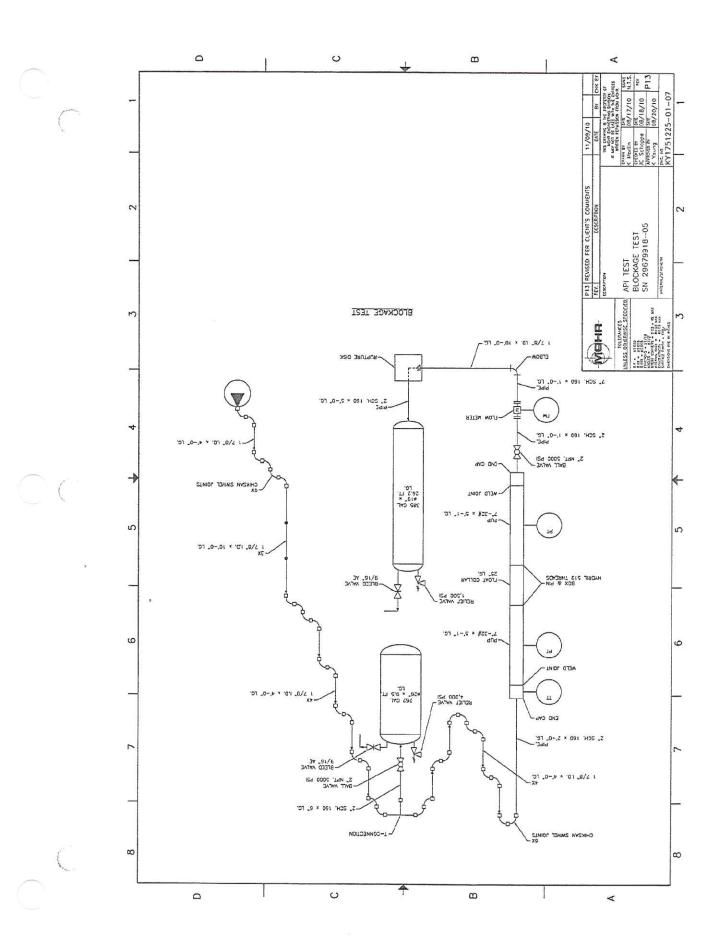


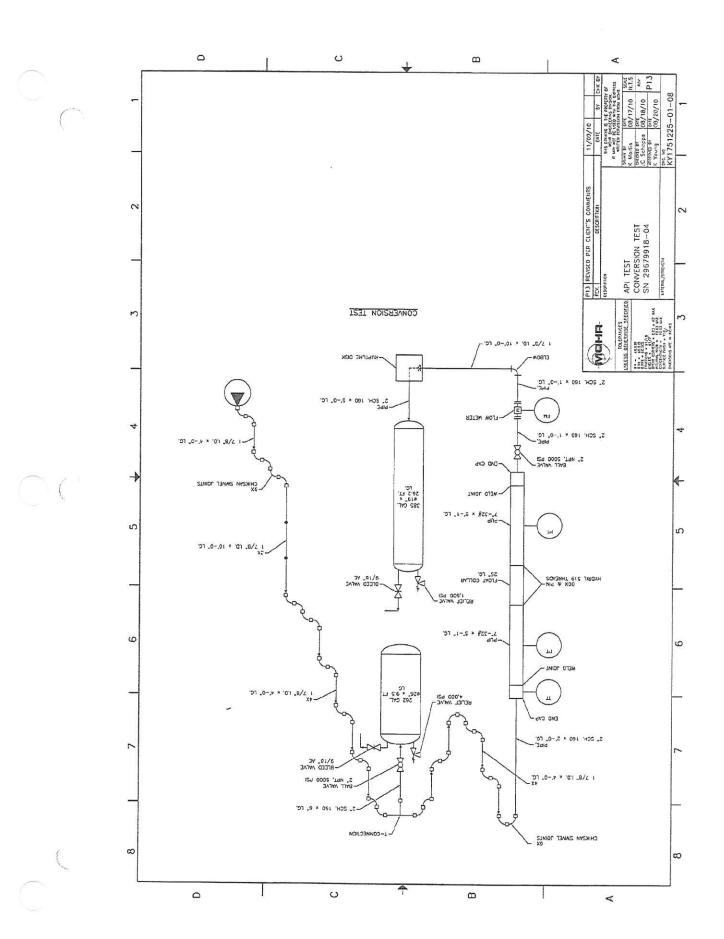


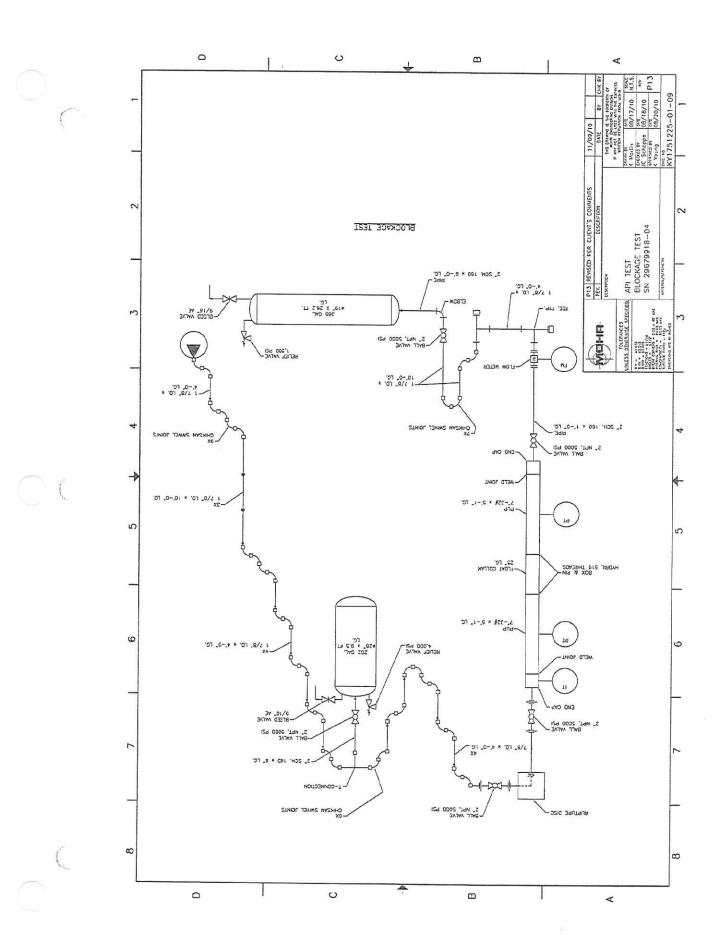


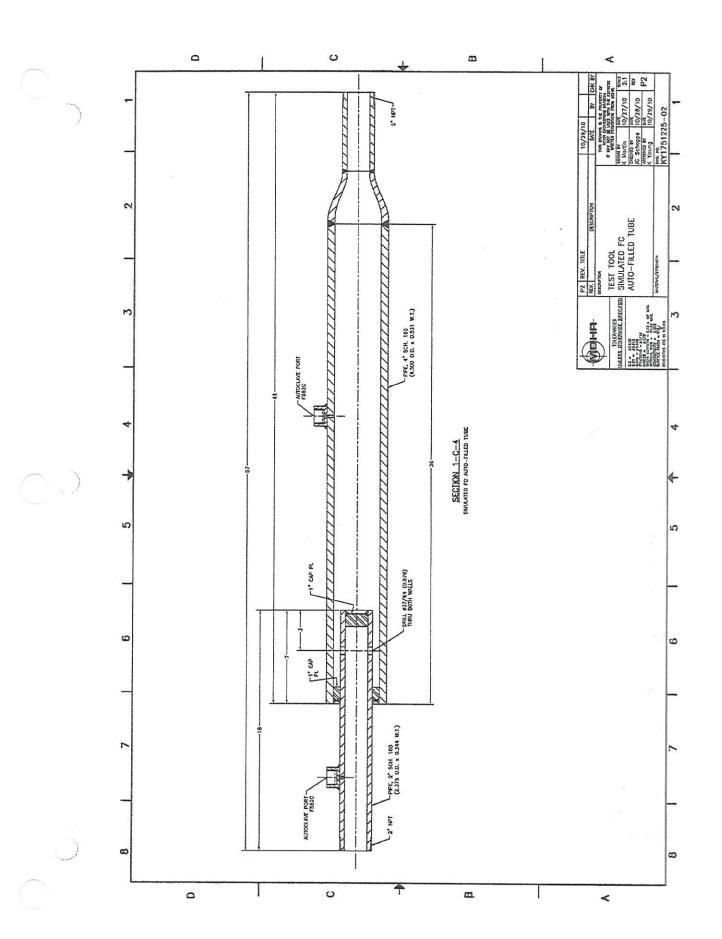






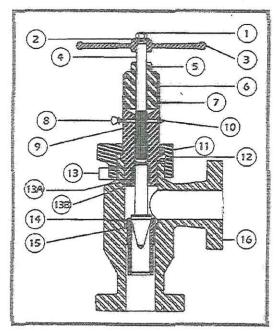






72

— TYPE H-H2 ADJUSTABLE CHOKES — MAX 2" ORIFICE

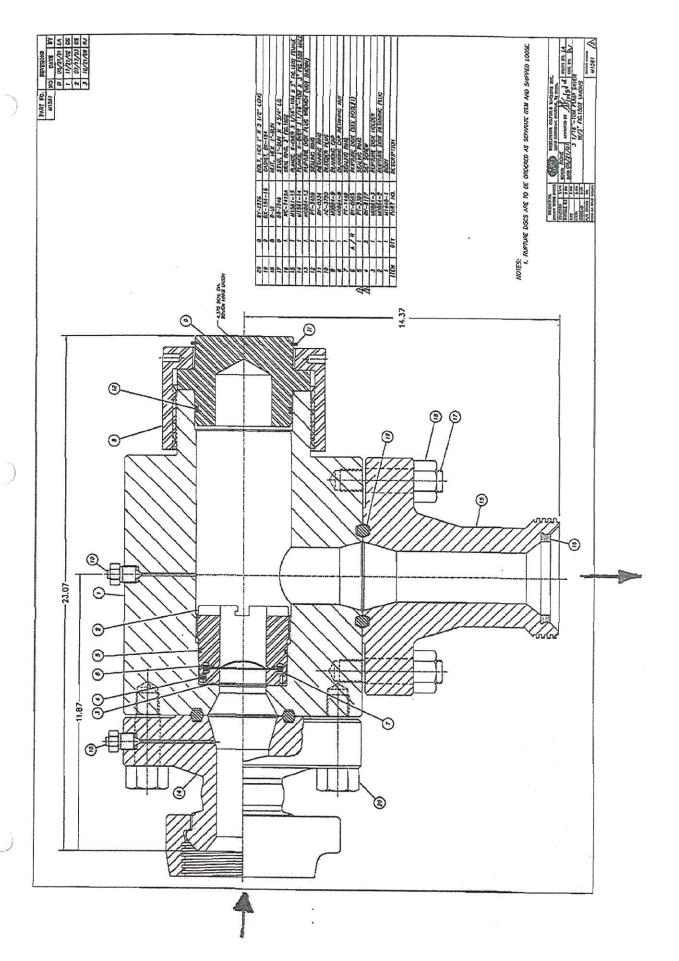


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4 1/16"	10,000 API	11.50	9.94	36.12
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2	Flat Washer		1023
-3	Handwheel	1	1521
4	Stem HS 27	1	1530
	Stém SS 2*	1	1590
	Stem SSTC 2"	1	1427
5	Set Screw		1535
7	Indicator 2"		1483
8	Bonnet		1510
9	Thumbscrew	1	1529
10	Nylon Balt		1004
13	Grease Fitting Hammer Nut SM		1013
	Hammer Nut 10M	î Ž	1511 1512
12	C-Rina		1528
13	Paciding	1	1505
13A	Junk Ring		1614
138	Retaining Ring	11.	1484
14	Seat HS 2	1.7	1513
turidayasi tes	Seat SS 2"		1514
	Seat SSTC ZT	j	1429
15	Seat Gasket	1	1464
16	Body, Flanged 3" 514	1	1516
	Body, Flanged 3" 10M	1	1517
*17	Seat Wrench	20 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1474
	*Sold Separately - Not	Pietries	

24 HOUR ANSWER/ORDER NUMBERS & TEL: 1-800-882-3717 & FAX: 713-466-3189



K

Annex K Mud Reports



Stress Engineering Services, Inc.

Confidential

Report No.: PN 1751225



5950 NORTH COURSE DRIVE, HOUSTON, TX 77072 281 561-1383 FAX 281 561-7240

ANALYTICAL SERVICES LABORATORY

Project Number: AS	155-0726-2010 Analyst:	Marc Churan	Date :	7/27/2010
Many COLAY Materials		And the second s		part were the same and the same
Sample Identification:	Play Sand from Stress Engi	neering Services, M	lohr Engineering, F	lempstead Yard
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Test Data:			The Carlotte Control of the Ca	
rest Data.				
Sieve Analysis:				
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Copies to: Jack Littleflel	ld	Signed:	Marc Churan	
Cole Vanya				
Jay Forrester				
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			Page 1 of 1	

Notice: This report is limited to the described sample tested. Any person using or relying on this report agrees that M-I LLC and its affiliates shall not be liable for any loss or damage, whether due to act or omission, resulting from such report or its use.

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Well Name :	comment a during					Walter County			
Contractor:				M-I We		diter county			
Report For:	and an extenditure of the second seco		Proposition become management of the					and the second second	
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	The state of the s	PERTIES	· La Maria de Propinsion (1980) (19	4		i i	PRODUCT	S USED L	AST 24 HRS
Sample From	Tenancia in a construction and	PIT@0				Prod	rets	1	Size I A
Flow Line Temp		F Lis	<u> </u>			ENG	NEERING SEE	VICE	_ I EA _
Depth/TVD Mod Weight	Ne/	n -/- gal 12,45@1	18°F			}	The field of white out the	-	
Fannel Viscosity		efat ! -	4			-	PP 1771-AP By Demokration (i.e.)		
Rheology Temp						1	and the same points of the same		
R600/R300		58/3:				1	The state of the s	1	
R200/R100								1	
R6/R3	······································	z[* 23				1			
W.	ISJ FOR		4			-	er en		
10s/10m/30m/Ge			- 1			1	ent o ter e		
API Flord Loss	cc/30 r					1			
HTHP FL Temp	cc/30 s	nin -(a)-°	F			1	design and a second second		
Cake APPITITIE		12" 1 6/-	1			1	10 × 111,1 × 12,74 × 12,2 × 144, 2,11 × 2/2,00		Comment of the same Proposed by Tages 1979 or for parameter
Selids		(a) 17					(a) (1-21) (a) 44 (1-44)	1	
Oil/Water		Vol 0/83		The second second second					Treat and the second se
Sand		Vol 4.5				SOL	DS EQUIP		Size H
MBT sil	ib/s	bhi <u>20</u>	·	HARACTERS CONTROL					
Alkal-Mad (Pm)		8.4 .1					(e)ere () (eren (a), (e)eren () () ()		
PI/MI		.05/.	7				1-14-r		
Chlorides	T1	g/1 200							
Jardness Ca		80	• •			(1900) 14 for 4 for 1/ _{4.5}			to programme the second
The second secon	• •• •• •• •• •• •• •• ••	***************************************						1	The section of the se
							The same of the same of		H 15 UH
CONTROL OF THE WAR THE CONTROL OF TH							electric de la company de la c		
						100	MUD DOOD	EDTY CDC	CIFICATIONS
10.5 to 10.5 t	the second area bridge, AM and determine an experience		and the Management of the State of the second			l	Weig		CIFICATIONS
				11 4 1 have the con-			Viscosi		
	Vitro de la composição de			and the state of t			Filtra		
								1	
F	REMARKS AND	TREATMEN	Т				REMARK	S	the state of the s
TIME DISTR L	ast 24 Hrs Muc	O VOL ACCTO	6 <u>(bbl)</u>	SOLIDS A	analysis (%	(lb/bbl)	MUD n/k Value		/ & HYDRAULICS
Indiana.	Water	Added	0	TKC1		0.70.	Tagy (16/1	0605	
ripping on-Productive Tin	Mad R	ccervel	. 0	Low Gravity		3.1/28.2	Tany (lb/) Bit Loss (ps. / 543	
ens-Productive Tin	0 Shaken Evapor		0	Bentomite Delt Solida		2.1/19.	EN THEFT	hup / list?	
	Centrif		0	Drift Solids Weight Mater	ia)	13.9/204	Bat Jef Vel 4 Ann Vel fi	(115c)	· · · · · · · · · · · · · · · · · · ·
	Formet	10/19	0	Chemical Cor		-/0.	Ann. Vel D	(C (fi/min)	
	Left in	Hole	0	Inen/React		0.4077	Crat Vel Of	(Il/men)	
	Other Dampe	al -	0	Average SG Carb/BiCarb (m molect i	3.91	Crit Vol (X	(lt/mm)	1
M-I EN	GR / PHONE		RIG PHON	and the second of the second of the second	REHOUSE P	A COUNTY OF THE PARTY OF THE PA	BAILY CO	ST C	UMULATIVE COS
Cole Vanya	070_22	0-7701		a.		1	USD 1,200.0		116D 3 400 00
	233-66	WITHE					USU LZVII.O	UF I	USD 2,400.00

D. 61: 6314			A THE PROPERTY OF THE PARTY OF	WATER-				T No. 3	}
Mi SV	VALL	All services		Date 7/22/		Depth/TVD		ft/ft	
	A CONTRACTOR OF THE PARTY OF TH	Control of the Contro			2010	Mud Type		Spud Mud	-
			Wate	or Depth		Activity	1		
	tress Engineerin	8		Field/Are					
Report For: K	concin Young	T		Description					
	venuerrora room	1 test				ler County			
Contractor:				Well N	o, :				
Report For:	APERNI 16					·			
DRILLING AS	SEMBLY	CASII	Parameter	MUD VOLUM	E (bbl)		CIRCULATIO	ON DATA	
3ij Size 0. in		Sucfa	CC	Flote		Pump Make		-	
Vozzles 1/32* Drill Pipe Size		Intermed	****	I speciment - and the organization of the second		Pump Size	0. X 0.in		(0.in
), in	Lengsh R	HIGHIGI	IIIIC	Active Pi	ES	Pump Cap Pump stk/mir	gal/	RK .	gal/st
Drill Pipe Size	Length	Intermet	linte	Total Circulati	na Mal	Leanth Section	Flow Rate !		l/min
), in	ft	meme	J. T.	I Star Cara	HIS FINA		Bottoms Lin		min
Drill Collar Size	Length	Production	or Liner	In Storag	c.		Circ Time		0.00
), in	<u> </u>			0	Ţ.		ng Pressure		
		MUD PROPE	RTIES	***************************************	*irring ()))))))))))	PRO	DOUCTS US	D LAST 24	HRS
Sample From		PIT@07:20	PIT@12:15	PIT@19:00		Product		Size	Am
Flow Line Temp.	5 0		-	The second living the party of the second second			ERING SERVICE		2
Depth/TVD	0		-7-	1		M-I BAR	ξ	100 LB BG	125
Aud Weight		12.25@100°F	12.3@95°F	12.2@110°F		M-I GEL		100 LB BG	12
unnel Viscosity		ļ		1		PLAY S	AND	50 LB BG	35
theology Temp	279 Fg.	120	120	120		and the second second second second second second	and a second property of the control	The live of the li	No. of Street Plans
2600/R300		32/19	48/30	51/33					
£200/£100 £6/R3			-/- -/-	1 +					
OV COVICE	-cl ⁵		18	18			THE SHOP SHOW		ļ
/P	2b/100ft ²		18	18				ļ	
0s/10m/30m Gel	1b/400ff	10/-/-	12/-/-	LS/-/-			en accessing a loss of the second	}	1
API Fluid Loss	cc/30 min		17.2	17.0					
THP FL Temp	cc/30 min		-@-°F	-@ <u>-</u> °F				<u></u>	-
Take APIATTHP	1/32"	6/-	6/-	7/-	A	e en			ļ
Solids	SaVol		16	16	Contract Security Section			Andrews (Carles and Carles and Ca	j
Oil/Water	%Vol		0/84	0/84	Communication of the Communication of the				f
Sand	%5Vel	2.5	4.0	3.0		SOLID	SEQUIP	Size	Hr
MRT	lb/bbl		20	20			1		(**)
1년		8,4	8.4	8.4					
Alkal Mud (Pm)		1		1					
PDMf Dilockies	220	200	.05/.2	200					
lardaess Ca	mg/l	80	80	80				-	
				- 30					(p.84)
The second state of the second	The state of the s								- 00
		i	Control of the Control of the Lorentz	1	*** *				
					WITCH SHIP SHIP SHIPS				
					*	1	- are in the contract of the		
1-01-1-01-1-01-1-1-1-1-1-1-1-1-1-1-1-1-		1				1	MUD PROPE	RTY SPECS	5
					Per manufacture de const	Weight		Annual Control of Control	THE REAL PROPERTY.
make a					(Market Comparison or	Viscos	tv .		
					Allements of the single successive	Tillrate			to the second
	MADUC AND			1,	and the second second		200		
KE	Marks and 1	REATMENT				REMA			
			9			CE CHARGES F		ACCOUNT FO)R
				ENGINEERING	SERVICE	CHARGE ON	7-19-2010.		
				1					
				1					
IME DISTR Last	24 Hrs MUD	VOL ACOTO	/her	601/06 41/4	NO 101 11		ID DUE DE L		
or Un/Service	24 Hrs MUD Oil Add	VOL ACCTG	(1dd)	SOLIDS ANALYS		0.1 nd Va	ID RHEOLOG	Y & HYDRAUL	ICS
ritting	Water A	dided !	65 3	saca CCi			(b/1000°)		
ripping	2 Mint Re	cerved	0 1	aw Gravity	2.6		5 (psi / %)		
ion-Productive Tim	Shakers		0 1	lentomie Drill Solids		16.7 Bit 1114	s (psi / %) P (lahp / (tSI)		
	i Lyapera Centritu	ANCAL TO THE PARTY OF THE PARTY	0 1	Onli Solids Veight Material	0.8	76.9 Bit Jet	Vel (ft/s) d DP (ft/min)		
Commence of the Commence of th	Fermal	365	0 10	hemical Conc		10. Ann Ve	DC (timum)	<u>-</u>	
	Len in t	loke	0 11	nert/React	0.3	492 Crit Vel	DP (ft/man) DC (ft/man)		
							The state of the s	The state of the s	
	Onlier		0 /	(verage SC	1	94 Crif Vel	TW United		
BJ FACD	Culter Usamped		5.9 (arb/BiCarb (m mol	LJ LIV	19.9	Tarrent carrier strongers of carrier		(Bush) Language B
M-I ENGR	Culter Usamped		S.9 (arb/BiCarb (m mol WAREHOL	LJ LIV	19.9	Y COST	CUMULATIVE	COS

BAL CIA	MACC		prant 11		TER-B	ASED MUI			. 4
Mi SV	WHLL	The same of the sa	The second secon	Date	and another transferred to be the person of			n/ft	
	The second of th	COMMON CONTRACTOR	Spud Water D	Date	7/20/2010	merchanism management of the same		Spud Mud	
Operator: S	tress Engineering			epm	Field/A	Activity	1		
Report For: K						rea: ion: Test			
	eatherford Tool 7	est.				ion: Waller Cour	rtv.		
Contractor;					M-I Well I				
Report For:			and commercial and a second	2000254711					
DRILLING AS	SEMBLY	CASING	MUD	VOLU	ME (bbl)	C	IRCULATI	ON DATA	
lit Size 0. in		Surface	1	140	ile	Pump Make			12
Sozzies 1/32* Drill Pipe Size	Length	intermediate		Active		Pump Size	0, X 0.1		X 0.ln
), în	fi	intermediate		-Futtori	- and	Pump Cap Pump stk/min		Ustk	gal/stl
Jril Pipe Size	Length	Intermediate	True		dating Vol		low Rate	- I	min
). in	fî l		-		- The state of the		roms Up	Ext	22454
Drill Collar Size		Production of Li	ner	In Sto		Total C	ne Time		
. in	ft		4	0		 Circulating 	Pressure		
ample From	MUD PROP		DITCHASE				CTS USE	D LAST 24 H	
low Line Temp	ol:	PIT@08:30	PIT@12:30			Products ENGINEERING S	EBINES	Size_	A
Pepth/TVD	fl		j.			CNOINCERUNG S	DERVICE	1_EA	
and Weight	lb/gal	- Second - market and are all and are	12.2@100°F						1
unnel Viscosity			•						
theology Temp :600/R300	F		120	-		ļ	***************************************		and and the state of the
200/R100		47/30	49/31						
6/R3		1 7	1-1-	-		A ALCOHOLOGIC COLUMN PROPERTY COLUMN			
v	eP	17	18	1		gradus received a section of the sec		1	
P	IP/1000-		13	1					
0s/10m/30m Gel	16/10017		13/-/-	-1		L			- 1
PI Fluid Loss ITHP FL, Temp	cc/3() min cc/3() min		17.0 -@-°F	_		in manner in terror			
ske API/ITHP	1/32"	7/-	6/-	-		1.0010000000000000000000000000000000000			
olids	%Vol	17	17			-	Manager Townson	-	-
Dil-Water	%Vol	0/83	0/83						
and	9aVol		3.5			SOLIDS EQUI	P	Size	_ Hr
MBT	lidabil		20			-		The share will a me	
H Akal Mud (Pm)		8,4	.1	-		1			
FMI		.05/.2	.05/.2			LANT-			
Intorides	me/l	200	200				<u> </u>		
fardness Cp	me/l	1 80	80	i		1	1		
		1	 						
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REI	MARKS AND TR	EATMENT	1		aramitation () salar (or) gag - aramitation	REMA	RKS		
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					Algorithm Control of the		The same same same	-	,,,,
TIME DISTR Last			bn soi	LIDS A	NALYSIS (%			GY & HYDRA	ULICS
dling	Onl Added Water Add		0 NaCl			0/0.1 te/k Vn	ties 5/100HN		
upping	Mud Roce	wed	0 Haw Go			42/384 Bit Lou	fraint That		and the company of
on-Productive Tim	Shakers Evaporation		0 Benton: 0 Drill So			19/17.7 Bit Hill 23/20.7 Bu lei	Filiship/Tisf Yel (Resi) !	
	Centringe		0 Weight	Maccria		2.8/187.8 Ann. Vo	OP (femin)		
A CONTRACTOR OF THE PROPERTY O	Formation		0 Chemic	a: Canc		- / 0. Ann. Ve	DC (filmin)		-
Three controls the state of the	i Left in Hol	<u> </u>	0 Inert/lee 0 Average			0.9198 Crit Vel 3.8 Crit Vel	Est (stemm) (X (stemm)		
A		Marian Branch Commission of the Commission of th		2100	- segalogal	J.o ILJH VCI	rac (trumb)		
	Dumped		O Carb/B	Title (m	i molezi.) - i	1/19.9		2	
'84 ENGR		RIG	O Carti/B		I (ROIC/L) EHOUSE PR	Andrew Commence of the Commenc	COST	CUMUI ATIV	E COST
M-I ENGR	Dumped	RIG				The state of the s	COST	CUMULATIV	E COST

133°F 12 0 27	: Test : Waller : (bbf)	Pump Make Pump Size Pump Size Pump Sik/mm B Total Circulatin PRO 0 Products ENGINEE	CIRCULATION 0. X 0.in gal/sik Flow Rate ottoms Up Circ Time g Pressure JDUCTS USED	(0,)	C 0.in gal/stl i/min HRS
cription: cocation: Vell No.: Vell No.: CluME (field cive Pits 60 circulating) Scarage 0 14:30 P	: Test : Waller : Waller : Waller : Waller : Waller : P : Waller : Waller : P : Waller : P : Waller : P : Waller : P : Waller :	Pump Make Pump Size Pump Size Pump Six Pump sik/mm B Total Circulatin PRO 0 Products ENGINE	0. X 0.in gaVstk Flow Rare outons Up Circ Time g Pressure DDUCTS USED	ga DLAST 24 Size	gal/st I/min MRS
cription: cocation: Vell No.: Vell No.: CluME (field cive Pits 60 circulating) Scarage 0 14:30 P	: Test : Waller : Waller : Waller : Waller : Waller : P : Waller : Walle	Pump Make Pump Size Pump Size Pump Sik/mm B Total Circulatin PRO 0 Products ENGINEE	0. X 0.in gaVstk Flow Rare outons Up Circ Time g Pressure DDUCTS USED	ga DLAST 24 Size	gal/st I/min MRS
Ocation: Well No.: OLUME (: Waller :: (bbl) -	Pump Make Pump Size Pump Size Pump Sik/mm B Total Circulatin PRO 0 Products ENGINEE	0. X 0.in gaVstk Flow Rare outons Up Circ Time g Pressure DDUCTS USED	ga DLAST 24 Size	gal/st I/min MRS
Vell No.: OLUME (Hole	(bbf) PIT@17:0 -/- 2 1@130° -/- 120 43/26 -/- 17	Pump Make Pump Size Pump Size Pump Sik/mm B Total Circulatin PRO 0 Products ENGINEE	0. X 0.in gaVstk Flow Rare outons Up Circ Time g Pressure DDUCTS USED	ga DLAST 24 Size	gal/st I/min MRS
Hole ctive Pits 60 ircutating Storage 0 14:30 P 133°F 12 0 27	PIT@17:0 -7- 2 [@130° -120 -43/26 -7- -7- 17	Pump Make Pump Size Pump Size Pump Cup ump sik/mm B Total Circulatin PRO 0 Products ENGINE	0. X 0.in gaVstk Flow Rare outons Up Circ Time g Pressure DDUCTS USED	ga DLAST 24 Size	gal/st I/min MRS
Hole ctive Pits 60 ircutating Storage 0 14:30 P 133°F 12 0 27	PIT@17:0 -7- 2 [@130° -120 -43/26 -7- -7- 17	Pump Make Pump Size Pump Size Pump Cup ump sik/mm B Total Circulatin PRO 0 Products ENGINE	0. X 0.in gaVstk Flow Rare outons Up Circ Time g Pressure DDUCTS USED	ga DLAST 24 Size	gal/st I/min MRS
ctive Pits 60 irculating Scarage 0 4:30 P 133°F 12 0 27	PIT@17:0 -/- 2 1@130° 120 43/26 -/- 17	Pomp Size Pomp Cup amp sik/mm B Fotal Circulatin PRO 0 Products ENGINE	gal/stk Flow Rate ottoms Up Cire Time g Pressure	ga DLAST 24 Size	gal/st I/min MRS
60	PIT@17:0 -/- 2 I@130° 120 43/26 -/- 17	Funip Cup unup sik/min B. Fotal Circulati PRO Products ENGINE	gal/stk Flow Rate ottoms Up Cire Time g Pressure	ga DLAST 24 Size	gal/st I/min HRS
60	PIT@17:0 -/- 2 I@130° 120 43/26 -/- 17	Emp sik/min B Fotal Circulatin PRO 0 Products ENGINE	Flow Rate of the Circ Time of Pressure of USEC	ga D LAST 24 Size	l/min HRS
Storage 0 P 133°F 12	PIT@17:0 -/- 2 1@130° 120 43/26 -/- 17	B. Total Circulatin PRO Products ENGINEE	ottonis Up Circ Time g Pressure DDUCTS USED	D LAST 24 Size	HRS
0 P	120 43/26 -/- 17	Total Circulation PRO Products ENGINEE	Circ Time g Pressure DOUCTS USED	Size	
0 P	120 43/26 -/- 17	Circulatin PRO Products ENGINE	Pressure	Size	
133°F 12	120 43/26 -/- 17	PRO Products ENGINE	DUCTS USED	Size	
133°F 12 0 27	120 43/26 -/- 17	0 Products ENGINE		Size	
133°F 12 0 27	120 43/26 -/- 17	ENGINE			
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New York (1997) (1997)					
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	· • • • • • • • • • • • • • • • • • • •			IT SPECS	
		Filtrate			
		REMA	RKS		
			Weight Viscosit Filtrate	Weight Viscosity	Viscosity Filtrate

				WATER-	BASI	ED I	MUD R	EPOR	RT No.	6
Mi SV	VACU	A CONTRACTOR OF THE PARTY OF TH		Date 7/27	2010	De	oth/TVD		fi/fi	
		ALESS THE REAL PROPERTY.		ud Date 7/20	2010		id Type		Spud Mud	
Operator : S	Stress Engineering		vvate	er Depth Field/An	١.		Activity			
Report For: k	Cenneth Young			Description		t				
	Weatherford Tool	Test			on : Wal		unty			
Contractor:				Well N	0.:					1.5
Report For : DRILLING AS	ecupi v	CASI		5010 1001 100		-				
Bit Size: 0. in	SEMBLI	Surf		MUD VOLUM	E (001)	Pos	op Make)	RCULAT	ON DATA	
Nozzles 1/32"		KP(#0 G)	as b	Titile		Ps	amp Size	0, X 0.i	n	X O.in
Drill Pipe Size	Length	Interme	diate	Active P	its		ump Cap		Vstk.	gal/stk
O. in Drill Pipe Size	<u>ft</u>	1		55		Pem	p stk/min			
0. in	Length ft	Imenne	SHARC	Total Circulat	ing voi			ow Rate toms Up		gal/min
Drill Collar Size	Length	Production	ot Liner	In Storag	:C	-	Total C	ire Time		
0. in	<u>ft </u>		not the control of th	0			Circulating	Pressure		
Sample From		MUD PROP				ment the block to draw to		ucts us	SED LAST 2	4 HRS
Flow Line Temp	9 F .	PIT@07:30	PIT@10:00	PIT@15:00			Products ENGINEER	BUT CONS	Size	Amt
Depth/TVD	0.1	-/-	-7-	1 -/-		Contraction of the Contraction	M-I GEL	HAO SEKA	IOO LB B	g 1
Mud Weight	ih/gal l	12.1@95°F	12.2@123°F	12.2@110°F			1		1	
Funnel Viscosity Rheology Temp		120	120	120			-			
R600/R300		41/26	50/32	51/32		to an antended to see the				
R200/R100		-f-	7-	-f-			<u> </u>	·		
R6/R3		-/-	-/-							· · · · · · · · · · · · · · · · · · ·
PV	(b/100fr ²)	15 11	18	19 13		-	 			
10s/10m/30m Gel	16/100A-	6/-/-	87-	71-1-			1	e de reguerate en la coll ection de la collection de la		
API Fluid Loss	cc/30 min		-	-			·			+
HTHP FL Temp Cake APL/HTHP	ec/30 min	-@-°F	-@-°F	-@-°F				- skelver		
Solids	1/32" %Vol	16	1 17	17			A 100 (1 - 01) and you were a company of the con-	and the transfer and the same		
Oil/Water	%Vol	0/84	0/83	0/83						
Sand	96Vol	3,5	3.5	3.5	F-1,000		SOLIDS E	QUIP	Size	Hr
MBT pH		8.1	8.2	8.2		and the second	The STORY COURS OF SUCK ARREST			
Alkal Mud (Pm)		0.1	- 0.4	8.2			**************************************	···	·····	
Pf/Mf		-/-	-/-	1 -/-		-				
Chlorides	mg/l			-			P	- 1		
Hurdness Ca				·	***************************************	ner men i "Bracket force				-thap
			J					}	_	
				Victoria de la composição de la composiç	And the second second second second	(F) F(A) (B) (A) (B) (B)				
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							8,88	ID DEAD	ERTY SPE	
							Weight	JD FILOT	LKIT SEL	
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				ļ <u>.</u>			Filmte			
RE	MARKS AND TI	REATMENT	1	1			REMARK	cs	L	
										1
				ž k						
*****				<u> </u>	~					
Rig Up/Service	24 Hrs MUD V	OL ACCTG	(bbl) N	SOLIDS ANALY:	SIS (%/Ibi	(ppl)			Y & HYDRA	ULICS
Orithing	Waser Ad	ded	0 18		0	./ 0. ./ 0.	Tany (lb/1	(cn0)		
Tripping Non-Productive Tim	Mod-Rece Shakers	aved i		ow County		/33.8	Bit Loss () Bit HHP ()	151/74 cm	***************************************	
The second state of the second	Evaporati		0 0	will Solids	3.7	7338	Bit let Vel	filler		
	Centralies Formation		8 8	leght Material hemical Conc	12.3	/ 180.6 / 0.	Ann. Vet Di	(tiremm)		
	Left in He		0 Ti	ieri-React	1	•	Cot Vel DP	(fi/min)	·	
	Other Dumped		5.11	verage SG arb/BiCarb (m mol	3	-0.1	Cot Vei DC	(H/min)		
MH ENGR		RIG	PHONE	WAREHO	USE PHO		DAILY	COST	CUMULATI	VE COST
la d'ac	979-220-770		92.50	7 N. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	e e e e e e e e e e e e e e e e e e e	nere		TRANSPORTED	Sangtone grown (500)	
Cole Vanya					76-2127		USD 1.22		USD 124	

B 42 CM		n.		WATER-	BASI			REPOR	RT N	lo. 7	r
Mi SV	WALL	A CONTRACTOR OF THE PARTY OF TH		Date 7/29	2010	Dep	xth/TVD		ft /	ft	
	and a second consistent processes the second	and the second of the second		d Date 7/20	2010		d Type		Spud	Mud	
Operator: S	tress Engineering	Marian Marian Carrot Property Commencer Commen	*********	Field/An	9a :		MICHIVILY		******		
Report For: K	enneth Young	9		Description	n: Test						
Well Name: W	Catherford Tool	Test			on: Wal	ict Co	unty				
Contractor : Report For :				Well N	0. :						
DRILLING AS	SEMBLY	CAS	NG :	MUD VOLUM	E (hhn	Ţ		IRCULAT	TON D	ATA	
Bit Sire 0. in	<u> </u>	Such	Action to the second se	Hole	- (000)	Pun	nn Make I	MOOLAI	ION D.	MIM	
Nordes 1/32*	ay a market to present the second			en er - sorial tallety papage present on La	2000 page - 1100 page 1100 page	1 12	emp Size	0. X 0.		0. 3	(0.in
Drill Pipe Size 0. la	Length	Interne	dinic	Active P	II.Ji		ump Cap		Vstk		gal/stk
Drill Pipe Size	Longth	Interme	Hinter -	55 Total Circular	no Val	1 cum	p skimini	Flow Rate	1		l/min
0. in						American Co.		ottoms Up	(1-1-a-7)-1 (1-1-a		EL STEERTS
Drill Collar Size	Length	Production	or Liner	In Storag	c			Circ Time			
0. in	1 1	MUD PROP	EDTICO	0	name injury/reside and be a low	1	Circulation	Pressure	Z== 1		
Sample From		PIT@08:40	PIT@14:00	PIT@16:20			Products	DUCTS U	SEUL	AST 24	-
Flow Line Temp	442		1	-1110010				RING SERV	/IC	I EA	Amt
Depth/TVD		-/-	-/-	-							<u> </u>
Med Weight Funnel Viscosity	lb/gal	12.15@90°F	12.05@130°F	12.05@136°F					1		
Rheology Temp	5'9'.	120	1 120	120	1		1				-
R600/R300		58/38	49/29	51/31					i		
R200/R100	The Transport		-/-	-J-							
R6/R3 PV	cP.	-/- 20	20	20							ļ
YP	IP/100Us1	18	9	11							
10s/10m/30m Gel	16/1004	6/-/-	7/-/-	71-1-							1
API Fluid Loss	cc/30 min	_									
HTHP FL Temp Cake API/HTHP	ce/30 min 1/32*	-@-°F -/-	-@-°F	-@-°F							-
Solids	%Val	16	16	16					- 		
Oil/Water	%Vol	0/84	0/84	0/84							d
Sand MBT	96Vot lb/bhl	3.0	4.0	4.0			SOLIDS	EQUIP		Size	Hr
pli	LUI CHIE	8.2	8.2	8.2					1		
Alkal Mud (Pm)		•	_					*******	-	man place to the providence of	****************
PI7MC		4	J-						1		
Chlorides Hardness Ca	mg/t mg/t	•	 						 		
			1			. 6040-40-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1			1		
					- 10				ļ		
									4		
								MUD PRO	PERTY	SPECS	5
A 100 A							Weight	+1-1-1-1-1-1-1-1	-		
				· · · · · · · · · · · · · · · · · · ·			Viscosit Filtrate	<u> </u>	-		
				I,						سيات سيسياد المنفعة المنطوس	
REI	Marks and t	REATMENT					REMAR	RKS		to the second	
		VOL ACCTG	(idd)	SOLIDS ANALY			MUI	RHEOLO	GY & H	YDRAUL	JCS
Rig Un Service	Oil Adde Water Ar		0 N;	rCl	0	70, 70,	n/k Vah Tany (th	FER			
Fripping	Mod Rec	cived	0 II.o	ov Gravity	3,3	/30.4	Bit Loss	(Dat / %)			
Non-Productive Tim	Shakers Evaporat	ίορ	0 Dr	internte III Solids	1 1	70. 730.4	Bit let V	(Mp / HSI) el (165)	To an in the best articles		t-re-
	Centrifu	e	0 TW	eight Material	12,7	/ 186.1	Ann Vel	(36) (Migrator)			
	Left in H			temical Case en/React		/ 0.	Ann Vel	DC (fl/min) Il' (fl/min)			
	Other		0 A	rerage SG		.87	Crii Vel I	K (it/min)			
M-I ENGR.	Damped		0 (Ca PHONE	wh/tsiCurb (m mo)	c/1.) 0.	-0.1	The street of the	COST	Clara	1.41	T WATER
			is course	VARRETO	JOE PRU	INE	MAIL	(400)	GOM	ULATIVE	1 10001
Cole Vanya	979-220-770	01:		713-6	76-2127		USD 13	200,00	tist	13,86	2.18

				WATER-	BASE	ED M	UD F	REPOR	RT N	lo. 8	3
	WACC	A CONTRACTOR OF THE PARTY OF TH		Date 7/30.	2010	Depth	TVD		Tt.	Literature of the control of the	
		Special Street, Special Street, Special Specia		rd Date 7/20/	2010		Type		Spud	MUCO	
Operator :	Stress Engineering		vvater	Depth Field/An		Ac	tivity		-	-	
	Kenneth Young	F1		Description	CONTRACTOR CO.						
Well Name :	Weatherford Tool	Test			m : Wal		ty				
Contractor:				Well N	o. :		•				
Report For :	CCENTIV		WO	551 D 1001 100							
Bit Size 0, in	1335MBL1	CAS Sard	The state of the s	MUD VOLUM	E (601)	T7		IRCULAT	ION D	ATA	a marijuma kanangan
Nozzles 1/32*		-2017	ALC .	HILIG.			Make p Size	0. X 0.	in	n ı	O.in
Drift Pipe Size	Lungth	Interne	dime :	Active Pi	15	Pun	p Cap		l'stk		gal/stk
O. in Drill Pipe Size	R	Interne		50		Pump		a have acceptable			
O. in	Length ft	intenne	winte	Total Circulati	ng vai			toms Up		gn	l/min
Drill Collar Size	Length	Production	or Liner	In Storag	Ċ	-		lire Time			A Commission of the Part of the Commission of th
0. in	<u>fi</u>	and property of the section of the section	i	0	contribution sales the fit	Ci	culating	Pressure			ediconstitution form
65-1-0-#		MUD PROP		* *** ******	p. 1 (1 mm) 11			DUCTS U			HRS
Sample From Flow Line Temp		PIT@06:50	PIT@09:30	PIT@11:55			roducts	RING SERV	ror l	Size	Amt
Depth/FVD	i	-/-	-/-	-/-			I-I BAR	WING SERV		LB BG	11
Mud Weight	Regal	12.35@95°F	12,25@138°F	12.35@145°F							
Rheology Temp	3/31 8F	122	100	130	_						
R600/R300		120 53/32	120 54/33	120 57/34		<u>-</u>					-
R209/R100		-/-	-1-	31134					·		-
R6/R3		<i></i>	=======================================	-/-				The second	ALL PROPERTY OF THE PARTY OF TH		·
PV	EP (21 11	21	23							J
10s/10m/30m Cel	-B/T00ft=1	5/-/-	64-	6/-/-							-
API Fluid Loss	cc/30 min	-	-	-	**************************************		at minima at minima				1
HTHP F1, Temp	cc/30 min	-@-°F	-@-°F	-@LOF				CHARLES A CONTRACTOR			
Cake APEHTHP	1/32" %Vol	17	17	17						er i menter de la companya de la com	
Oil/Water	%Vol	0/83	0/83	0/83	(((A A A) ())						
Smid	%Vol	4.0	3.5	3.5		S	OLIDS	EQUIP	5	Stze	Hr
MBT_	lb/bbl	8,2		-							
DH Alkal Mud (Pm)			8.2	8.2	-						
PPMf			1 -/-	<u> </u>					-		
Chlorides	rng/[-							_	A 1 2000 1100 1100 1100 1100 1100 1100 1	
Hardness Ca	mid.	-							1		Mary (110-1000) - 1 (10-1) (1-1)
·			 	turalization photos - 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			and the same of		-		
				·				****			
			\$					2012 Mark 18 18 17 18 18 18 18 18 18 18 18 18 18 18 18 18		-	
The state of the s			ļ					UD PRO		5550	
			· · · · · · · · · · · · · · · · · · ·				Veight	DU PRO	ERIT	SPEC	2
						1	iscosity		Ť	_	
			1				ilirate		1		Total Commission of the Commis
	EMARKS AND T	REATMENT	J	<u> </u>	(Lawrence)		REMAR	VC.	1		
	Emartito Alto (9			KEMMAN	NO.			
				N .							
				1							
			6	1							
			***************************************	1			-				
RIE Un/Service	st 24 Hrs MUD \	OL ACCTG		SOLIDS ANALYS				RHEOLO	GY & H	YDRAUL	JCS
Orilling	Water Ad	ded	0 KC		0.	70. 7	A: Value	1000°2			
Pripping Non-Productive Lim	Mad Rec Shakers	rived	0 1,0	ss Gravers	1.8	1349 H	is Land t	(pst / %)			
THE PERSONNELS OF THE PERSONNE	Evaperati		0 Dr	ill Selicts	3.8	1349 1	ut Jet Ve	(hhp / HSI) £ (ft/s)	-		
	Centrifus Formation			eight Material	13.2	1935	unn, Vei I	of (thanin)			-
	Left in 45		0 Inc	enneal Cone st/React		10 6	ra Vel I	P (Mmin)			
	Cither		0 AV	entre Sti		84 C	m Val D	C (firmin)			
M-I ENG	B / PHONE	Feles	5.749 Ca	rb/BiCnrh (in mol			DAILY	COST	Ctran	ULATIVE	FORT
200 00000000000000000000000000000000000	7.7.8.1000 (2.1.0.10.10.10.10.10.10.10.10.10.10.10.10			# # # # PE-E () # 15	end in . 1 . 3 1 lef	***	I	-W-21	CUM	ML	
Cole Vanya	979-220-770	1		713-6	76-2127	1	ISD 1,5	44.48	USE	15.40	5.67

				WATER	-BASE	ED I	MUD F	REPORT	No. 9	-
Mi SV	WACE		100000000000000000000000000000000000000	Date 8/2/	2010	Der	th/TVD		ft / ft	- 129
		The state of the s		id Date 7/20	12010		id Type		भाव सिधवं	
Operator: S	tress Engineering		wyate	r Depth Field/Ar	20.1		Activity		- Commenter of the Comment of the Co	ti on ett
Report For : K		•		Descripti						
Well Name : 9		Test		Locati	on: Wall	ler Cn	mntu			
Contractor:				Well N	lo. :		uny			
Report For:							-2012/10/2004/2004			
DRILLING AS	SEMBLY	CASI	The second secon	MUD VOLUM		1		RCULATION	DATA	-
Bit Size 0, in Nozzles 1/32*		Surfi	ice	Hole			np Make	- A M. C.		
Orill Pipe Size	Length	Interme	diam	Active F	New.		mp Size	0. X 0.in gal/stl	0. X 0,	
), in	ñ _	**************************************		65			p sticinin	Kanzu	. 92	l/st
Orill Pipe Size	Længth	Interne	diate	Total Circulat	ling Vol-	Language and the control		low Rate	gal/m	in
). in Drill Collar Size	_ , 0	Production						stoms Up		**********
), in	Length	Production	or Einer	In Storag	ge	14,070-761-9176-761	l otal (Circulatine	Circ Time		-
<u> </u>	men and have the	MUD PROPI	ERTIES		and the factor of the second s	denie .	PRO	DICTS HEE	LAST 24 HR	20
Sample From	The state of the s	PIT@07:30	PIT@12:40	PIT@15:30	PIT@I	7:30	Products			Am
low Line Temp		-	-	and the same of th	1 -			RING SERVK	LEA	1
Depth/TVD dud Weight		-/- 12.1@111°F	12.2(2)1.1200	12.30015695	12.2001	caer	40			
annel Viscosity	10/gat #/q1	12.1(0)1117	12.2@142°F	12.2@156°F	12.2@1	OZYF	 			-
Rheology Temp		120	120	120	120					77
3600/R300		50/32	46/27	54/34	57/3			1		
1200/R100		<u> </u>	-/-		i -/-					
R6-R3 PV	сP	√- 18	- <i></i>	1 ====	21					
YP	fb/100n2	14	8	20	15					
10s/10m/30m Gel	I6/100ft ²	7/-/-	7/-/-	8/-/-	8/-/-	•				-
MI Fluid Loss	ec/30 min	~		•				11000 - Mar- 11000	The second second	-
THP FL Temp ake API/HTHP	ec/30 min	-@ , °P	-@-°F	-@-°F	-@ <u>-</u> °	F		Qualitation Compa		
Solids	1/32" %Vol	- -/- 15	16	16	16					
Oil/Water	26Vol	/85	/84	/84	/84		11 Mars 2 (1008	L		
Sand	%Yol	3.5	4	4	3.5		SOLIDS	EQUIP	Size	Hr
MBT	lb/bbt_				1	Maria (1984) 1	ration and constraint and con-	F 15,0070 15,0070		
aH Alkal Mud (Pm)	sio a maa a i	8.2	8.2	8,1	8.2					
PE/MC	and the second s					and the second				
Chlorides	നുമി	-	-		·					-
lardness Ca	l'em	-	-		and Coloradors are a first an analysis	Terri				
						m cones		<u>i</u>		-
		**************************************	ļ			to extended to				(- (M , u) + ()
man de sons e comprese de la compres	The lease of the second		ĺ			Home is a				100
				The same of the sa						
and the first containing the state of the st								IUD PROPER	TY SPECS	
1 14 111				-			Weight Viscosity			
					ļ		Filtrate	haran da an		المار يفعون
								The second secon	The same of the same	
RE	MARKS AND T	REATMENT		1			REMAR	KS		THE STATE OF THE S
TIME DISTR Last	24 Hrs MUD Oil Adda Water A		0 N	SOLIDS ANALY	0	/0.	n/k Valu	es	& HYDRAULIC	S.
ripping	i Mud Re		0 1	CI aw Gravity	1.7/	15.6	Bit Loss			
lon-Productive Tim	Shakers	***************************************	0 B	entomic	0	70.	But HHP	thho / HSD		
	Evapora		0 D	rill Solids eight Material		15.6	Ann Vell	Maritima)		
	Formatic	d)	0 6	remical Cone		/ 0.	Ann Vel I	DC (it/min)		NAME OF
	Left in 1	692 1		ert/Renet verage SG		.02	Crit Vel D	P (fi/min)		
	Dumped		0 C	arb/BiCarb (m ma	lefta 0.7	-0.1	Can vert	~ (indan)		_
M-I ENGR	PHOME	RIG	PHONE	WAREHO	USE PHO		DAILY	cost c	UMULATIVE C	US
ilenn Beisert	936-697-58	_			575-2127		USD 1,2		USD 17.313.21	

Mi SV	NACC	•			ER-BA		D MUD F	REPOR		10
IAH SA	AHUE	A CONTRACTOR OF THE PARTY OF TH		Spud Date			Depth/TVD Mud Type		ft / ft Soud Mud	
	Company of the Compan			ater Depth			Activity		Clarific Later	
Report For: 8	Stress Engineering Kenneth Young Weatherford Tool			Des	eld/Area : cription : .ocation : Well No. :	Test Waller	County			The same of the sa
DRILLING AS	SEMBLY	CASIN		MUDV	OLUME (C	IRCULATION	ON DATA	
Bit Size 0. in Nozzles 1/32*	Security of the Contract of th	Surface	3		Hole	1-	Pump Make Pump Size	0. X 0.in		X 0.in
Drill Pipe Size 0. in	Length n	Intermedi	18965		ctive Pits 81	I	Pump Cap	gnl/		gal/stk
Drill Pipe Size 0. in	Length	Intermedi	nic.	Total C	Tirculating V	/ol		low Rate		al/min_
Drill Collar Size 0. in	Length R	Production or	Liner	În	Storage 0			lire Time		
	The same and a second second second	MUD PROPER	TIES				PROI	DUCTS US	ED LAST 2	4 HRS
Sample From		PIT@11:00					Products		Size	Ana
Flow Line Temp Depth/TVD	11 th							RING SERVI		3
Mud Weight_	lh/gal	13.95@134°F					M-I BAR M-I GEL		100 LB BC	
Funnel Viscosity	5/q1	-			1				TOW LESS DO	,
Rheology Temp	- af:	120								
R600/R300 R200/R100	•	68/40								
R6/R3	1 1799	-/-		Name of the State	· · · · · · · · · · · · · · · · · · ·				 	
PY	cp	28 		Tarkey and a dispersion of the contract of the			The state of the s	one contract	1	
ур 10s/10m/30m Gel	th/100fc2	9/-/-								
API Fluid Loss	cc/30 min	77-1-							 	
HTHP FL Temp	cc/30 min	-@-°F		1		***			 	}
Cake API/ITTIP	1/32*	7- 22								
Salids Oil/Water	%Vol	778						**************************************	1	1
Sand	%Vol	2.5		The state of the s		2027 17 198	SOLIDS	FOLID	Size	Hr
MBI'	lb/bbl	-		**************************************			10000	27571		
(pH		8.1	1000000							
Alkal Mud (Pm)	The state of the s									
Chlorides	mg/l	- 1 1		+			· ·	1		
Hardness Ca	ny1	- <u>-</u> 1		The Property Commission of the			1	····	*****	***************************************
	Maria Company (maria		-							
	-					-				
					1		to the second se	· · · · · · · · · · · · · · · · · · ·	Harten and the second district the	
			,			· · · · · · · · · · · · · · · · · · ·		IUD PROPI	ERTY SPEC	S
							Weight Viscosity			
	and the second s				•		Filtrate		110 (\$ 300)00 (100 (100)	
			<		_ 1			1		
KE	MARKS AND T	REATMENT					REMAR	:KS		
TIME DISTR Last		VOL ACCTG	(ppl)		ANALYSIS (Y & HYDRA	LICS
Drilling	Oil Adda Water Ad	dded	63	TKCI —		0./0	Tany (the	(Carry -)		
Tripping New-Productive Tim	Mud Rec Shakers	cived	0	Low Gravity	Commentered to the control of the co	1.8/1	67 Air Loss	(PICE V They)		
INCOME TO SECURE THE	Evaporat	lon j	- 0	Bentonne Drill Solids	en our eugen e-	1.8/1	6.7 Bit let V	(http://fisi) 1 (ft/s)	*****	
	Centrifu	200	0	Weight Math		202/2	90.5 Ann. Ve	31 (44) (13) (42)		
	Formatio		0 -	Chemical Co	ant.	-1	U. Ann. Vel i	P (filmin)		
	Other	3	0	Average SG		40	7 Crit Vel D	C (Rimin)		-
M-I ENGR	(PHONE		65 HONE	LCarb/BiCarl	(m mole/L) REHOUSE	0./-0 PHOM		COST	CUMULATI	in cour
	100		, martin		. 11 . 11 . 1			1		
Glenn Beisert	936-697-58:	52			713-676-21	127	USD 11,	669.08	USD 28,9	82.30

Contractive Contractive Contractive Contractive Contractive Contractive Contractive Contractive Contractive Co		والقيور بدرا الفحد منا في يتريب المحافظ والمحدود والمحدود والمحدود والمحدود والمحدود والمحدود والمحدود والمحدود		WATER-BA	ASE	DA	NUD R	EPOR'	TNo 1	1
Mi SV	VACE	District Control of the Control of t		Date 8/13/201	10	Dept	h/TVD		ft! ft	
The second secon	The second secon	A STATE OF THE PARTY OF THE PAR		rd Date 7/20/201	10		d Type	S	Spud Mud	
Operator: 9	Stress Engineering	O	vvate	r Depth Field/Area :		Α.	ctivity			Same of the second
Report For : K		5		Description :						
Well Mame: V		Test		Location:		T Con	ntv		Si.	
Contractor:		///		Well No. :		w con	uty			
Report For:	and the second section of the section of the second section of the section of the second section of the section of th	and the state of t								
DRILLING AS	SEMBLY	CASI		MUD VOLUME (bbl)			RCULATIC	N DATA	****
Bit Size 0, in Nazzles 1/32*		Surfi	ice	Hole	1		n Make	e e e e e e e e e e e e e e e e e e e		
Drill Pipe Size	Length	Interne	dinte	Active Pits			np Size	0. X 0.in		0.in
0. in	ft	immilli	undle j	89	į		nn Cap stk/min	gal/s	KK.	gal/stk
Drill Pipe Size	Length	Interme	diate	Total Circulating	Vol. i	1 407443		low Rate	eval.	/min
O. in	<u> </u>		ì		j		Bo	toms tip		
Drill Collar Size 0. in	Length ft	Production	or Liner	In Storage	į		Total C	ire Time	THE PARTY OF THE PARTY OF THE PARTY.	no for the birth of the
W. III	1	MUD PROPE	EDTIES	0	1		irculating		er jako lisaka a keri iyari iyara ya kata a ca	
Sample From		PIT@11:30		1			Products	/UC15 USE	ED LAST 24	Mineral Hall Branchise
Flow Line Temp			1 -			· · · · · · · · · · · · · · · · · · ·	comment order of the company of the com-	UNG SERVIC		Ann
Depth/TVD	fì		-/-				M-I BAR	ou amonings.c.th	100 LB BG	40
Mud Weight		13.95@154°F	13.95@163°F	<u> </u>				ENGINEER	I EA	2
Funnel Viscosity Rheology Temp	्रह्म	120	120	 				SERVICE	100 LB	880
R600/R300	* *** • * *** 4	68/40	67/39	 			PALLETS SURINE W	TRAPPING	L I EA	19
R200/R100		J. S.	1		T 1			RVICE - PAS	I EA	19
R6/R3								natural from a sure for		-
PV YP	cP Barroom	28	28		-1: lul		er a constant and a constant in			() A grown or many or many
YP 10s/10m/30m-Gel	lb/100ft ²	9//	9//				er en de sant en			
API Fluid Loss	ee/30 min		7//	 	Talleton Tables			والمعارضة المالية المحافظة المعارضة المعارضة المعارضة		
HTUP FL Temp	ec/30 min		1	at the commencer and comments of the desire of the company of the comments of	had forms at most of		Tall the state of the same	and the first personal residence of Europe Annual	1	
Cake API/FITHP	1/32"	The same and the same and the same and						The state of the s	Personal Company of the Company	
Solids Oil/Water	%Vol		22			يعامدوها وراددي	Approximate the second		Marie I william - Stromer	1
Sand	%Vol %Vol	778	778			*************	SOLIDS	FOLUE	Size	Hr
MBT	lb/bb1	<u> </u>		÷			JULIUS I	-wuir	Size	HE
pH		8.2	8.1						terminaliste announce (all announce announce	
Alkal Mud (Pm)					/las**************************		A COLUMN TO THE RESIDENCE OF THE PARTY OF TH		Philips and the same of the same	
Pf/Mf Chlorides					-					
Hardness Ca	<u>mg/l</u> 								mand refrect and analysis and and	The Secretary Control of Section 1
							***************************************		eringe tentigerine	
يورد است بينسنده بها يور والمساسيو						Marine David Paragraphics			distance of the same of the same	********
				1			* Language of the Control of the Con			
						M	terrolder over 1 men en	_nontermeterment		
					100 (100 (100 (100 (100 (100 (100 (100	1 1 1 1 1 1	AA.	IID PROPE	RTY SPECS	
	***************************************						Weight	J	TALLOS	er or manner of retrieval
							Viscosity			eronomerous
	-o.:					,r	l'iltrate			
DE	MARKS AND	PEATMENT	<u> </u>		Control to the School		DEMAG	ve	***************************************	new Manager of the section
NC.	MANUS MIND	INCH I MEN					REMAR	NS		
				100						
							12			
				1						
	24 Hrs MUD	VOL ACCTG	(bbl)	SOLIDS ANALYSIS	(%/16/1	(ldc	MUD	RHEOLOGY	& HYDRAUL	ics
Rig Up/Service	Oil Add Water A	cd	0 N	#1	0./	0.	rule Value	3		
Tripping	Mud Ro	cerved		or Carrie	18/	0. 16.7	Yany (lb/ Bit Loss (DSL / 457		
Non-Productive Tim	Shakers		0 is	entorule:	0.3	0.	Bu HHP	Cohn (FISE)		
	f.vapora Centrifa			nti Solids codit Alaterial		16.7 296.5	Bit Jet Ve Ann, Vel I	1 (165) 30 (6/min)		-
	Formatia	TOTAL CONTRACTOR OF THE PROPERTY OF THE PROPER	0 (0	emical Conc		0,	Ann. Vel L	C (Wann)		
	Lett in I	tote		eri Keaci Vergoe NG		07	Crit Vel D	(ft/mars)		********
	Dumped	r		verame 5G s:b/HaCarb (m mole/L)	07	-0.1	Crit Vet 13	(mmm)	-	
MH ENGR	/ PHONE	RIG	PHONE	WAREHOUSE			DAILY	COST	CUMULATIVE	COST
Glenn Beisert	936-697-58			1	1122	1	tion ca	15.50	1100 02.00	
JACINI DESCRIT	730-077-78	DE J	Million Capital Spring (1990) - Capital Spring (1990)	713-676-2	2127		USD 6,7-	15.52	USD 35,727	.81



ANALYTICAL SERVICES LABORATORY

Request : Testing Pr	PSD ocedure: Beckman Coulter LS for Particle Size.					
Data:		MANAGEMENT AND				
vala.	Security La Partitio Side Analysis Security La Partitio Side Analysis Security La Partitio Side Analysis					
	Also across Control of the Control o	And the transmission of th				
	The state of the s	-10:	Mesh	Micron	Inches	ì
	0 date (a) 1 27 5 c c c c c c c c c c c c c c c c c c	· · · · · · · · · · · · · · · · · · ·	4 6 8 12 16 20 30 40	4760 3360 2380 1680 1190 840 590 420	0.185 0.191 0.093 0.065 0.046 0.0328 0.0232 0.0164	
Y	Solution (Section Conference Conf		50 60 70 60 100 140	297 250 210 177 149 105	0.0116 0.0097 0.0082 0.0069 0.0058 0.0041	
			200 233 270 325 400 625 1250 2500	74 62 53 44 37 20 10 5	0.0029 0.0023 0.0021 0.0017 0.0015 0.0008 0.0004 0.0002	
onclusio	on: The sand size is approximately 60 microns to 400 micro	ons. Th	is is app	roximat	ely 40 to 23	30 mesh.
pies to:	Glenn Beisert-Jack Sig	ned:	George			

Notice: This report is limited to the described sample tested. Any person using or relying on this report agrees that M-LLC and its affiliates shall not be liable for any loss or damage, whether due to act or omission, resulting from such report or its use.

	AIR	•	y	WATE	R-BAS	ED MUD	REPOR	T No. 1	2
IANS	WACC	A STATE OF THE PARTY OF THE PAR		Date 8/	0/2010	Depth/TVD)	作/作	
	The state of the s	A CONTRACTOR COMPANY	A PRODUCE TO A STREET OF BUILDING	pud Date 7/1 ter Depth	0/2010	Mud Type		pud Mud	
Operator :	Stress Engineerin	n	1 469	Field!	lma:	Activity	<u> </u>		
	Kenneth Young	6			tion: Tesi				
	Weatherford Tool	Test		Loca	tion: Wal	tor County			
Contractor:				Well	No.:	der Conney			
Report For:									
DRILLING A	ASSEMBLY	CASI	ING	MUD VOLU	ME (bbl)		CIRCULATIO	N DATA	
Bit Size 0. in		Surf	ice	110		Pump Make	- Lincold Anno	MUNIA	antiene metero La
Vozzles 1/32"						Pump Size		0. X	0.in
Orill Pipe Size), in	Leugh R	Interne	diate	Active		Pump Cap			gal/st
Dritt Pipe Size	Length	literne	dinta	Total Circu		Pump stk/int			
), in	ñ			FOAT CHOU	stuß An		Flow Rate Bottoms Up	139	/min
Drill Collar Size	Length	Production	or Liner	La Stor	age	Tota	Circ Time		
. in	<u>f</u>	nin service produce a marini ancioni de la calcidad		0		Circulati	ng Pressure		To the same of the
	Annalista tarineelikis kalinaliik k	MUD PROPI				PR	ODUCTS USE	D LAST 24	HRS
ample From low Line Temp	Parameter series in a nei immersion from parameter from the	PIT@08:00	PIT@10:00)	Produc	ts	Size	Am
lepth/TVD	9F fl	112	120	126			EERING SERVIC	I EA	1
And Weight	Ib/cal	14.16011201	14 1601200	F 14.05@1269		M-I BAI	R	100 LB BG	16
unnel Viscosity	s/qt		1	. 17.05(0)120	'				
theology Temp	ol;	120	120	120					
600/R3(0)		62/40	58/36	60/38				***************************************	-
200/R100 6/R3	***************************************								
V V	ď	22	22						
1>	IP\100U_	18	14	16	-				
0s/10m/30m Gel	1b/100ft ²	9//	9//	10//				ļ	
PI Fluid Loss	cc/30 min			1					-
THP FL Temp	cc/3() min								-
uke API/HTITIP	1/32"								
olids il/Water	%Vol	22	22	22	-				
and	%Vol %Vol	778	778	778				F	
BT	lddfdl			3		SOLID	S EQUIP	Size	Hr
i-I	253,777	7.9	7.8	7.8				-	
dkal Mud (Pni)				1		AND THE RESIDENCE OF THE PARTY			
MI)					and comments and a second			menovalence in the material control of the control	
hlorides lardness Cu	mg/]				1				
municky Cu	møi				-				
	Western Her (1981)				-				
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Marian paragraph provides the region of the formation of the section of the secti					1				
Translative rate control of the cont								The second second	
**************************************					1		MUD PROPE	RTY SPECS	
					-	Weight			
all the later and the later an			The state of the s			Viscosi			
A STATE OF THE PARTY OF THE PAR						Filtrate			
R	EMARKS AND T	REATMENT	-	1		REMA	RKS	other grant and an arrange and	
						u Nime IVEP			
		¥11		Ī					
				-					
				į.					
		-	-		N - 71 - 11 - 1				
		OL ACCTG	(bbl)	SOLIDS ANAL			JD RHEOLOGY	& HYDRAUL	CS
g Up/Service	Oil Adde Water Ad			VaCI KCI	0,	O. nok Val	ues	The same of the sa	
pping	Mud Rea			ANV Graver	0.7	0. Tany (1	h-100ff-)		
n-Productive Time	Stakers		0 [lentonite	0.	0. Bit 11111	(ps: %) (hlip (HS!) cl (lVs)		
	Evaporati		0 1	Drill Solids Weight Material	0.7.	6.4 Bn Jer V	el (hs)		
	Formation	1		Themical Cone			DP (ft-min) DC (ft-min)		
	Left in He	He	0 1	nert/React		 Crit Vel 	DP (flomin)		
	Other Dunmed	The transition of the second	0 10	hverage SO Jarh/BiCarb (etc me	4.	15 Crit Vel	DC (ff min)	- V-10-	
MIENGE	LIPHONE :	RIG	PHONE	MANDED (III IN	AUSE PHON	-0.1	VICOST 1	1 15 27 1	
	713-591-235		15-12	A Service State of	with a series	LIANT.	Y COST C	UMULATIVE	LUST
on Keeling onn Beisert	113-371-633					1		The state of the s	



ANALYTICAL SERVICES LABORATORY

5950 NORTH COURSE DRIVE, HOUSTON, TX 77072 281 561-1383 FAX 281 561-7240

Drainet Number - ACCO 4 0	000 0040
Project Number: AS024-0	903-2010 Analyst: Tyler Adams Date: 9/3/2010
Sample Identification:	Sand Mud from MOHR Engineering
	Sand Wide Horn Worth Engineering
Lab Master #: 20102699	
Request: Sieve Analysis	
Testing Procedure: Wet S	Pierre Ameliaria
resting Procedure	Sieve Analysis
Test Data:	w.
Sione Analysis	•
Sieve Analysis:	2lay Sand
	Stress Engineering Services
+10 mesh	
-10 mesh and +20 mesh	-
-20 mesh and +40 mesh	-
-40 mesh and +60 mesh	0.01 wt% solids
-60 mesh and +80 mesh	0.33 wt% solids
-80 mesh and +100 mesh -100 mesh and +200 mesh	0.75 wt% solids
-200 mesh and +325 mesh	3.25 wt% solids
-325 mesh	8.88 wt% solids 86.77 wt% solids
OZD IIICSII	50.77 Wt76 SOIIUS
	•
	*
Conios to	
	enneth Young / Jay Forrester Signed: Tyler Adams
Marc Churan	
-	
	Page 1 of 1
969 045	

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ANALYTICAL SERVICES LABORATORY

5950 NORTH COURSE DRIVE, HOUSTON, TX 77072 281 561-1383 FAX 281 561-7240

Project Number: AS025-0	0903-2010 Analyst:	Tyler Adams	Date :	9/3/2010
-	Sand Mud from MOHR En			3/3/2010
		3.1.007.11.g		
Lab Master # : 20102700				
Request : Sieve Analysis	and PSD	ii		
Testing Procedure : Wet	Sieve Analysis and Beckm	an Coulter Particle S	Size Analysis	
Test Data:	(100)			
5 Table 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				
Sieve Analysis:		<i>2</i>		
+10 mesh	MOHR Engine	onno		
-10 mesh and +20 mesh	-			
-20 mesh and +40 mesh				
-40 mesh and +60 mesh	0.01 wt%	enlide		
-60 mesh and +80 mesh	0.22 wt%			
-80 mesh and +100 mesh	1.78 wt%			
-100 mesh and +200 mesh	3.00 wt%			
-200 mesh and +325 mesh	7.84 wt%			
-325 mesh	87.14 wt%			
	elly Hall / Jason Keeling Forrester / Marc Churan	Signed:	Tyler Adams Page 1 of 1	

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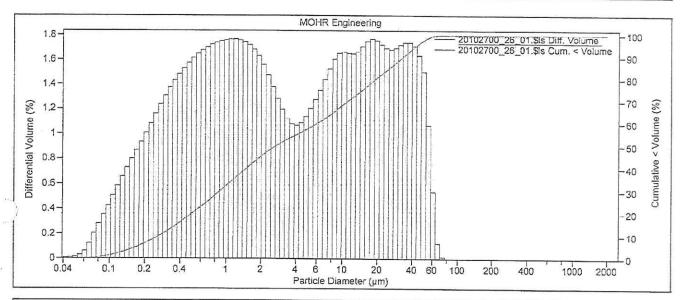


Beckman Coulter LS Particle Size Analyzer

3 Sep 2010 14:03

M-I SWACO Analytical Services Laboratory

File name: C:\LS13320\samples\Samples 2010\20102700_26_01.\$is 20102700_26_01.\$ls File ID: 20102700 MOHR Engineering Tyler Adams Sample ID: Operator: Run number: 25 Comment 1: Sand from Test Well AS025-0903-2010 Comment 2: Optical model: Fraunhofer.rf780d PIDS included Residual: 0.48% LS 13 320 Universal Liquid Module Start time: 13:54 3 Sep 2010 Run length; 123 seconds Pump speed: 62% Obscuration: 13% PIDS Obscur: 78% Fluid: water Software: 5.01 Firmware: 2.02



Volume Statistics (Arithmetic) 20102700_26_01.\$ls Calculations from 0.040 µm to 2000 µm Volume: 100% Mean: 10.18 µm S.D.: 14.15 μm 200.2 μm² Median: 2.690 µm Variance: Mean/Median ratio: 3.785 1.685 Right skewed Skewness: Mode: 18.00 µm Kurtosis: 2.050 Leptokurtic <10% <25% <50% <75% <90% 0.261 µm 0.667 µm 2.690 µm 14.69 µm 33.11 µm

20102700_26	_01.\$ls					
Particle Diameter	Volume % <	Particle Diameter	Volume % <			
μm		μm				
1	32.5	75	99.997			
1.5	40.2	84	100			
2	45.3	90	100			
2 3 4	51.5	96	100			
4	54.9	128	100			
6 8	59.9	192	100			
8	64.3	256	100			
10	68.2	384	100			
12	71.4	512	100			
16	76.6	768	100			
24	84.1	1024	100			
25	84.9	1536	100			
24 25 32	89.4	2000	100			
48	96.8	ATT (0.1507)				
50	97.4				90	
64	99.9					
72	99.99					

/		*********	E (1) (10Ph)	WATED	DACE	-0		MD3	T B1-	
MIS	WACC	7	ſ	Date 9/3/	2010 T	0	MUD REP	UKI		13
a was despri		The second secon	Sp	ud Date 7/20			ud Type	S	ft / ft pud Mud	
One of the last	C/F		Wate	or Depth	_1		Activity		May/Lestin	ig .
	Stress Engineering Kenneth Young	E		Fleid/Ard Description						
	Weatherford Tool	Test		Logatio	on: Vall	cr C	ounty			
Contractor:				Well N	0, :	•• •	onaity			
Report For :	oocas v	-								
Bit Size 0, in	1225 MRFL	CAS Surt		MUD VOLUM	E (bbl)	L		LATIO	N DATA	
Novies 1/32"		.714(6.	IR. C	liale			ump Size 0.	X O.in		
Drill Pipe Size	Length	Interne	drate	Active (1	LS	P	пипр Сир	gal/s		0.in gal/stk
0. in Oriti Pipe Size	Length	Interme	general constitution and	90		Pun	ip sik/min	-		- Augusta
0. in	ñ	nucine	ciare	Total Circulat	ing voi	-	Flow R		g3	Vmin
Drill Collar Size	I engili	Production	or Liner	In Storag	c	Office of the	Total Circ Ti			
O. in	R1	MUD PROP		L			Circulating Press	ure		
Semple Front		Pit@09:30	Pit@12 30	Pit@14:45	Piu@16		PRODUCT	S USE		
How Line Temp		LEGUZZU	THE PY	1100014.43	rigatio	45	Products ENGINEERING S	COUNT	Size 1 EA	Anit
Depth/TVD	n	12 0/0/1000			-	******	M-I BAR	SER CO.	100 LB BG	24
Mnd Weight Funnel Viscosity	ayar 11vpus	13.95@140°F	13.95(@144*)	14.0k@148°F	140014	8°F	The second secon		100 LB BG	8
Rheology Temp Rocki/R300		120	120	120	120		CAUSTIC SODA		SO LE BG	5
R600/R300	-	70/40	67/38	77/43	95/55		CHOOTIC SODA		- NILL DIS	1
R200/R100	Monthly was s	1040 A.T.		— — — — — — — — — — — — — — — — — — —						
PV	ci	30	29	34	40		ļ		***	
YP 10s/10m/30m Gel	HAI (KM);	10	9	9	15					
API Fluid Loss	11x100ft ² cc/30 min	8//	9//	9//	10//		ļ	- 1		
ICHP FL Lemp	ec/30 mm		 				1			-
Cake APVIITIIP	1/32"							-+	~	-
Solids Oil/Water	%Vol	0/78	22 -	0/78	22		1	1		11
Sund	%V0	2.5	2.5	2.5	0/78 2.25		SOLIDS EQUI	9 1	Size	Hr
MUI	Thurst	22.5	25	25	25		SOCIES EGO!	-	Skille	err
plf Alkal Mud (Pin)		9.2	9.1	9.0	8.9					
Pi/MI					-					
Chlorides								-		
Hardness Ca	mg/l				PARTIES.			_ [
-				1						ALPHON U
man man										H Gross
	n 255 mm									
	- 1 ne ne 11-1		10 Pers 1000	The second of the second			MILLO	OODEC	TY SPECS	
				1			Weight	VOI LE	(11 oraco	
	o esse sign			 		_	Viscosity			
		304 K WA		1			Filtrate			
RE	MARKS AND T	REATMENT		,[REMARKS			
-										1
1										1
										j
										1
		OL ACCTG	(061)	SOLIDS ANALYS	IS (%/ID/b)	56)	MUD RHEO	LOGY	& HYDRAULI	ns -
Rig Up Service	Oit Added		0 N	iCl	670	0.	ln.k Values			
Trippone	Mud Reco	is de	0 10	w Chavity	1.8/1	6.7	Ba Los (par 6.)			
Non-Productive Time	Stukers Es apsyute			mienie Il Solida	2.6/ 2	3.2	Hit HITE dulp II	SI)	1	
ļ	Contribute	- 1	0 14.	ciptit Material	20.2/2	96.5	Ann. Vd DP (ft m	19)		
<u> </u>	Left in He		O True	emical Conc at Reset	-0.25		Ann. Vel DC (II. m) Cut Vel DP (IV.m)	ri l		-
	Other Dumpak		0 1.40	Craye SG	4.0	7	Crit Vel DC (it mi	il .		
MAENOR		RIG	PHONE 103	th BiCath (in mole WAREHOU			DAILY COST	- T 7-	UMULATIVE	ener -
Jason Koeling	713-591-235	1				•	17411.7 (20/4)	1 5	OWIGE RELIVE	1.1.25.7
Glenn Beisert	936-697-585	2		713-67	6-2127		USD 3,702.59	1	USD 41,134.	48

Operator: S Report For: H Well Name: V Contractor:		•	Field/Area : Description : Location : Water Depth :	: Test : Waller Count	y	Sį	pth/TVD : Date : oud Date : lud Type :	9/8/ 7/20	2010 /2010
Report For :			Rig Name :			W	Activity:		d Mud ulating
DRILLING AS		CAS			UME (bbl)	1		ATION DATA	liating
ft, -in				Hole	Active Pits		Pump Make		
ft, -in ft, -in				Tatal Cianul	90		Liner x Stk		0x0 in
ft, -in					ating Volume		acity gal/stk		
ft, -in					ed Last 24 hr	1. P	mp stk/min	0@0%	0@0% gal/min
ft, -in					ft		p Pressure		psi
Nozzles 0				Volume Dril	led Last 24 hr		Bottoms Up		
Bit 0-in	U	MUD PROPE	OTICO	<u> </u>	bbi		Circulation		
Sample From		Pit 9:00	Pit 10:00	Pit 12:00	Pit 15:00	Products	RODUCTS	USED Last 24	
lowLine Temp	"F		1	1 12.00	FR 13.00	ENGINEERING	SERVICE	Size 1. EA	Amoun
Depth/TVD	ft		1	1	1	DUO-VIS		25. LB BG	
/lud Weight /Temp	lb/gal	14.0@	14.1@	14.0@	14.0@				
Funnel Viscosity Rheology Temp	s/qt "F	120	120	120	400	-			
R600/R300		98/56	83/46	82/47	120	-		-	
R200/R100		1	1 /	1 /	102/55	1			
R6/R3			1	1	i				
P	cP	42	37	35	43				
0s/10m/30m Gel	Ib/100ft ²	14	9//	12 8//	16				
PI Fluid Loss	cc/30min	311	311	8//	9//	-			
ITHP Fluid Loss	cc/30min	.0@	.0@	.0@	.0@				
ake APT/HT	1/32"	, i		1 1	1				
olids oli/Water	%Vol	22	22	22	22				
Sand	%Vol	/78 3	/78	/78	/78	SOLIDS	CONTROL	EQUIPMENT L	
MBT	lb/bbl	3	2.25	2.5	2.5	Type		Model/Size	Hrs Use
H / Temp	TO/OD!	.0@	.0@	.0@	.0@				
ikal Mud (Pm)				.00	.0(4)				
f/Mf		.00/.00	.00/.00	.00/.00	.00/.00				
Chlorides Flardness (Ca++)	mg/L								
ididiless (Ga++)			-						
			 				-		
						MUD P	ROPERTY	SPECS	Actual
						Weight	T		14.0
						Viscosity			14.0
eserve Volume	REMARKS AND)			Filtrate			
	REMARKS AND	TREATMENT				REMAR	KS		- Children Control
TIME DISTRIBUTION ig Up/Service		MUD VOL AC		SOLID	S ANALYSIS (%		RHE	OLOGY & HYD	RAULICS
rilling		Dil Added Water Added		NaCI KCI		0./ 0.	n		
ipping		Aud Received		Low Gravity		0./ 0.	k Tauv		
on-Productive Tim		Aud Returned		Bentonite		0./ 0.	Bit Press	1.055/%	
		hakers		Drill Solids		2.2/20.1	Bit HHP/H		
		entritude		Weight Material		19.8/290.9	Jet Veloc		
		Centrifuge Formation		Chemical Conc Inert/React		- / 0.	Va:Pipe		
		eft in Hole		Average SG		4.04	Va Collan		
		Other				4.04	CVa Pipe		
		Dumped					ECD @S		
	s	Sandtrap					ECD at T		
			1						
M-I ENGR / PI	HONE	RIG PH	ONE	WAREHOUS	SE DHONE	DAUVA	722		
Glenn Beisert 93		,	W.1.1.1.	**AKEROUS	PHONE	DAILY C	081	CUMULATI	VE COST
Jason Keeling 71:	3-591-2351	CONTRACTOR DESCRIPTION		713-676	20107	\$1,740	40	\$42.87	

Report For: Ke Well Name: Vvc Contractor: Report For: DRILLING ASSEM ft, -In ft, -in ft, -in ft, -in ft, -in Nozzles 0 1/32' Bit 0-in 0	eatherford T 0 0	ool Test W	Description : Location : Tater Depth : Rig Name :	: Waller Coun	•		Date :		2010
Contractor: Report For: DRILLING ASSEM ftin ft,-in ft] Bit O-in 0	0	W Cas	ater Depth :	vvaller Coun					promising.
Report For: DRILLING ASSEM ft, -in Ozzles 0 1/32		GAS			ty.		Spud Date:		
DRILLING ASSEM ft, -In ft, -in ft, -in ft, -in ft, -in ft, -ln ft, -in Nozzles 0 1/32' Bit 0-in 0							Mud Type:	Spud	
ft, -In ft, -in ft, -in ft, -in ft, -in ft, -in Nozzles 0 1/32' Bit 0-in 0	IDLT					-	Activity:	0	
fl, -in ft, -in ft, -in ft, -in ft, -in Nozzles 0 1/32' Bit 0-in 0			0		JME (bbl)			ION DATA	
ft, -in ft, -in ft, -ln ft, -in Nozzles 0 1/32' Bit 0-in 0			0	Hole 0	Active Pits		Pump Make		0
ft, -in ft, -in ft, -in Nozzles 0 1/32' Bit 0-in 0			0		ting Volume	Duran	ump Liner x Stk	0x0 in	0x0 in
ft, -in ft, -in Nozzles 0 1/32' Bit 0-in 0			0		o volume	Pump	Capacity gal/stk		0
ft, -in Nozzles 0 1/32' Bit 0-in 0			0		d Last 24 hr		Pump stk/min Flow Rate		0@0% gal/min
Bit 0-in 0			0		ft		Pump Pressure		psi
	•		0		ed Last 24 hr		Bottoms Up		
amole From			0	0	bbl		Total Circulation		
amole From	IV.	UD PROPERT	TIES				PRODUCTS U		
		PIT 16:45				Products		Size	Amoun
owLine Temp	°F						0	0	
epth/TVD ud Weight /Temp	ft 1h/mal	13.95@	-	-			0	0	
unnel Viscosity	lb/gal s/qt	10.000		-			D	0	
heology Temp	°F	120		-		()	0	0	
600/R300		92/53		<u> </u>			0	0	
200/R100							0	0	
6/R3							0	01	
V	cP	39					0	0	
Р	lb/100ft ²	14					0	0	
0s/10m/30m Gel	Ib/100ft ²	9//					0	0	
PI Fluid Loss	cc/30min						0	0	
THP Fluid Loss	cc/30min						0	0	
ake APT/HT olids	1/32"	- 20					0	0	
olids il/Water	%Vol	22 0/78					0	0	
and	%Vol	3					S CONTROL E		
IBT	lb/bbl					Type		Model/Size	Hrs Use
H / Temp	10,501					0		0	0.0
Jkal Mud (Pm)						0		0	0.0
f/Mf	0					0		0	0.0
hlorides	mg/L					0		0	0.0
ardness (Ca++)						0		0	0.0
						0		0	0.0
						0		0	0.0
						10		0	0.0
						0		0	0.0
·						0	ODODEDTY	0	0.0
-						Weight	PROPERTY SE		Actual
						Viscosity	1 0		14.1
eserve Volume	bbl	0				Filtrate	1 0		0
REMAR	KS AND TRE	ATMENT		0			MARKS	THE PARTY OF THE P	
TIME DISTRIBUTION La		MUD VOL A			ANALYSIS (%		RHEOLO	OGY & HYDRA	ULICS
g Up/Service		Oil Added Water Added	0	NaCl KCl		0./ 0.	n		0
ipping		Mud Received	0	Low Gravity		0./ 0.	k Taun		0
on-Productive Time		Mud Returned	D	Bentonite		0./ 0.	Tauy Bit Press Loss/	96	0
0	0	Shakers	0	Drill Solids		0./ 0.	Bit HHP/HIS	/4	0
0		Evaporation	D	Weight Materia		0./ 0.	Jet Velocity		0
0		Centrifuge	0	Chemical Cond		0,/0,	Va Pipe		0
0		Formation	0	Inert/React			Va Collars		0
0)		Left in Hole	0	Average SG			CVa Pipe		0
		Other Dumped	0	0		0	CVa Collars		0
		Sandtrap	0				ECD @Shoe		0
		O O	0				ECD at TD		0
		0	0				 		
M-I ENGR / PHON Cole Vanya 979-		RIG PI		WAREHOUS	EPHONE	DAJLY	COST	CUMULATIV	VE COST

Depth Onlied Last 24 hr Flow Rate Californ Rt. Pump Pressure Psi	Operator: Str Report For: Ke Well Name: We Contractor: Report For:	nneth Young eatherford Tool	Test	Location : Water Depth : RIg Name :	scription: Test Location: Waller County ter Depth: 0 ft Rig Name:			oth/TVD : Date : ud Date : ud Type : Activity :	9/9/ 7/20 Spuc	0 ft 2010 /2010 I Mud
R, in R, i		EMBLY	CASI	NG			 	CIRCUL	ATION DATA	
Total Circulating Volume Pump Capacity galaxist Pump Capacity Pu		1			11016					Dy0 in
Time		1								
R		1					Pu		0@0%	0@0%
Nozzles 0 1/32 ** Seltoms Up Solutions Up S					Depth Unite		Pum			
### MUD PROPERTIES PRODUCTS USED Last 26 hr					Volume Drift					pai
### PIT 7-45 PIT 10-45 PIT 14-45 Products Step Amount from "FIF FIGURE 15 PIT 14-45 Products Step Amount from "FIF FIGURE 15 PIT 14-45 PIT 14-45 Products Step Amount from "FIF PIT 14-45	Bit 0-in 0		11115 000005			bbl				
owt.net femp	ample From				DIT 12:45	DIT 14:46		RODUCTS		
### Pibrail 14.1 (@ 14.1 () (@ 14.1 () (& 14	lowLine Temp	۰۶	111 7,45	F11 10:45	FII 12:43	F11 14:45		SERVICE		Amour
Multiplifferm	epth/TVD			1						
Peology Temp			14.1@	14.1@	14.1@	14.1@				
SOURTSOO			120	120	120	120	-			
	600/R300						1			
V	200/R100				1	1				
P		CD					-			
Part	<u>v</u>						-			
THP Fluid Loss	0s/10m/30m Gel	lb/100ft²							-	
Act	PI Fluid Loss									
MILE DISTRIBUTION Last 24 hrs MUD VOL ACCTG (bbl) SOLIDS ANALYSIS (%/lb/bbl) RHEOLOGY & HYDRAULICS Service Dills Solids Nacl N							-			
IMVater %Vol	olids			 	/	/				
### According to the control of the	il/Water	%Vol		1	1	1	SOLIDS	CONTROL	EQUIPMENT	ast 24 hr
### ### ##############################	and		2.5	2.5	2.5	2.5	Туре		Model/Size	Hrs Us
MILD PROPERTY SPECS MILD VOL ACCTG (bbi) SOLIDS ANALYSIS (%/Ib/bbi) RHEOLOGY & HYDRAULICS		lb/bbl	00	0.60						
MUD PROPERTY SPECS Actual Mud PROPERTY SPECS Actual Mud Property Mud Prop			.000	.0@	.0@	.0(0)	-			
MUD PROPERTY SPECS Actual Weight 14.1	f/Mf		.00/.00	.00/.00	.00/.00	.00/.00				
MUD PROPERTY SPECS Actual Weight 14.1	hlorides	mg/L								
Weight 14.1 Seerve Volume bbl Filtrate	ardness (Ca++)									
Weight 14.1 Seerve Volume bbl Filtrate							-			
Weight 14.1 Seerve Volume bbl Filtrate										
Weight 14.1 Seerve Volume bbl Filtrate										
Weight 14.1 Seerve Volume bbl Filtrate										
								ROPERTY	SPECS	Actua
Filtrate REMARKS AND TREATMENT REMARKS REMARKS				-				-		14.1
REMARKS AND TREATMENT REMARKS	serve Volume	bbl						-		
TIME DISTRIBUTION Last 24 hrs			TREATMENT					S		
Display										
Water Added KCl 0.7 0. K				CTG (bbl)		S ANALYSIS (%			OLOGY & HYD	RAULICS
Deping Mud Received Low Gravity 0.109790752 Tauy				 						
Mud Returned Bentonite 0.7 0. Bit Press Loss/%	pping	М	ud Received		The state of the s					
Evaporation Weight Material 42.5/ 625.4 Jet Velocity	on-Productive Tim				Bentonite		0./ 0.	Bit Press		
Centrifuge										
Formation									ity	
Left in Holo		Fo	ormation						s	
Dumped ECD @Shoe					Average SG			CVa Pipe		
EOD (welloe										
			.worn		WAREHOU	OL PHONE	DAILT	031	CUMULAT	IVE COST
M-I ENGR / PHONE RIG PHONE WAREHOUSE PHONE DAILY COST CUMULATIVE COST	Cole Vanya 979	-220-1101					1			

		-			Section 1997 (1997)
		_	WATER-BA	SED MUD REP	ORT No. 17
MIS	WACC		Date 10/8/2016	Depth/TVD	- n/ n
			Spud Date 7/20/2019	Mud Type	Spud Mud
Ĺ	- Comment		Water Depth	Activity	
	Stress Engineerin	g	FieldiArea:		
Report For:	Kenneth Young	- //	Description:	Test	
Well Name :	70		Location :	Waller County	
Contractor:			Well No. :	•	
Report For:	-				
DRILLING	ASSEMBLY	CASING	MUD VOLUME (b	bt) CIRCU	LATION DATA
Bit Size 0. in		Surface	Hele	I'ump Make	7
Nozzles 1/32					X 0.in 0. X 0.in
Drill Pipe Size	f ength	Intermediate	Active Pits	L Fump Cap	gal/stk gal/stk
0. in	£		60	Pump stk/min	
Drill Pipe Size	Length	Internediate	Total Circulating V		
O. in	fl L		ļ <u>-</u>	Bottonis	
Drill Collar Size	L.cngth	Production or Liner	In Storage	Total Circ Ti	
O_ in	<u>n</u>	MUD PROPERTIES	· · · · · ·	Circulating Press	we l
Complete Comment	9 000 00			PRODUCT	S USED LAST 24 HRS
Sample From	બુટ	PIT@08:00		Products	Size Ann
Flow Line Temp Depth/TVD	11		1	M-I BAR	100 LB BG 4
Mud Weight	nyan	14.0		DRIVE-BY ENG	NEER! I EA L
Funnel Viscosity	wqt	2.00			
Rheology Temp		120	·		
R600/R300		72/41	i - 1 -	-	
R200/R100	_)	1	Sec. 19 ====	-1
R6/R3		1	T		
PV	<u></u>	31	Internation of the		- 1 -
YP	16/100ft ²	10			- 1 -
10×10m/30m Gel	Jb/10002	6//			; - ;
API Fluid Loss	cc/30 min		_ 1 1		
HIIII FL Femp	EC/30 min			. i	
Cake API/HTHP	1/32"				
Solids	%Vol		1		
Oil/Wmer	"aVol		-1		
Sand	- "aViil		- 1	SOLIDS EQUI	Size Hr
MBT	Iddisti		- 1 1	- :	
Alkal Mud (Pm)					e e e com e s ou
POME			- + - ! -		I
Chlorides	mg/l	-			!
Hardness Cu	mg.1			Santa	F
T. Gardine Live o		1	-	· · · · · · · · -	
				-	
1			-		
				· · · · · -	1
			1		· NECTORY D. MARKET
			1 1		ROPERTY SPECS
i		: -		Weight	
and the second second				Viscosity	
				_ l'iltrate	_
	CMAGNO THE T	BELTIEN -	- 		- + ==
R	EMARKS AND T	KEAINENI		REMARKS	
1			27		
			L)		
1			Į.		
TIME DISTR La	st 24 Hrs MUD	VOL ACCTG (bbi)	COLIDE ANALYSIS	VALLE SALES FROM	W. S. C. W. S. C.
Rig Up Service	Cil Add	NO COLOR	SOLIDS ANALYSIS (0.70. int. Values	LOGY & HYDRAULICS
Drilling	Water A	dded 0	RCI T	070. They (the footie)	- · · · · · · · · · · · · · · · · · · ·
Tripping	Mad Re	cened 0	Law Gravety 1	43.37 -394. Hr. Luss (psi / %	
Non-Productive 1 im		0	Hentonile	0/0. His HHP (hhp/1	RSD
	L'vaporat Centrifu		Orili Solids Weight Material	43.37-394 His Jet Vel (11/s) 43.37-636.4 App. Vel DF (11/n)	
1	Formutic		Chemical Cone	- / 0. Ann Vel Dr 110n	100
:	Lett in I	tile 0	i Inert-React	Crit Vel DV (that	ini E =
	Other	- 0	Average SG Carty ReCart (as mode/L)	· Crit Vel IX. Gun	
MI ENC	Dumped R / PHONE	RIG PHONE	Counter (man for wings)	0/-0.1	
MATERICAL CONTRACTOR	KI PROME	RIG PHONE	WAREHOUSE	PHONE DAILY COST	CUMULATIVE COST
C. L. W.	970 770 77	na l	513 (26 34		Î

MiS	0	Date 1	WATER-BASED MUD REPORT No. 18 Date 10/12/2010 Depth/TVD ft./ ft Spud Date 7/20/2010 Mud Type Spud Mud					
		8	Water Depth Field Descr Lo	1/Area: iption: Test cation: Walfer	Mud Type Activity	_ Spud Mud		
Report For : DRILLING A Bil Size 0. in	ASSEMBLY	CASING	MUD VOI	UME (bbi)		ILATION DATA		
Nozzles 1/32* Drill Pipe Size	Length	Surface		lale ve Piis	Pump Size D. Pump Cap		X 0.in	
Orill Pipe Size	ft Length	Intermediate	l l		Pump stkiming	gal/stk	gal/stk al/min	
0. in Drill Collar Size	Langth	Production or Li	ner ha Si	огаде	Bottoms Total Circ T	l.p		
0, in	<u> </u>	MUD PROPERTI	E8	0 !		S USED LAST 24	HRS	
Sample From Flow Line Temp Depth/TVD		PITS@14:00			Products DRIVE-BY ENG	NEERI L.FA.	Ann	
Mud Weight Funnel Viscosity Rheology Temp		14.05@120°F				-	! - !	
R600/R300 R200/R100 R6/R3								
PV YP	eP 			_ _ =			1	
10s/10m/30m Gel API Fluid Loss HTHP Ft. Temp Cake API/HTHP	cc/30 min cc/30 min							
Cake API/HTHP Solids Oil/Water	1/32* %Vol %Vol				_			
				1	1			
Sand MBT old	%Vol lb/bbl	2000 0 17			SOLIDS EQUI	P Size	Hs	
MIST pH Alkal Mud (Pm) PDM1	Ib/bbl				SOUDS EQUI	P Size	He	
MBT pH Alkal Mud (Pm)					SOUDS FOU	F Size	HE	
MBT pH	me/				SOUDS FOU	ē Stae	HE	
MBT pH	me/				WUD P	P Size	He	
MBT pH	me/						He	
MIST ptf Alkal Mud (Pm) PDMf Chlorides Hardness Ca	me/	REATMENT			MUD P Weight Viscosity		He	
MIST ptf Alkal Mud (Pm) PDMf Chlorides Hardness Ca	me/ me/	REATMENT			Weight Viscosity Filtrate		He	
MIST pti Alkal Mud (Pm) PDMT Chlorides Hardness Ca	EMARKS AND T	VOLACETG (bb	I) SOLIDS AM	LYSIS (XANDO	Weight Viscosity Filtrate_ REMARKS			
MIST ptt Alkal Mud (Pm) PDMT Chlorides Hardness Ca	EMARKS AND T	VOLACCTG (bt	NSCI KCI Low Gravity	0/6 0/6 42.9/-3 0/6	Weight Viscosity Filtrate REMARKS MUD RHEC Tay (16/1001) Bit Less (ps. 1%) Bit Hell Chip. 1	ROPERTY SPECS		
MIST ptf Alkal Mud (Pm) PDMf Chlorides Hardness Ca TIME DSTR Las Rig Up-Service Drilling Tripping	EMARKS AND T	VOLACCTG (bb	NSC Low Gravity Hentonite Drill Solids Weight Material Chemical Conc Insert/React Insert/React	070 070 42.97-3 070 (2.97-3	Weight Viscosity Filtrate REMARKS MUD RHEC REMARKS MUD RHEC Rev viboreon Mit Lanc (par 12 Mit L	ROPERTY SPECS		
MIST ptt Alkal Mud (Pm) Ptt/Mf Chlorides Hardness Ca TIME DSTR La Reg UpService Drilling Tripping Non-Productive Im.	EMARKS AND T St 24 Hre MUD Oil Adde Water A Mud Ree Shakers Frapecal Control of Formatic For	VOL ACCTG (bled) Idea	NSC KC Low Gravity Bentonite Drill Solids Weight Material Chemical Cone IncrVReact Average SG CarbAliCarb (in	0/6 0/6 42 % 3 6/3 6/3 0/3/3 0/4/6	MUD PHECE Weight Viscosity Filtrate REMARKS MUD RHECE Task (Miles of the Values of th	ROPERTY SPECS	ics	

				WATE	R-BAS	ED MI	UD RI	PORT	No	19
Mi SI	NACI		1	Date 1	0/15/2010	Depth	TVD		ft / ft	12
		The second of th		and the second section of the second	/20/2010		Туре	Sp	ud Mud	1 - 1 - 1 - 1 - 1 - 1
Operator:	Stress Engineerin	Ř		r Depth Field	/Area:	AC	tivity			
	Kenneth Young			Descr	iption: Tes					
Well Name : Confractor :					ation: Wa	Her Count	ry .			
Report For:				AA G	H NO. :					
DRILLING A	SSEMBLY	CASIN			UME (bbl)	1	CIR	CULATION	DATA	
Bit Size 0. in Nozzles 1/32*		Surfac	e	11	ole	Pump I		0.1607		
Drill Pipe Size	Length ft	Intermedi	inte		e Pits		Size n Cap	0. X 0.in gal/stk		X 0.in gal/stk
Drift Pipe Size 0. in	Length ft	Intermedi	inte	Total Circ	ulating Vol	T dingr St	Flo	w Rate	g:	al/min_
Drill Collar Size	Length	Production o	r I.iner	In St			Total Cir	ms Up		
0. in	ni	MUD PROPE	OTIES		0	. Circ	culating P	ressure		777.
Sample From		PIT@08:45	Kiles			Dr.	oducts	CTS USE		
Flow Line Temp	۰۴:	1116000.10	Carlo Service Colores				UO-VIS		Size 25 LB BG	Anu_
Depth/TVD								NGINEER	I EA	1
Mud Weight	lb/gal	14.05		1						
Rheology Temp			£ 0000	1.17 (**ANNE 41 AN					h actions	
R600/R300	<u></u>	 				** ** **				
R200/R100			***************************************	- -						
R6/R3				1						· · · · · · ·
PV VP	cP	<u> </u>		4						
10s/10m/30m Gel	1b/100ft ²			+						
API Pluid Less	cc/30 min					altar Jan			-	
HTHP FL Temp	cc/30 min		and the same and an incident	-		\$\$1.00 mg (0.00 mg)				
Cake API/HTHP	E/32"			1					-	7
Solids	%Vol					į	2 -14-11-14-1			
Oil/Water Sand	%Vol					جه	OLIDS E	ST-122 - 1-1		
MBT	ldd/dl					- SC	שוחים בי	AUIP	Size	Hr
pH			********							
Alkal Mud (Pm)			or events it is	1			1007 (#120		*******	
Pf/Mf Chlorides	mg/l									
Hardness Ca	mg/1		The state of	į						
A CONTRACTOR OF THE PARTY OF TH				1		100		**************************************	4.000	
				1						
ļ			Market S. 1994	1						
						4-				
			**********				6.00	D PROPER	TV COEC	
te a meant a meanman.		1		1		W	veight	- 1101	C. UFEC	2
l				1		V	iscosity			
		· · · · · · · · · · · · · · · · · · ·		ļ		Fi	iltrate			
RF	MARKS AND T	REATMENT		4,		ь.	EMARK	·		
• • • • • • • • • • • • • • • • • • • •	-10W W -1-10 - 1-10 - 1	The transfer of		İ			CINAICA	÷.		
				Ì						
e E				ļ						
										į
										į
TIME DISTR Las	24 Hrs MUD	VOL ACCTG	(bbl)	SOLIDS ANA	LYSIS (%/Ib	(hall)	MIDR	HEOLOGY &	HVDDAIII	lice
Rig Up/Service Brilling	Oil Adde	rd I	0 N	aC.1	0	70. Ind	k Values	***************************************		-100
Troping	Water Ad	uicd Trived		Cl aw Gravity	0	I To	nuv (16/10))f(²)		
Tripping Non-Productive Tim	Shakers		0 13	culgante	0	/ -390 : Ba / 0 : Ba / -390 : Ba	a little (b)	p / HSh		
	Evaporar		0 D	ill Solids	42.9	7-390. Bu	Jet Vel ((1/5)		
	Formatio		0 V.	eight Muterial temical Conc	142.4	D.SU. 9: MI	nn, Vel DP	(It/min)		
	Left in It		0 [u	ert/React		- Cr	it Vel DP	(t/min)		
	Other Damped		0 A	verage SG arb/BiCarb (m	and all I	7-6.1 Cr	it Vel IXC	(A.min)		
M-I ENGR			HONE	WARE	HOUSE PHO		DAILY C	OST C	UMULATIV	E COST
Cole Vanya	979-220-77	01			13-676-2127					
		554			13.610-2121		ISD 1,015.	94	USD 48.61	5.24

		•	WATER-BASE	ED MUD REPO	PT No. 20
Mi Si	WACC		Date: 10/20/2010	Depth/TVD	ft/ft
		. S	pud Dato 7/20/2010	Mud Type	Spud Mud
Operator:	Stress Engineering		tor Depth Field/Area:	Activity	
	Kenneth Young		Description : Test		
Well Name : Contractor :			Location: Wall	er County	
Report For :			Well No. :		
DRILLING A	SSEMBLY	CASING	MUD YOLUME (bb)	CIRCUITA	TION DATA
Bit Size 0. in		Surface	Fiole	Pump Make	TION DATA
Nozzles 1/32* Drill Pipe Size	Length	Intermediate	Active Phs	Pump Size 0. X	The state of the s
0. in	Ř	50-W125-2W1250-1-WE-0001-5-U-2000-5-1	50	Pump Cap Pump stk/min	gal/stk gal/stk
Drill Pope Size	1.ength	Intermediate	Total Circulating Vol	Flow Rate Bottoms Up	
Orill Collar Size	Length	Production or Unier	In Storage	Total Circ Time	. [
0.12	<u>n</u> !	MUD PROPERTIES		Circulating Pressure	
Sample From		PITS@07:25	- T	Products	USED LAST 24 HRS
Flow Line Temp Depth/TVD	- "11	1	_	M-I BAR	100 LB BG 36
Mud Weight		14.05		DRIVE-BY ENGINE	ERU I EA I
Funnel Viscosity	- sigt				
Rheology Temp R600/R300	_°E	120			
R200/R100		50/3.L			
R6/R3			i		
YT	18/1000°	19			
10s/10m/30m Get	19/100Us	9//	- 		
API Fluid Loss	ec/30 min			<u> </u>	
Cake API/HTTIP	ec/30 min				
Solids	"aVol			••• 1 • • • • • • • •	
Oil/Water Sand	56Vol.				
MBT	th/bhi	1.75	rala o o o —	SOLIDS EQUIP	Size Hr
MBT				SOLIDS EQUIP	Size Hr
MBT pH Alkal Mud (Pm)				SOLIDS EQUIP	Size Hr
MBT				SOLIDS EQUIP	Size Hr
MIST pH Alkal Mud (Pm) PEMC				SOLIDS EQUIP	Size Hr
MBT pH Alkal Mud (Pm) PFMF Chlorides				SOLIDS EQUIP	Size Hr
MBT pH Alkal Mud (Pm) PFMF Chlorides				SOLIDS EQUIP	Size Hr
MBT pH Alkal Mud (Pm) PFMF Chlorides				SOLIDS EQUIP	Size Hr
MBT pH Alkal Mud (Pm) PFMF Chlorides					
MBT pH Alkal Mud (Pm) PFMF Chlorides				MUDPRO	Size Hr
MBT pH Alkal Mud (Pm) PFMF Chlorides				Weight Viscosity	
Mistingil. Alkal Mud (Pm) PEMf Chlorides Hardness Ca	Itvhjii 			MUD PRO	
Mistingil. Alkal Mud (Pm) PEMf Chlorides Hardness Ca				Weight Viscosity	
Mistingil. Alkal Mud (Pm) PEMf Chlorides Hardness Ca	Itvhjii 			Weight Viscosity Filtrate	
Mistingil. Alkal Mud (Pm) PEMf Chlorides Hardness Ca	Itvhjii 			Weight Viscosity Filtrate	
Mistingil. Alkal Mud (Pm) PEMf Chlorides Hardness Ca	Itvhjii 			Weight Viscosity Filtrate	
Mistingil. Alkal Mud (Pm) PEMf Chlorides Hardness Ca	Itvhjii 			Weight Viscosity Filtrate	
Misting II. Alkal Mud (Pm) Pf2Mf Chlorides flardness Ca	IIVhjii Ing/l	EATMENT		Weight Viscosity Filtrate REMARKS	
Misting II. Alkal Mud (Pm) PEMf Chlorides Itardness Ca		CLACCTS (bbs)	SOLIDS ANALYSIS (*ARBID	Weight Viscosity Filtrate REMARKS	
MBT pil Alkal Mud (Pm) Pf2Mf Chlorides flardness Ca Rig p/Service Disting	It/hjti Img/l Ing/l Ing/l MARKS AND TE	CLACCTS (bbs) (bcd 0 0 0 0 0 0 0 0 0	Vact 67	Weight Viscosity Filtrate REMARKS 60) MUD RHEOLO 10. In/L Voluce 10. Tayle (th/1000)	PERTYSPECS
MBT pil Alkal Mud (Pm) Pi2Mf Chlorides flardness Ca RE RE RE RE RE RE RE RE RE RE RE RE RE	ItVhili Ing/l Ing/l	CLACCTS (bbil) CLACCTS (bbil) Col. accts (bbil) Col. accts (bbil)	VaC1 07 CC1 67 .ow/Gravity 42.97	Weight Viscosity Filtrate REMARKS 60) MUD RHEOLO Tall Values Tany (ht/100f*) 350 01 Lors (ps//*5)	PERTY SPECS
Mist pil Alkal Mud (Pm) Pi2Mf Chlorides Hardness Ca Rardness Ca Right Pi2Mf Pi2Mf Pi3Mf Pi	EMARKS AND TE	CLACCTG (bbs) cd 0 kgd 0	VacCt 07 CC1 07 abs Gravity 42.97 gentonate 07 brill Solids 42.97	MUD PRO Weight Viscosity Filtrate REMARKS 50 0. not Volues 0. Tany (lb/10/04) 0. tots (psi/%) 0. tots (psi/%) 0. tot lots (psi/%) 0. tots (psi/%) 0. tots (psi/%) 0. total vol (this)	PERTY SPECS
Mist pil Alkal Mud (Pm) Pi2Mf Chlorides Hardness Ca Rardness Ca Right Pi2Mf Pi2Mf Pi3Mf Pi	mg/l ing/l i	CLACCTG (bbil) CLACCTG (bbil) Cold (bc) Cold (Sact 67	MUD PRO Weight Viscosity Filtrate REMARKS 50 0. not Volues 0. Tany (lb/10/04) 0. tots (psi/%) 0. tots (psi/%) 0. tot lots (psi/%) 0. tots (psi/%) 0. tots (psi/%) 0. total vol (this)	PERTY SPECS
Mist pil Alkal Mud (Pm) Pi2Mf Chlorides Hardness Ca Rardness Ca Right Pi2Mf Pi2Mf Pi3Mf Pi	MARKS AND TE	OLACCTS (bbs) ied 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Granting Granting	MUD PRO Weight Viscosity Filtrate REMARKS 60 0. Int. Volues 0. Loss (psi / %) 0. Int. Unit Volues 350 0. It Loss (psi / %) 0. It Loss (psi / %) 0. It Loss (psi / %) 0. Ann. Vol DP (ffmin) 0. Ann. Vol DP (ffmin) 0. Ann. Vol DP (ffmin) 0. Int. Vol DP (ffmin) 0. Int. Vol DP (ffmin) 0. Int. Vol DP (ffmin)	PERTY SPECS
Mist pil. Alkal Mud (Pm) Pf2Mf Chlorides flardness Ca RE TRME DISTR Loa Re Tripping Tripping Mon-Productive (in)	mg/l ing/l i	CLACCTG (bbil) cd 0 0 0 0 0 0 0 0 0	CCI 07 CCI 07 OW Gravity 42.97 Sentionate 07 Joill Solids 42.97 Weight Motorial 42.97 Bernical Cone - 7 net/fifenct - 7 activities art (in mole/L) 07 activities art (in mole/L) 07	MUD PRO Weight Viscosity Filtrate REMARKS MUD RHEOLO I any (lb/100ft) I any (lb/1	PERTY SPECS
Mist pil Alkal Mud (Pm) Pi2Mf Chlorides Hardness Ca Rardness Ca Right Pi2Mf Pi2Mf Pi3Mf Pi	mg/l ing/l i	CEATMENT CLACCTG (bbb) Cold (c) (c) (c) (c) (c) (c) (c) (c) (c) (c)	Cr GT GT	MUD PRO Weight Viscosity Filtrate REMARKS MUD RHEOLO I any (lb/100ft) I any (lb/1	PERTY SPECS

CONFIDENTIAL

Annex L Connection Make/Break



3	- WALLER				3	ACUNA						,,	3.					kwise																			
- 1	STRESS ENG - WALLER	KEN YOUNG	1751225	WALLER	7 32# Q125 513	ANNOperator 2: 74	10700 Ft-Lbs.	10650 Ft-Lbs.	2396 Ft-Lbs.	48.0 ln.	33897.0	10791 Ft-Lbs.	10791 Fr-Lbs.	0.492	0,7	2523	5124.2	Counter-Clockwise	Accept	CPLEMIX B	100X		4/8/2														
Date: 07-15-2010	Cust:	Rep:	PO Number:	Location:	Description:			Dump Torque:	Dump Torque Reset:	Arm Length:	Encoder Pulse/Rev:	Final Torque:	Peak Torque:	Final Revolutions:	Average RPM:	Data Points:	Ave Points/Rev:	Turn Direction:	Result	Comments:	Comments:	Comments:		** ***	•						27					Time:	
0.00			Dispatch@	Bucking	Masters.com	(800) 882-3928																				W.		19	6.9							_	0.0
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12375-										~2	Date: 07-15-2010 Time: 19:14:20	Time: 19:14:20
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11138-	Out Final				,	e	ě	ě	10700		Rep:	KEN YOUNG
			,		••	**	_		2.	. Dispatch@	PO Number:	1751225
9900-		i			: •)	ii .	_		•	Bucking	Location:	WALLER
		,	**		•:					Masters.com	Description:	7 32# Q125 513
										(800) 882-3928		Operator 1; 8 JUNEMANNOperator 2; 74 ACUNA
0000				raut .		ě						10700 Fr.Lbs.
-2999	•							٠.	•		Dump Torqua:	10650 Ft-Lbs.
											Dump Torque Reset:	2396 Ft-Lbs.
					٠						Arm Length:	48.0 ln.
7425		•		÷	ŀ	-		:			Encoder Pulse/Rev:	33897.0
						_		9			Final Torque:	10751 Ft-Lbs.
					• •	-					Peak Torque:	10751 Ft-Lbs.
6188-				9		_	!	•	18 N		Final Revolutions:	0.640
8						_					Average RPM:	1.0
						_					Data Points:	2356
4950-						_			e		Ave Points/Rev:	3678.4
						_		50F	300		Turn Direction:	Counter-Clockwise
						_	•				Result	Accept
3712.								***			Comments:	CPLBOXXA
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0.0	0.1	0.2	0.3	9.4	0.5	0.9	0.7	0.8	0.9	6.0		
				R	Revolutions	13						
												77

Torque (FI-Lbs)



S/N:	1112622	
Capacity:	50k	Lbs.
Shunt:	17850.00	Lbs.
	Power Tong	
<4>	: 38.81	Inches

Daq Gain	Daq Offset
4405.34	-0.018
Ctrl Gain	Ctrl Offset
4405.16	-0.019

Cal time date 7/21/2010 11:20 AM

C:\TT v2.5 dap\Cal\MARC, 8 2010

	Dag Board	
Raw Volts	-0.018	Volts
Load Cell	-0.06	Lbs
Torque	-0.19	Ft Lbs
Gain	4405.34	Ft Lbs/V
Offset	-0.018	Volts

	DUITED BOS	ira
Raw Volts	-0.019	Volts
Load Cell	0.26	Lbs
Torque	0.83	Ft Lbs
Gain	4405.16	Ft Lbs/V
Offset	-0.019	Volts



S/N:	1125899	
Capacity:	50k	Lbs.
Shunt:	18160.00	Lbs
	Power To	nq
-15	120	01 - 1
<4>>		81 Inches
	zin Da	

KAW VOILS	-0.000	VOITS
Load Cell	-0.38	Lbs
Torque	-1.22	Ft Lbs
Gain	4485.52	Ft Lbs/V
Offset	-0.006	Volts
Ce	ontrol Boa	ırd
Raw Voits	-0.007	Volts

Dag Board

Raw Voits -0.007 Voits

Load Cell 0.07 Lbs

Torque 0.21 Ft Lbs

Gain 4486.33 Ft Lbs/V

Offset -0.007 Voits

Calibration File

C:\TT v2.5 dap\Cal\MARC, 8 2010

Cal time date

7/21/2010 11:20 AM



S/N:	1125899	
apacity:	`````	
apacity:	120K	Lbs.
Shunt:	18160.00	Lbs.
	Power To	ng
<4>	38.	.81 Inches
<4>		.81 Inches
***************************************	ain p	
Daq Ga	ain Di	aq Offset

Torque 58737.1 Gain 4486.97 Offset -0.006	
Control	Board
Raw Volts 4.039	Volts
Load Cell 18160.7	5 Lbs
Torque 58734.8	8 Ft Lbs

Gain 4488.50

Offset -0.007

Dag Board

Voits

Ft Lbs/V

Volts

Lbs

Raw Volts 4.042

Load Cell 18161.45

7/21/2010 11:20 AM

C:\TT v2.5 dap\Cal\MARC, 8 2010



S/N:	1112622	
Capacity:	pacity: 50k Lbs Shunt: 17850.00 Lbs	Lbs
Shunt:		Lbs.
	Power Ton	g
<4>	38.8	 I Inches
<4>		I Inches Offset

Daq Gain	Daq Offset	
4406.80	-0.018	
Ctrl Gain	Ctrl Offset	
4406.67	-0.019	

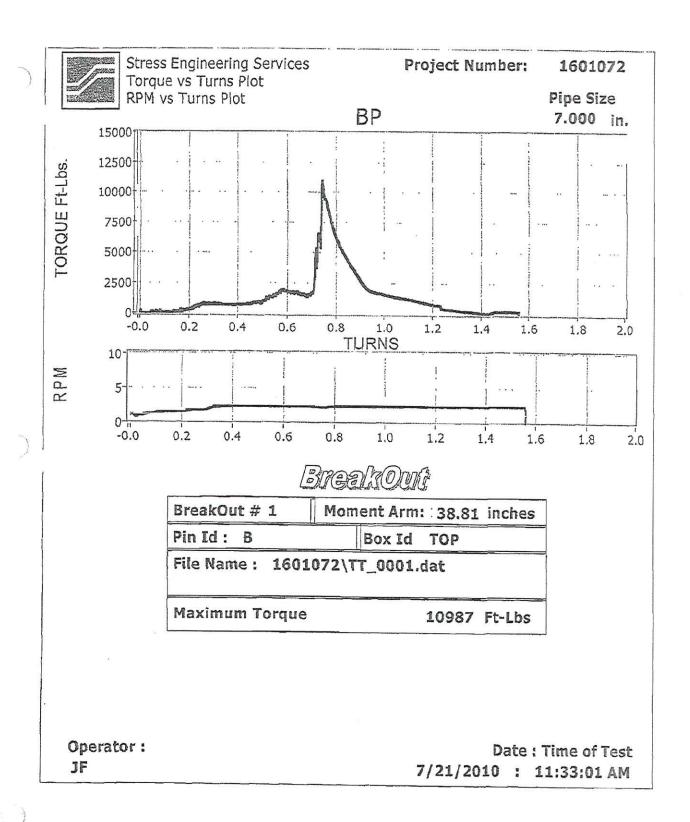
Cal time date 7/21/2010 11:20 AM

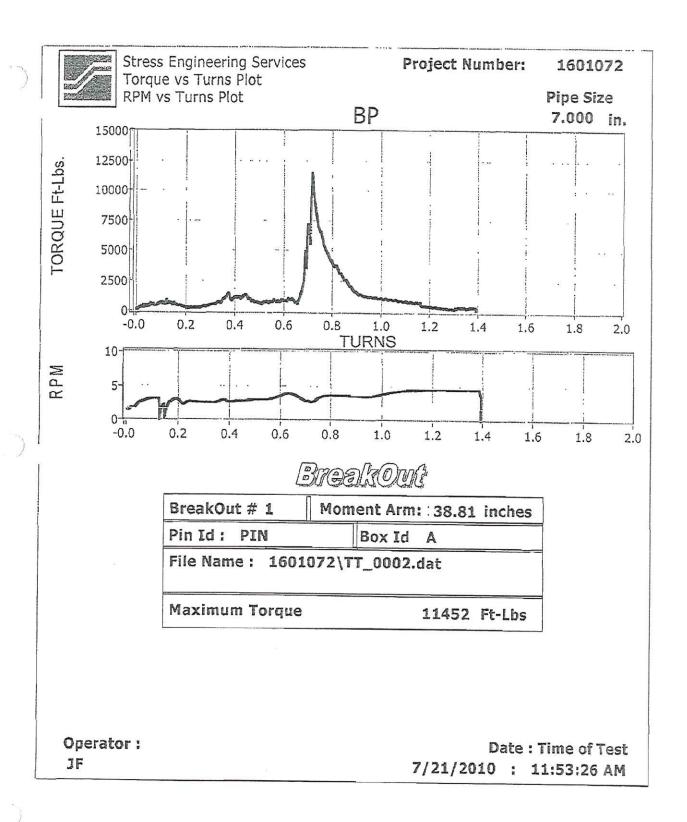
Calibration File C:\TT v2.5 dap\Cal\MARC, 8 2010

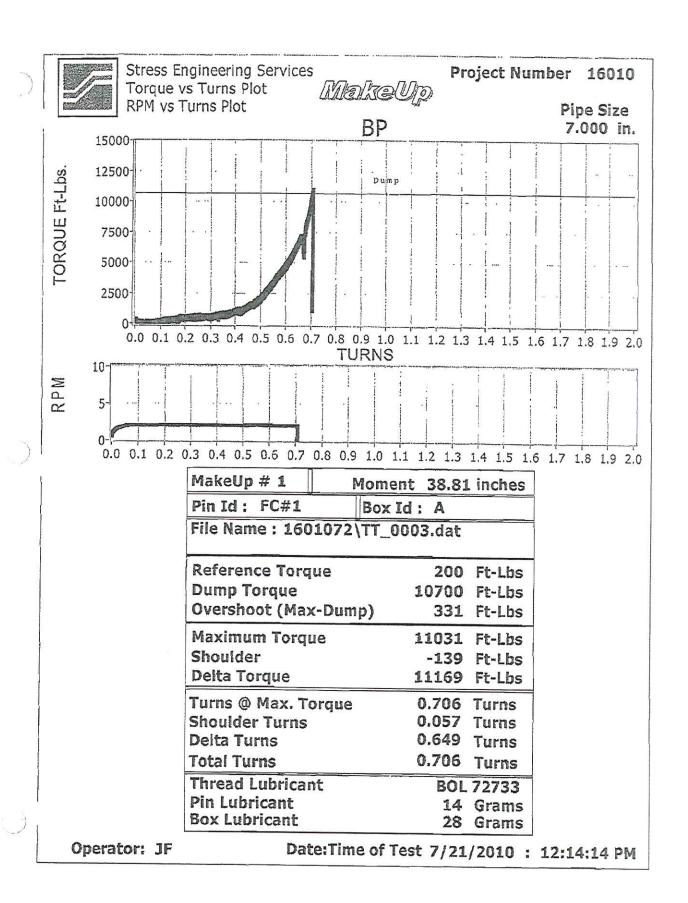
Dag Board

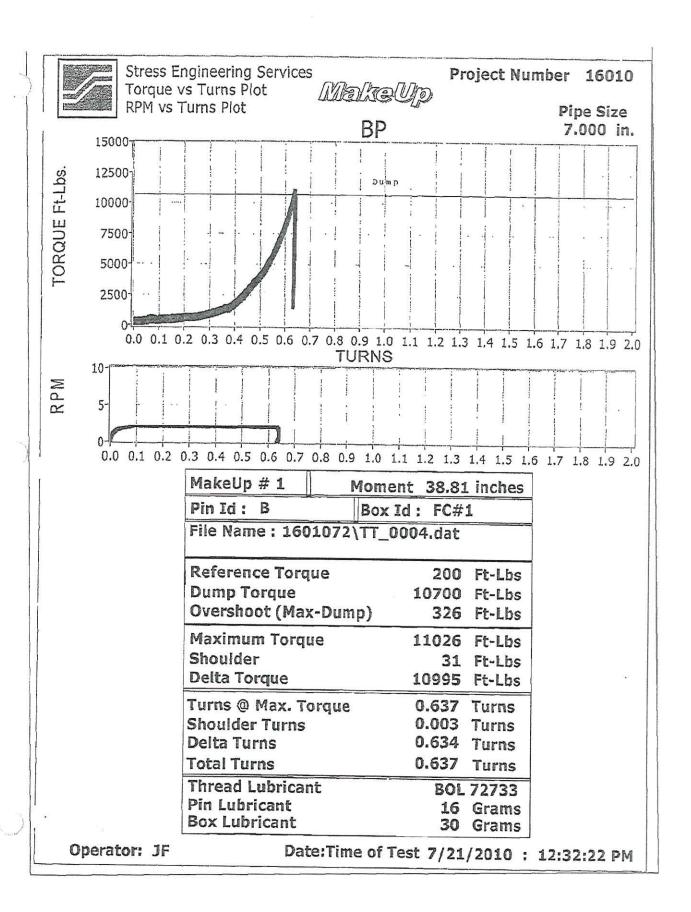
Raw Volts	4.033	Volts
Load Cell	17850.22	Lbs
Torque	57730.58	Ft Lbs
Gain	4406.80	Ft Lbs/V
Offset	-0.018	Volts

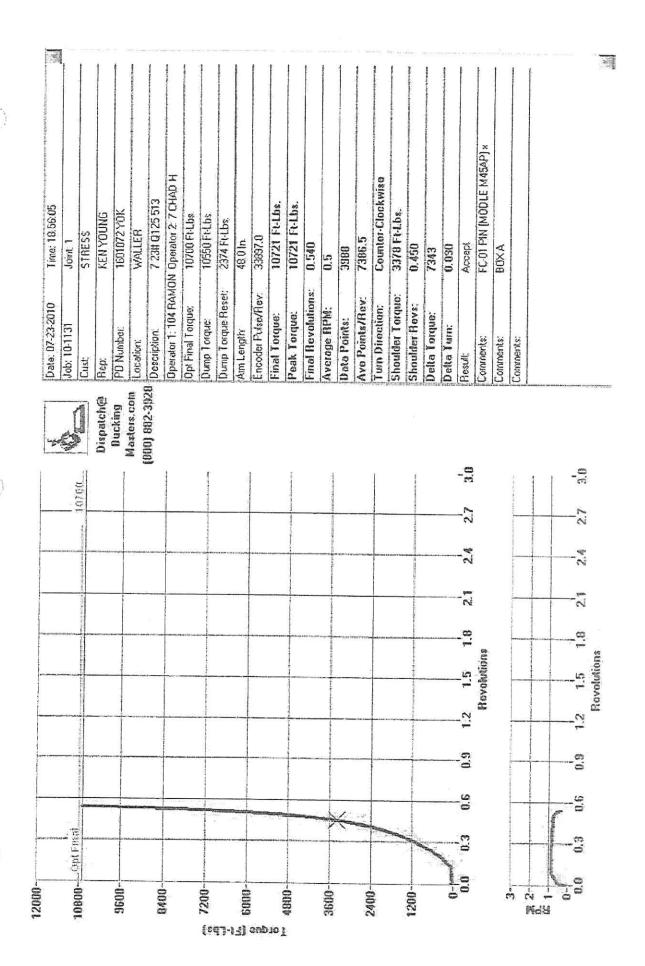
Raw Volts	4,031	Volts
Load Cell	17850.30	Lbs
Torque	57730.85	Ft Lbs
Gain	4406.67	Ft Lbs/V
Offset	-0.019	Volts













- 38.81 Inches

Power Tong

Dag Gain	Daq Offset	
4406.76	-0.016	
Ctrl Gain	Ctrl Offset	
4405.30	-0.018	

Cal time date

7/28/2010 7:53 AM

Calibration File

C:\TT v2.5 dap\Cal\MARC, 24 2010

Dag Board

Raw Volts	-0.016	Volts
Load Cell	-0.35	Lbs
Torque	-1.12	Ft Lbs
Gain	4406.76	Ft Lbs/V
Offset	-0.016	Volts

Raw Volts	-0.018	Volts
Load Cell	-1.48	Lbs
Torque	-4.80	Ft Lbs
Gain	4405.30	Ft Lbs/V
Offset	-0.018	Volts



Load Cell	Dag Boar	·d
S/N: 1112622 Capacity: 50k Lbs. Shunt: 17850.00 Lbs. Power Tonq <4> 38.81 Inches	Raw Volts -0.003 Load Cell 0.04 Torque 0.13 Gain 4406.76 Offset -0.003	Voits Lbs Ft Lbs Ft Lbs/V Voits
Daq Gain	Control Bo Raw Volts -0.005 Load Cell -0.24 Torque -0.77 Gain 4405.30 Offset -0.005	Voits Lbs Ft Lbs Ft Lbs/V Voits



4410.56

Stress Engineering Services Torque Turn Calibration

C/M.	1112622	····
2/14;	11112022	
Capacity:	50k	Lbs.
Shunt:	17850.00	Lbs.

<4>	38.81 Inches
Daq Gain	Daq Offset

-0.003

Ctrl Gain Ctrl Offse		
4410.52	-0.005	
14410.52	-0.005	
Cal tim	e date	

7/28/2010 7:53 AM

Calibration File

C:\TT v2.5 dap\Cal\MARC, 24 2010

Dag Board

Raw Volts	4.044	Volts
Load Cell	17849.96	Lbs
Torque	57729.74	Ft Lbs
Gain	4410.56	Ft Lbs/V
Offset	-0.003	Volts

Raw Volts	4.042	Volts
Load Cell	17851.38	Lbs
Torque	57734.33	Ft Lbs
Gain	4410.52	Ft Lbs/V
Offset	-0.005	Volts



S/N:	1112622	. As testinosing
Capacity:	50k	Lbs
Shunt:	17850.00	Lbs
F	ower Tong	
<4>	38.81	Inches
<4> Daq Ga		Inches

C	ontrol Boa	ard
Raw Volts	4.032	Volts
Load Cell	17850.60	Lbs
Torque	57731.82	Ft Lbs
Gain	4407.87	Ft Lbs/V
Offset	-0.018	Volts

Dag Board

Volts

Ft Lbs

Volts

Ft Lbs/V

Lbs

Raw Volts 4.035

Load Cell 17849.90

Torque 57729.54

Offset -0.016

Gain 4407.03

7/28/2010 7:53 AM Calibration File C:\TT v2.5 dap\Cal\MARC, 24 2010

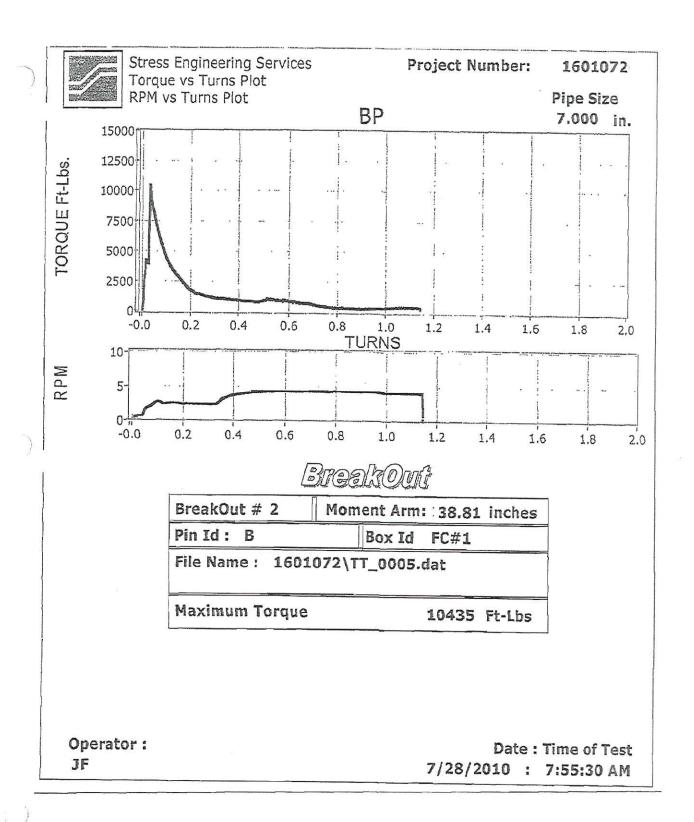
Cal time date

Ctrl Offset

-0.018

Ctrl Gain

4407.87





Load	Cell

S/N: 1112622

Capacity: 50k

Shunt: 17850.0

17850.00 Lbs.

Lbs.

Power Tong

<4> \ 38.81 Inches

Daq Gain Daq Offset

 Ctrl Gain
 Ctrl O

 4407.87
 -0.019

Cal time date

7/29/2010 7:30 AM

Calibration File

C:\TT v2.5 dap\Cal\MARC, 24 2010

Dag Board

Raw Volts -0.018 Volts

Load Cell 0.17

Lbs

Torque 0.57

Ft Lbs

Gain 4407.03

Ft Lbs/V

Offset -0.018

Volts

Control Board

Raw Volts -0,019

Volts

Load Cell 0.52

Lbs

Torque 1.67

Ft Lbs

Gain 4407.87

Ft Lbs/V

Offset -0.019

Volts



000 MA COLUMN	11126	22	
Capacity:	50k		Lbs.
Shunt:	17850	0.00	Lbs.
	Powe	r Tong	
<4>	>	38.81	Inches
Daq G	ain	Daq O	ffset
4410.56		<u>j-0.005</u>	
0	ain	Ctrl O	fset
Ctrl G a 4410.52		-0.006	
4410.52	al tim		

Raw Volts	-0.005	Voits
Load Cell	-0.09	Lbs
Torque	-0.30	Ft Lbs
Gain	4410.56	Ft Lbs/V
Offset	-0.005	Volts
C	ontrol Boa	ırd
Raw Volts		Volts
	-0.006	
Raw Volts	-0.006 0.32	Volts
Raw Volts Load Cell Torque	-0.006 0.32	Voits Lbs
Raw Volts Load Cell Torque Gain	-0.006 0.32 1.04	Voits Lbs Ft Lbs

Dag Board



Load Cell

S/N: 1112622

Capacity: 50k Lbs.

Shunt: 17850.00 Lbs.

Power Tong

<4> 38.81 Inches

Dag Gain	Daq Offset
4410.26	-0.005
Ctrl Gain	Ctr! Offset
4411.15	-0.006

Cal time date

7/29/2010 7:31 AM

Calibration File

C:\TT v2.5 dap\Cal\MARC, 24 2010

Dag Board

Raw Volts 4.043 Volts

Load Cell 17851.14 Lbs

Torque 57733.57 Ft Lbs

Gain 4410.26 Ft Lbs/V

Offset -0.005 Volts

Control Board

Raw Volts 4.041 Volts

Load Cell 17851.46 Lbs

Torque 57734.61 Ft Lbs

Gain 4411.15 Ft Lbs/V

Offset -0.006 Volts



S/N:	1112622	
apacity:	50k	Lbs.
Shunt:	17850.00	Lbs.
	Power Tong	
<4>	. 38.81	Inches

Daq Gain	Dag Offset
1406.72	-0.018
Ctrl Gain	Ctrl Offset
1406.81	-0.019

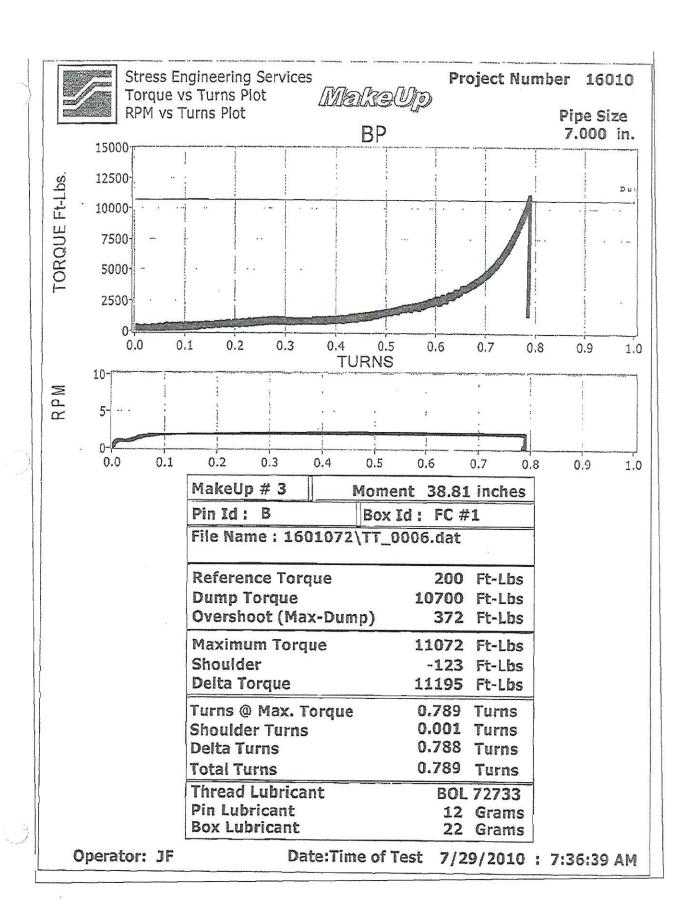
Cal time date 7/29/2010 7:31 AM

C:\TT v2.5 dap\Cal\MARC, 24 2010

Dag Board

Raw Voits	4.033	Volts
Load Cell	17850.09	Lbs
Torque	57730.17	Ft Lbs
Gain	4406.72	Ft Lbs/V
Offset	-0.018	Volts

Raw Volts	4.031	Volts
Load Cell	17849.61	Lbs
Torque	57728.62	Ft Lbs
Gain	4406.81	Ft Lbs/V
Offset	-0.019	Volts





S/N: 1112622	
Capacity: 50k Lbs.	
Shunt: 17850.00 Lbs.	
Power Tong	_
<4> 38.81 Inches	
	1.
	J :
Dag Gain Dag Offcet] <u> </u>
Daq Gain Daq Offset 4406.76 -0.018]
4406.76 -0.018 Ctrl Gain Ctrl Offset]]]
4406.76 -0.018	- - - - -
4406.76 -0.018 Ctrl Gain Ctrl Offset	- - - -

Dag Board				
Volts				
Lbs				
Ft Lbs				
Ft Lbs/V				
Volts				
Control Board				
Volts				
Lbs				
Ft Lbs				
Ft Lbs Ft Lbs/V				



S/N:	1125899		
apacity:	50k		Lbs.
Shunt:	18160.0	0	Lbs.
	Power'	Tong	
<4:	> 🔻	38.81 In	ches
Daq G 4485.98	ain	Dag Off	set
	in	Ctrl Offs	

Cal time date

C:\TT v2.5 dap\Cal\MARC, 24 2010

8/3/2010 10:56 AM

Dag Board			
Raw Volts -0.005	Volts		
Load Cell 0.24	Lbs		
Torque 0.77	Ft Lbs		
Gain 4485.98	Ft Lbs/V		
Gaiii 4403.30			
Offset -0.005	Volts		
Offset -0.005			
Offset -0.005			
Offset -0.005	oard		
Offset -0.005 Control Bereick -0.006	oard Volts		
Control Bereau Volts -0.006 Load Cell -0.20	oard Volts Lbs		

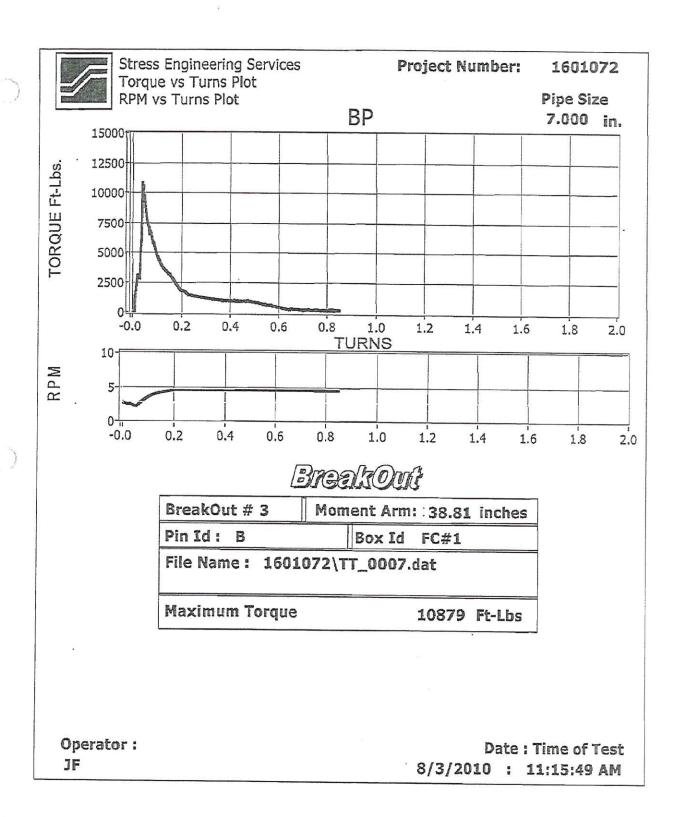


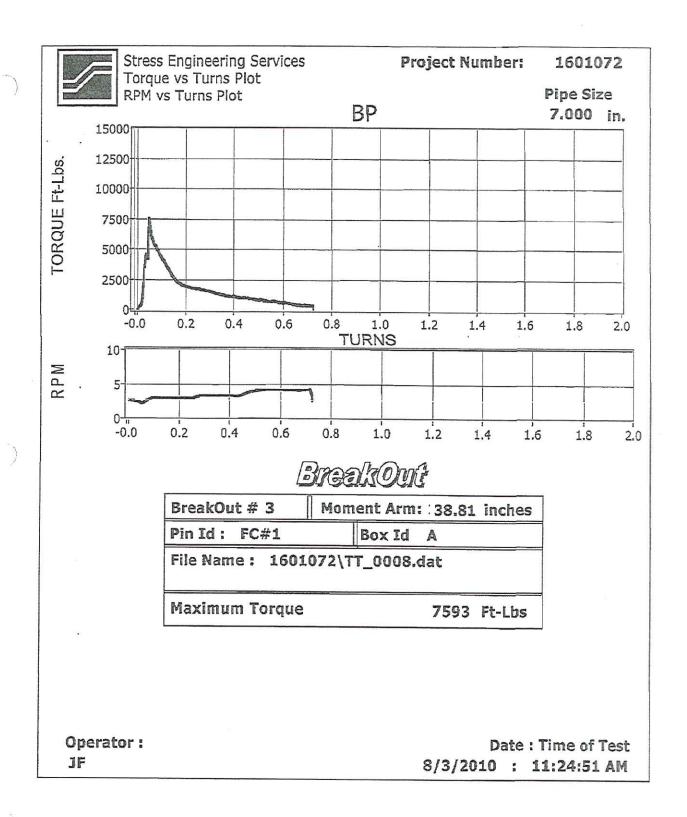
S/N: 1125899	7
apacity: 50k	Lbs.
Shunt: 18160.00	Lbs.
Power Ton	q
<4> 38 8	Inches
38.6	Lineties
	Offset

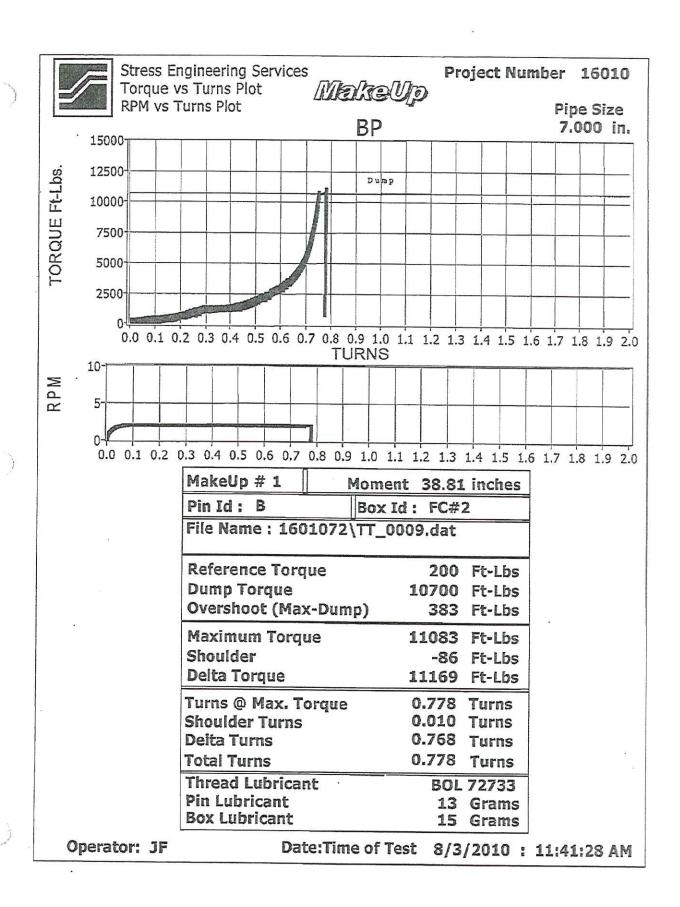
C:\TT v2.5 dap\Cal\MARC, 24 2010

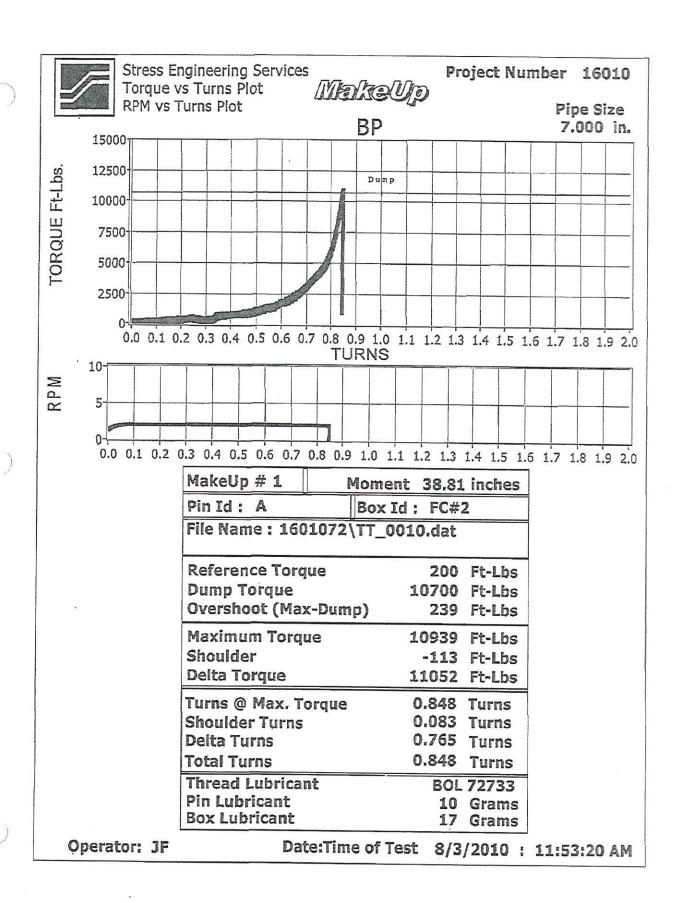
Dag Board	d
Raw Volts 4.042	Voits
Load Cell 18160.35	Lbs
Torque 58733.58	Ft Lbs
Gain 4487.15	Ft Lbs/V
Offset -0,005	Volts
Control Bo	ard

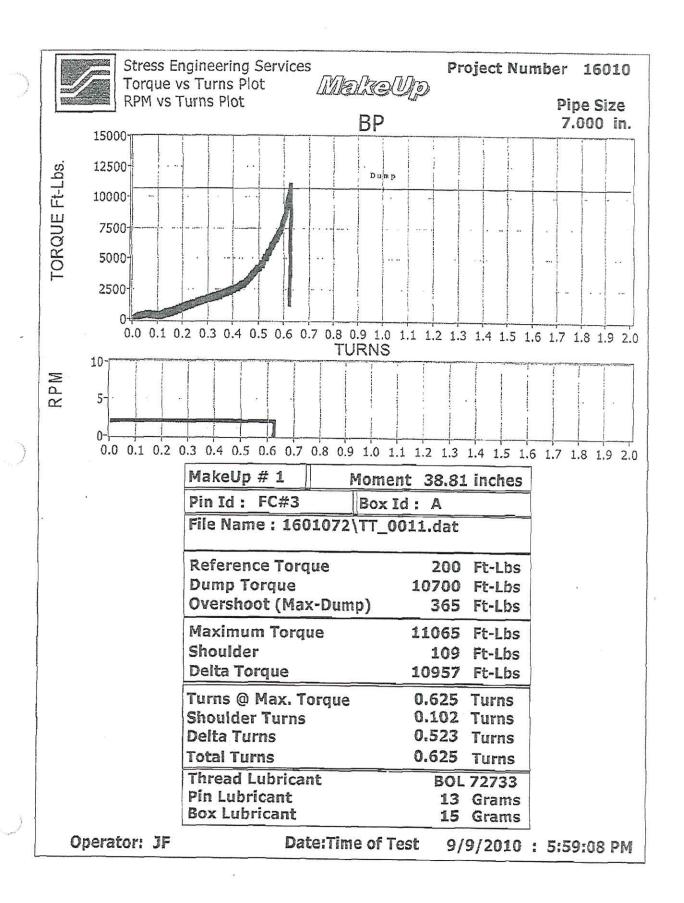
		SEARCE MAKE
Raw Volts	4.040	Volts
Load Cell	18161.40	Lbs
Torque	58737.00	Ft Lbs
Gain	4488.62	Ft Lbs/V
Offset	-0.006	Volts

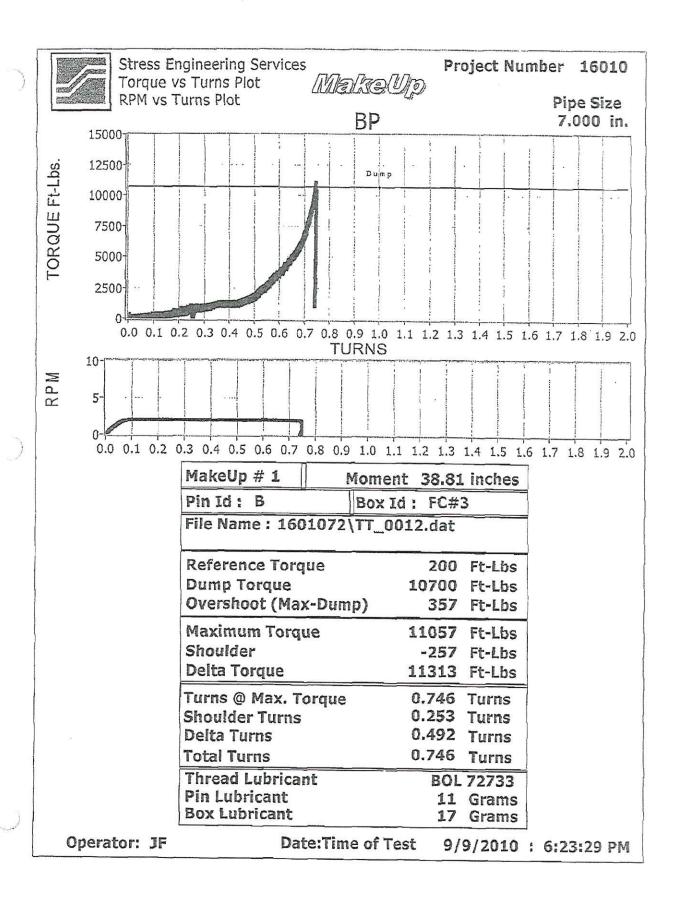


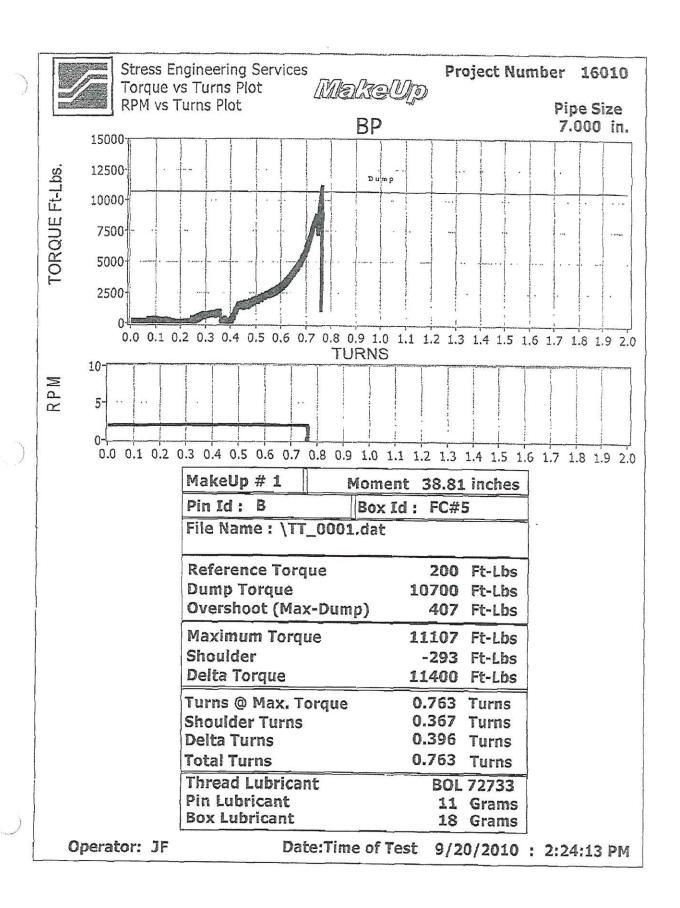


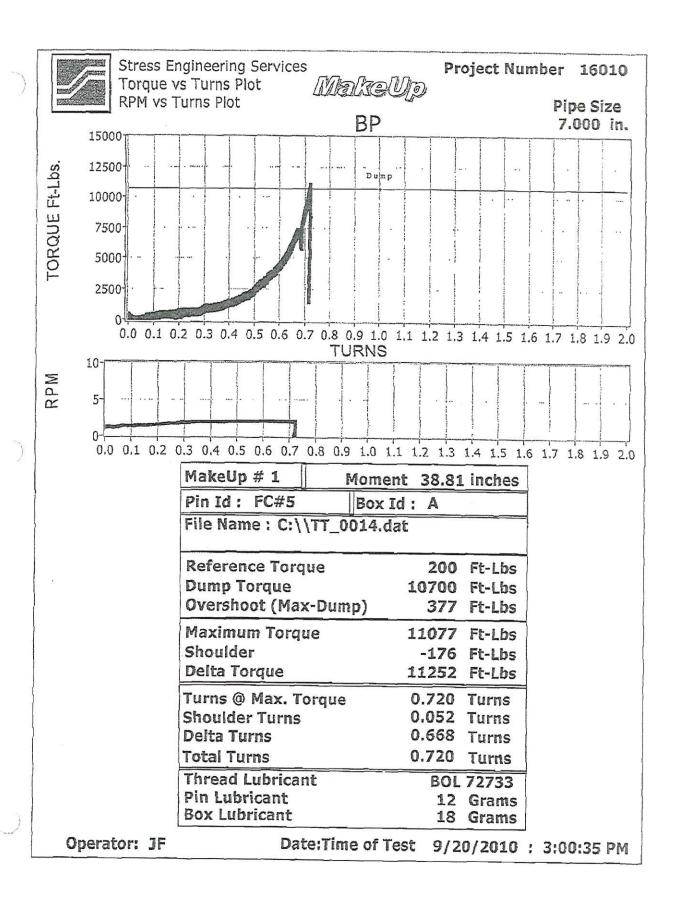


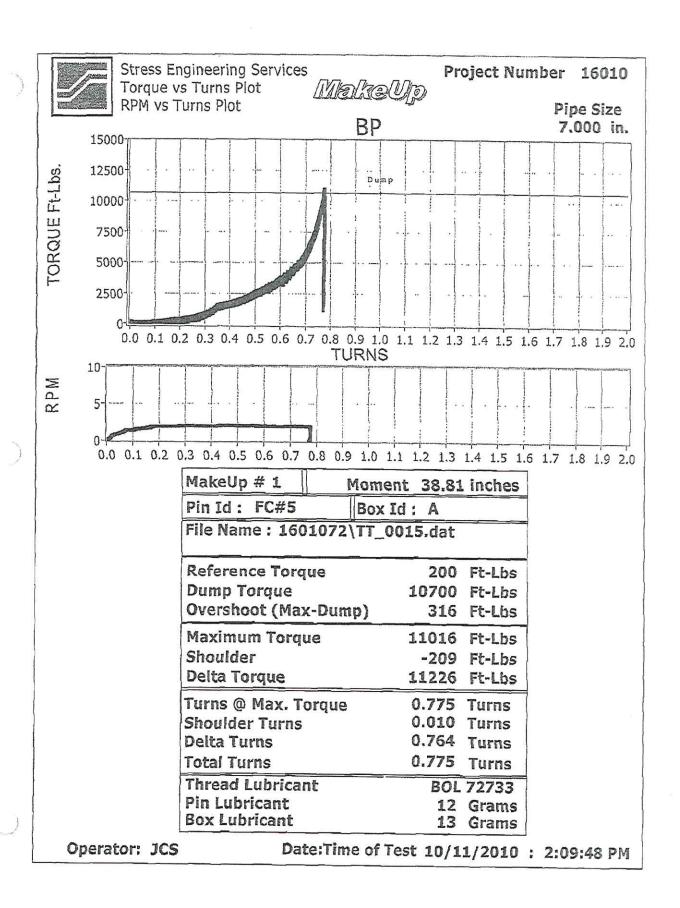


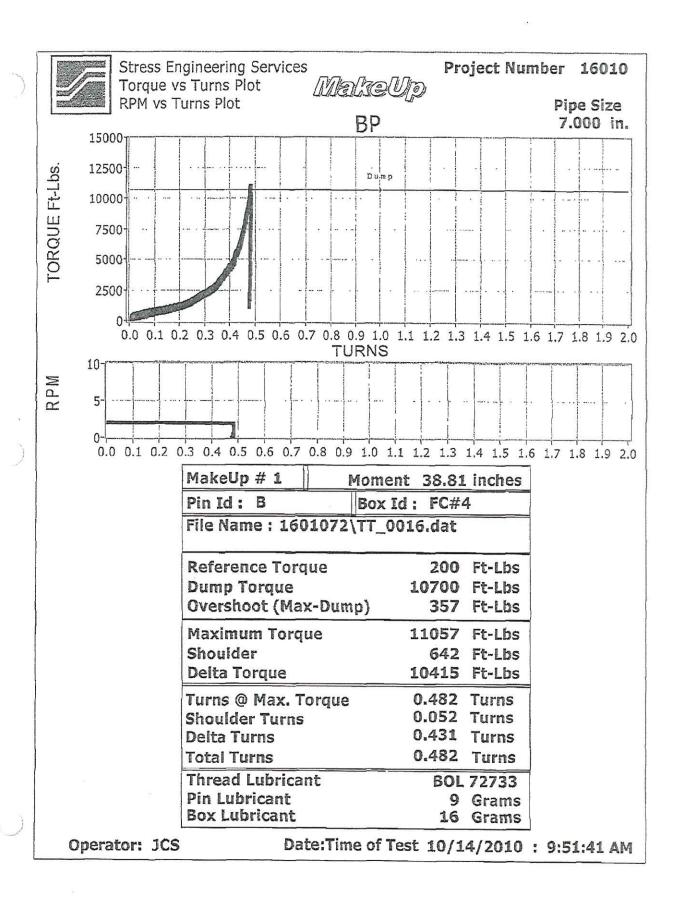


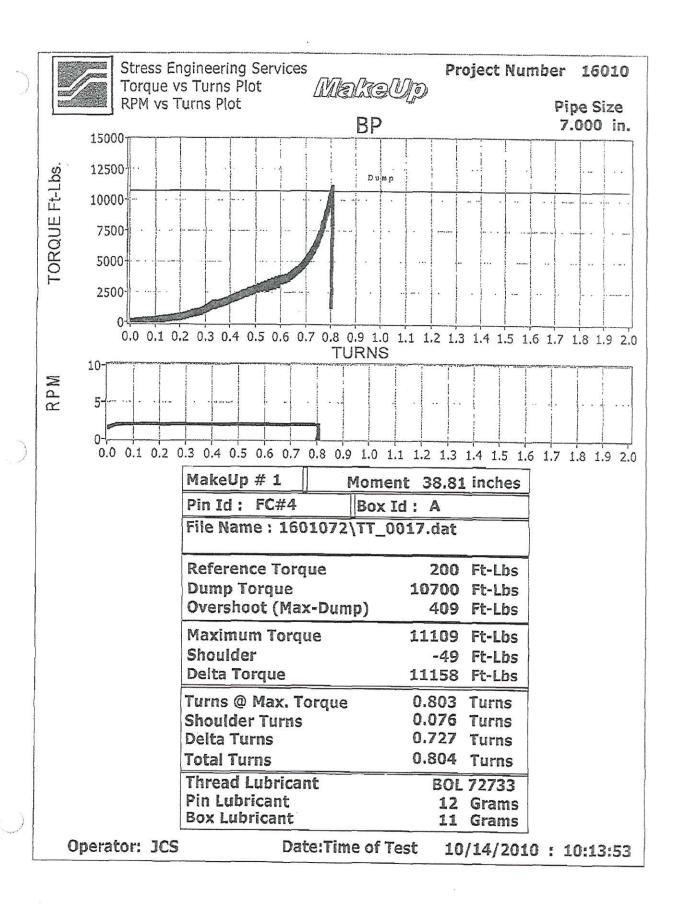


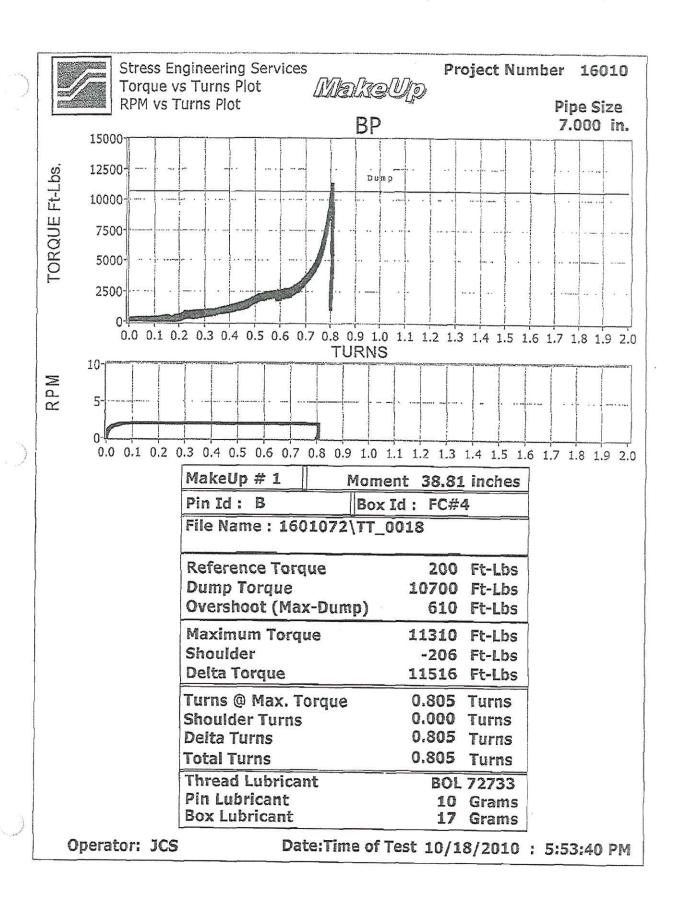














Annex M Calibration





PO Box 355 Dobbin, Tx 77333 Phone - 713-515-3619

CALIBRATION CERTIFICATE

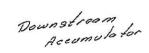
		CALIBRATION CER	HFICATE			
CUSTOMER:	MOHR ENGINEER	ING				
13602 WESTLAI	ND EAST BLVD					
Transducer Make:	Dynisco	Transducer Model:	G830-300-5M-K73			
Fransducer S/N:	490645465	Transducer Range:	0 - 5000 psi			
Reference an	d testing conditions:	979.312 gals	23°C +/- 1.5 deg			
		Excitation	4.999 volts			
CALIBRATION READINGS (as left) ACTUAL READING 1 CONVERTED PERCENT ERROR (psi) (mv) (psi) % of FS 0 -0.058 0 0.00 500 1.439 500 0.00 1000 2.935 999 -0.01 2000 5.929 1999 -0.02 3000 8.923 2999 -0.02 4000 11.920 3999 -0.01						
ACTUAL	READING 1	CONVERTED	PERCENT ERROR			
(psi)	(mv)	(psi)	% of FS			
•	-0.058	0	0.00			
	1.439	500	0.00			
1000	2.935	999	-0.01			
2000	5.929	1999	-0.02			
3000	8.923	2999	-0.02			
4000	11.920	3999	-0.01			
5000	14.917	5000	0.00			
	All readings within manufac					
	CONVERSION FACTOR	S (Reading - Offset)*gain				
Shunt Reading	Shunt Reading	Offset	Gain			
(millivolts)	(psi)	(millivolts)	(psi/mv)			
11.922	4000	-0.058	333.90			
alibration performed pe	r STS document PTC1001 and t	racable to N.I.S.T.				
	ements model M3800 SN:61205,		7007060			
echnician L. Wilso		DATE: May 16, 2010				
IGNED:	u'C	RECALL: May 16, 2011				



PO Box 355 Dobbin, Tx 77333 Phone - 713-515-3619

CALIBRATION CERTIFICATE

MOHR ENGINEERING CUSTOMER: 13602 WESTLAND EAST BLVD Transducer Make: Transducer Model: Dynisco G830-300-5M-K73 Transducer S/N: 190948937 Transducer Range: 0 - 5000 psi Reference and testing conditions: 979.312 gals 27°C +/- 1.5 deg Excitation 5.034 volts CALIBRATION READINGS (as left) ACTUAL READING 1 CONVERTED PERCENT ERROR (psi) (mv) (psi) % of FS 0.058 0.00 500 1.565 499 -0.01 1000 3.073 999 -0.012000 6.089 1999 -0.02 3000 9.107 2999 -0.02 4000 12.125 4000 -0.015000 15.143 5000 0.00 All readings within manufacturer tolerence (+/- .5% F.S.) CONVERSION FACTORS (Reading - Offset)*gain Shunt Reading Shunt Reading Offset Gain (millivolts) (psi) (millivolts) (psi/mv) 12.121 3998 0.058 331.44 Calibration performed per STS document PTC1001 and tracable to N.I.S.T. Equipment used: Pressurements model M3800 SN:61205, HP Model 34401A Sn: MY47007060 Technician L. Wilson DATE: June 19, 2010 In wil SIGNED: RECALL: June 19, 2011





PO Box 355 Dobbin, Tx 77333 Phone - 713-515-3619

CALIBRATION CERTIFICATE

Compression of the second second second second second second second second second second second second second		CALIBRATION CERT	IFICATE	
CUSTOMER:	Stress Engineerin	g / Waller Division		
42403 Old Houst	on HWY			
Transducer Make:	Dynisco	Transducer Model:	G830-300-10M-K73	
Transducer S/N:	190948938	Transducer Range:	0 - 10000 psi	
Reference and	testing conditions:	979.312 gals	23°C +/- 1.5 deg	
		Excitation	4.999 volts	
	CALIBRATION I	READINGS (as left)		
ACTUAL	READING 1	CONVERTED	PERCENT ERROR	
(psi)	(mv)	(psi)	% of FS	
0	0.040	0	0.00	
500	0.790	501	0.01	
1000	1.538	1001	0.01	
2000	3.035	2002	0.02	
4000	6.029	4003	0.03	
6000	9.020	6002	0.02	
8000	12.011	8001	0.01	
10000	15.001	10000	0.00	
A	Il readings within manufac		F.S.)	
	CONVERSION FACTOR	RS (Reading - Offset)*gain		
Shunt Reading	Shunt Reading	Offset	Gain	
(millivolts)	(psi)	(millivolts)	(psi/mv)	
11.93	7950	0.04	668.40	
	STS document PTC1001 and t			
Equipment used: Pressure	ments model M3800 SN:61205,	, HP Model 34401A Sn: MY47	007060	
Technician L. Wilson		DATE: May 16, 2010		
SIGNED:	u'L	RECALL: May 16, 2011		



DIV OF RACINE FEDERATED INC. 8635 Washington Avenue

Racine, WI 53406 TEL: (800)235-1638 OR (262)639-6770 FAX: (262)639-2267

ORDER NO:

C2-037276

PAGE:

SHIP NUMBER:

247202

DATE: CUST PO NUMBER:

07/08/2010 J8740

CSR:

BLB

PACKING LIST

SCLD TO:

B44131

SHIP TO:

POWER ASSOCIATE INT'L., JIM EXT. 102 281-458-7020

MOHR ENGINEERING

13117 GREENRIVER DR HOUSTON

281-458-9124

13602 WESTLAND EAST BLVD TX

TX

77044

HOUSTON USA

77041

USA

SHIP VIA: FOB:

UPS SHIPPING POINT

TRACK# TERMS:

1ZV300E50349068767 0 - 0 DAYS; 0 --

DAYS; NET 30

TOTAL PCS:

WEIGHT (LBS): 18.90

TAG PO:1751225-JEK

LN#:	ITEM/CATALOG ITEM	ORDER QTY	QUANTITY DUE	SHIPPED QTY	BACKORDER OTY	
003	B000005 CERTIFICATE, CALIBRATION; 5-POINT	Γ	1	1	0	
002	B28SLM-AB MONITOR; B2800, SMP, LP, MM, GAL	ī	I	1	0	
001	B111-520 METER, 2; 1100 CS; 40-400 GPM	1	1	1	0	

Packed By:

Checked By:

Date:

Blancett Flow Meters

A Division of Racine Federated Inc.

8635 Washington Ave Racine, Wisconsin 53406 Phone: 262-639-6770 Fax: 262-639-2267

Calibration Report

Unit Under Test (UUT) Information:

Description:

METER, 2"; 1100 CS; 40-400 GPM

Model Number: Serial Number:

111-520 070810706

Sensor Type:

Magnetic Pickup

Output type:

Frequency

Minimum Flow:

40 GPM 151.4 LPM

Maximum Flow: Calibration Date: 400 GPM 1514.2 LPM July 8, 2010

Calibration Interval:

12 Months

Cal. Liquid: Ambient Temperature: Water 73.81 °F 54.38 %RH

Ambient Humidity: Linear Points:

Master Meter:

Std uncertainty: Traceability No:

TFM-1671

Model No: Serial No:

OPTIFLUX 4000C

A053003

Customer Information:

Customer Name:

Customer No: Order No:

POWER ASSOCIATE INT'L., INC.

B44131 C2-037276

UUT Calibration Data Table In GPM-

Flow Standard	Actual GPM	UUT Hz	UUT Temp °F	Visc. cSt	UUT F/V Hz/cSt	UUT K CYC/GAL	(Hz*60)/NK GPM	Linear COEFF.	Raw Err
1	400.60	317,600	75.60	0.904	351.443	47.57	404.73	0.9898	-1.03
1	224.00	175,900	75.50	0.905	194.385	47.12	224.16	0.9993	-0.07
1	126.30	99.000	75.50	0.905	109.404	47.03	126.16	1.0011	0.11
1	70.70	55.400	75.50	0.905	61.222	47.02	70.60	1.0014	0.14
1	38.50	29,900	75.40	0.906	32.998	46.60	38.10	1.0104	1.03

Nominal K (NK)

47.083

III IT Calibration Data Table In I DM

			Temp °F	¢St	Hz/cSt	Cyc/Liter	LPM	Linear COEFF.	Raw Err % Rate
1 1	1516.44	317,600	75.60	0.904	351.443	12.57	1532,08	0.9898	-1.03
1 ;	847.93	175.900	75.50	0,905	194.385	12.45	848.53	0.9993	-0.07
1	478.10	99.000	75.50	0.905	109.404	12.42	477.57	1.0011	0.11
1 :	267.63	55.400	75.50	0.905	61.222	12.42	267.25	1.0014	0.14
1	145.74	29.900	75.40	0.906	32.998	12.31	144.24	1.0104	1.03

Nominal K (NK)

12,438

Status:	PASS
Meter Accuracy (of Rate):	± 1.03 %
Average Calib. Temperature :	75.5 F
Average Calib. Specific Gravity:	1
Average Calib. Viscosity:	0.9 cSt
Flow Direction :	Forward

Calibrated By:

Edward Perez

Certified By:

Blancett calibrations are preformed using standards traceable to the National Institute of Standards and Technology The equipment and calibration procedure complies with ISO 9001:2008 and MIL-STO-45662A This calibration report may not be reproduced, except in full, without the written approval from Racine Federated Inc.

QS248 Rev. A '06/08

Calibration Information Sheet

Customer Omega Engineering	g	WO No. C6-020540	Model No. FD-410	SN 57836
	are Ver.	Output 4-20mA	Technici DJM	an Mfg. Date 7/19/2010
	Calibrated	Comments I with transducer S	/N 57838	
Temperature 73.73 °F	Relatīve Hi 57.64		Size Scale 0-30fps	Flow Units
Actual Flow 1 2.000	Actual Flow 2 4.000	Actual Flow 3 6.000	Actual Flow 4 8.000	Actual Flow 5 10.000
Flow 1 2.087	rdicated Flow 2 4.070	Indicated Flow 3 6.104	Indicated Flow 4 8.019	Indicated Flow 5 9.971
Calibration Statement The flow measurement system listed a The equipment and methods used to g ISO9001:2008. All certifications are co mathmatically corrected and are not tra	nducted with tan wat	erat 70 F (21 C) and 10 -	s certificate are traceable to	NIST and conforms to
Flow Loop Number: 8 Pipe Type: 3" SCH 80 PVC	The second secon	Optiflux 4300 ober: A05-8371	Uncertainty:	ue: 09-11-10 +/-0.5% of Reading
Test Performed By: 000 Test Performed By: 000	mylisted above was while Language Language operated and data was red on the date of	7/19/2	2010 2010	

RCN Enterprises, Inc. 371 Bowler Road Waller, Texas 77484

29 July 2009

Calibration Report

Owner:

Stress Engineering Services, Inc.

Ambient Temp: 77.8 F

42403 Old Houston Highway

Waller, Texas 77484

Machine:

MTS 20,000Lb Universal Testing Machine

MTS Load Cell Model: 661

Model: 661.20C-03

MTS DAQ and Control System

Software Compression Gain: 513.3636

Frame 11 - Tension

Serial: 49417 Excitation: 10Vdc

Tension Delta K: 0.9991

Run 1:	

Run 2:

Load, in Lbs:		Machine En		Load, in Lbs:	ī.	Machine En	ror	Repeatability	τ.
True:	Indicated:	Lbs:	%:	True:	Indicated:	Lbs:	%:	Lbs:	%:
1,999.5	1,995	-5	0.23%	1,997.8	1,997	-1	0.04%	4	0.19%
2,999.7	2,988	-12	0.39%	2,997.8	2,992	-6	0.19%	6	0.20%
4,000.6	3,998	-3	0.06%	3,998.8	3,987	-12	0.30%	-9	-0.23%
5,999.9	5,992	-8	0.13%	5,995.6	5,987	-9	0.14%	-1	-0.01%
7,997.2	7,986	-11	0.14%	7,996.9	7.985	-12	0.15%	-1	-0.01%
9,999.6	9,992	-8	0.08%	9,996.9	9,994	-3	0.03%	5	0.05%
11,997.6	11,993	-5	0.04%	11,996.6	11,993	-4	0.03%	1	0.01%
13,996.4	13,995	-1	0.01%	13,995.5	13,995	-1	0.00%	1	0.01%
15,995.1	15,998	3	-0.02%	15,995.5	15,999	4	-0.02%	1	0.00%
17,994.4	18,003	9	-0.05%	17,997.1	18.005	8	-0.04%	-1	0.00%
19,992.9	20,006	13	-0.07%	19,998.8	20,010	11	-0.06%	-2	-0.01%

System Resolution: 1 Lbs
Machine Loading Range: 1,995 to 20,010 Lbs
Maximum Error Observed: 0.39 % @ 2,988 Lbs Indicated

True loads were recorded at values of indicated load According to the ASTM Standard E-4-07

The following instruments were used to calibrate this machine. They were verified as noted by National Standards Testing Laboratory to the current ASTM Standard E-74. Instruments were compensated for the effect of temperature on zero and span by the manufacturer(s).

Device:

Sensotec Load Cell

Serial: 658345

Class "A" Range, in Lbs:

1,560 - 25,000

Verified: 16 Oct 2008

Weh

Certificate of Verification

This is to certify that the:

MTS 20,000Lb Universal Testing Machine Frame 11 - Tension
MTS Load Cell Model: 661.20C-03 Serial: 49417
MTS DAQ and Control System Excitation: 10Vdc
Software Compression Gain: 513.3636 Tension Delta K: 0.9991

Located At:

Stress Engineering Services 42403 Old Houston Highway Waller, Texas 77484

Was calibrated on 29 July 2009 according to the current ASTM Standard E-4-07 and determined to indicate load within the specified 1.0 percent tolerance on the ranges listed below. The maximum error observed was 0.39 percent.

Machine Range, lb:

Loading Range, lb: 1,995 – 20,010

20,000

Ambient temperature recorded during this calibration: 77.8 F

Devices used were verified as noted below by National Standards Testing Laboratory according to the current ASTM Standard E-74.

Device:

Serial:

Class "A" Range, in Lbs:

s:

Sensotec Load Cell

658345

1,560 - 25,000

Verified: 16 Oct 2008

Weh

RCN Enterprises, Inc. 371 Bowler Road Waller, Texas 77484

29 July 2009

RCN Enterprises, Inc. 371 Bowler Road Waller, Texas 77484

29 July 2009

Calibration Report

Owner:

Stress Engineering Services, Inc.

Ambient Temp: 76.3 F

42403 Old Houston Highway

Waller, Texas 77484

MTS Load Cell

Machine:

MTS 20,000Lb Universal Testing Machine

Model: 661.20C-03 MTS DAQ and Control System

Software Compression Gain: 513.3636

Frame 11 - Compression

Serial: 49417 Excitation: 10Vdc

Tension Delta K: 0.9991

Run 1:

Run 2:

Load, in Lbs:		fachine Er	ror	Load, in Lbs:		Machine En	ror	Repeatability	r:
True:	Indicated:	Lbs:	%:	True:	Indicated:	Lbs:	%:	Lbs:	%:
2,009.0	2,008	-1	0.05%	1,997.4	1,996	-1	0.07%	0	-0.02%
3,000.6	3,004	3	-0.11%	3,004.8	3,002	-3	0.09%	-6	-0.21%
4,005.4	4,000	-5	0.13%	4,013.7	4,008	-6	0.14%	0	-0.01%
6,000.4	5,995	-5	0.09%	6,008.4	6,003	-5	0.09%	o o	0.00%
8,002.3	8,000	-2	0.03%	8,003.0	7.996	-7	0.09%	-5	-0.06%
9,997.8	10,001	3	-0.03%	9,999.7	9,993	-7	0.07%	-10	-0.10%
11,996.3	12,000	4	-0.03%	11,998.3	11,988	-10	0.09%	-14	-0.12%
13,996.1	14,003	7	-0.05%	14,091.3	14,097	6	-0.04%	-1	-0.01%
15,986.8	15,991	4	-0.03%	15,989.1	15,994	5	-0.03%	1	0.00%
17,979.5	17,990	11	-0.06%	17,986.6	17.994	7	-0.04%	-3	-0.02%
19,975.4	19,988	13	-0.06%	19,971.0	19,983	12	-0.06%	-1	0.00%

System Resolution: 1 Lbs Machine Loading Range: 1,996 to 19,988 Lbs Maximum Error Observed: 0.21 % @ 3,002 Lbs Indicated

True loads were recorded at values of indicated load According to the ASTM Standard E-4-07

The following instruments were used to calibrate this machine. They were verified as noted by National Standards Testing Laboratory to the current ASTM Standard E-74. Instruments were compensated for the effect of temperature on zero and span by the manufacturer(s).

Device:

Serial:

Class "A" Range, in Lbs:

Sensotec Load Cell

658345

1,560 - 25,000

Verified: 16 Oct 2008

Web!

Certificate of Verification

This is to certify that the:

MTS 20,000Lb Universal Testing Machine Frame 11 – Compression MTS Load Cell Model: 661.20C-03 Serial: 49417

MTS DAQ and Control System Excitation: 10Vdc Software Compression Gain: 513.3636 Tension Delta K: 0.9991

Located At:

Stress Engineering Services 42403 Old Houston Highway Waller, Texas 77484

Was calibrated on 29 July 2009 according to the current ASTM Standard E-4-07 and determined to indicate load within the specified 1.0 percent tolerance on the ranges listed below. The maximum error observed was 0.21 percent.

Machine Range, lb:

Loading Range, lb:

20,000

1,996 - 19,988

Ambient temperature recorded during this calibration: 76.3 F

Devices used were verified as noted below by National Standards Testing Laboratory according to the current ASTM Standard E-74.

Device:

Serial:

Class "A" Range, in Lbs:

Verified:

Sensotec Load Cell

658345

1,560 - 25,000

16 Oct 2008

Web'

RCN Enterprises, Inc. 371 Bowler Road Waller, Texas 77484

29 July 2009



Annex N Photographs

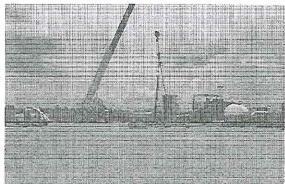


Stress Engineering Services, Inc.

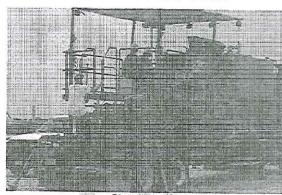
Confidential

Report No.: PN 1751225

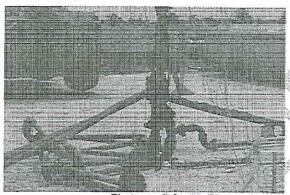
Equipment Setup for FC SN 29679918-01 Reverse-Flow Tests



Photograph 1



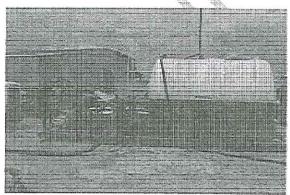
Photograph 2



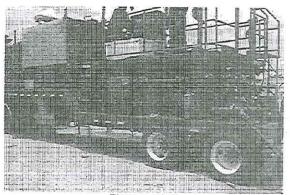
Photograph 3



Photograph 4

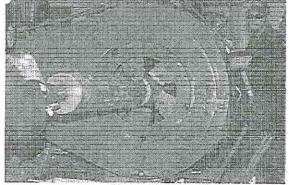


Photograph 5

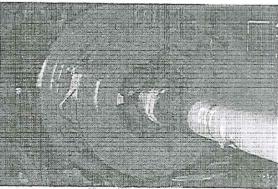


Photograph 6

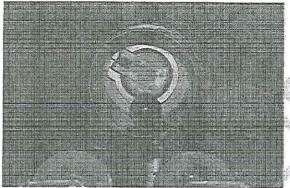
Break-out/Make-up of FC SN 29679918-01 after Conversion



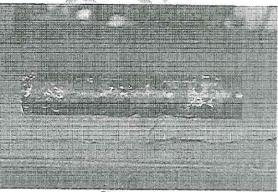
Photograph 7



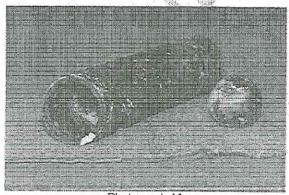
Photograph 8



Photograph 9

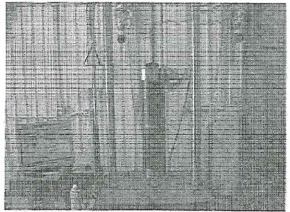


Photograph 10

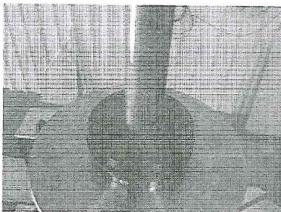


Photograph 11

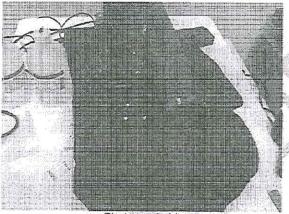
Conversion Mechanical Failure Test



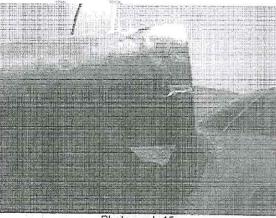
Photograph 12



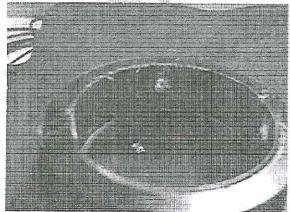
Photograph 13



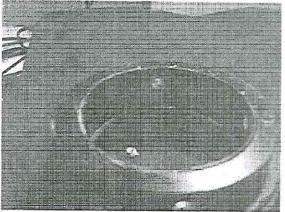
Photograph 14



Photograph 15



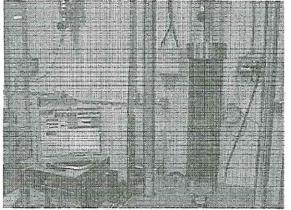
Photograph 16



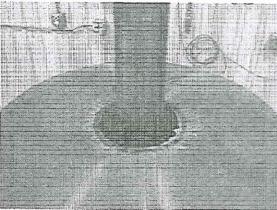
Photograph 17

Report No.: PN 1751225

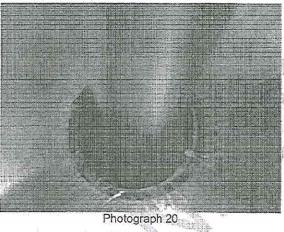
Auto-Fill Tube Lower Ball Seat Mechanical Failure Test

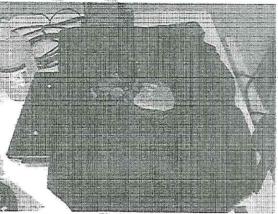


Photograph 18

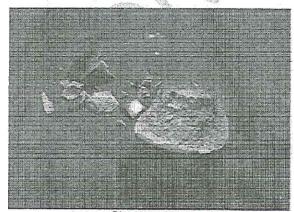


Photograph 19





Photograph 21

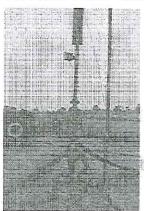


Photograph 22

Equipment Setup for FC SN 29679918-02 Reverse-Flow Tests



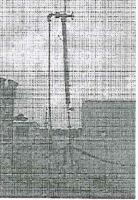
Photograph 23



Photograph 24

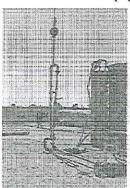


Photograph 25



Photograph 26

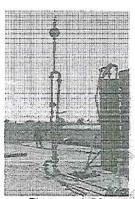
Rehearsal for Steady-State Conversion Test with Simulated FC (Typical Equipment Setup)



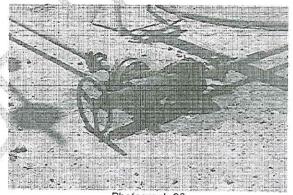
Photograph 27



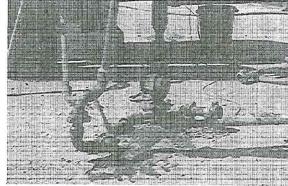
Photograph 28



Photograph 29



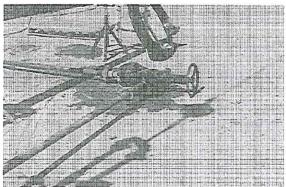
Photograph 30



Photograph 31



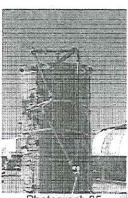
Photograph 32



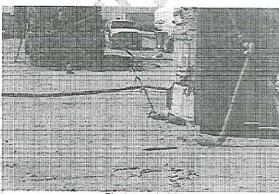
Photograph 33



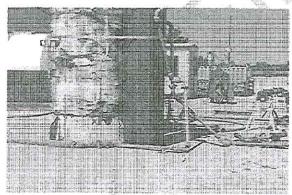
Photograph 34



Photograph 35



Photograph 36



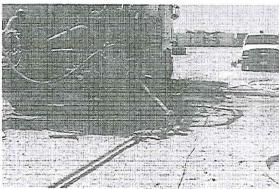
Photograph 37



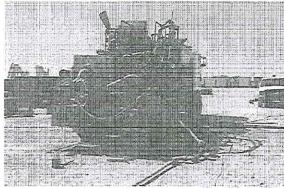
Photograph 38



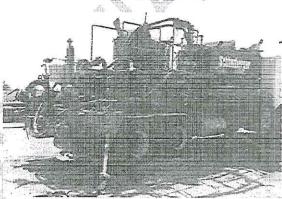
Photograph 39



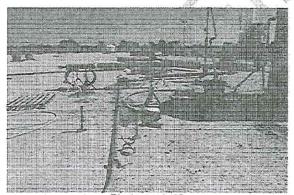
Photograph 40



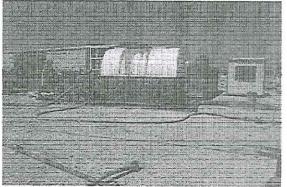
Photograph 41



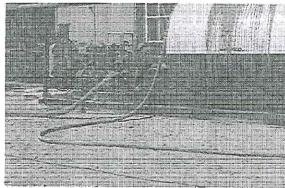
Photograph 42

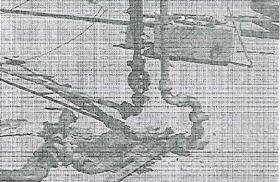


Photograph 43



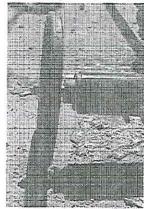
Photograph 44





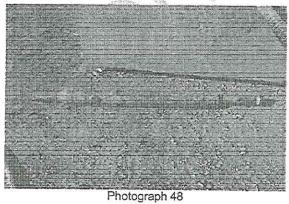
Photograph 45

Photograph 46



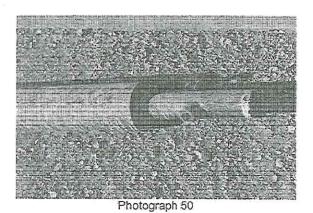
Photograph 47

Simulated Float Collar Auto-Fill Tube for Flow Surge Rehearsal Tests

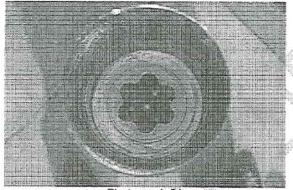




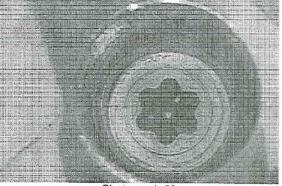
Photograph 49



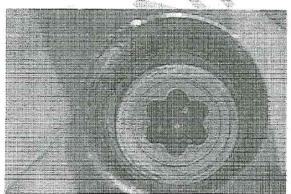
Allamon Ball after Conversion Test of FC SN 29679918-05



Photograph 51



Photograph 52



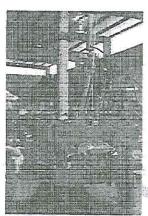
Photograph 53



Photograph 54

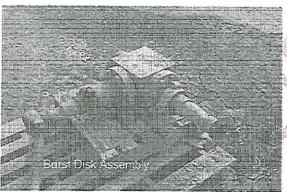


Photograph 55

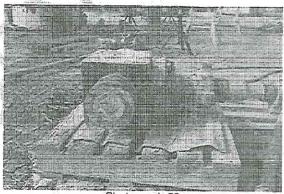


Photograph 56

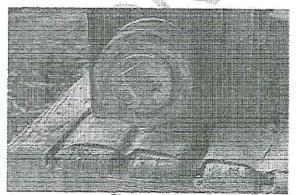
Second Flow Surge Test of FC SN 29679918-04



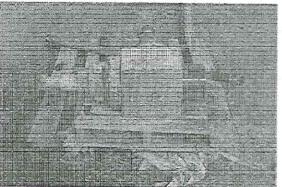
Photograph 57



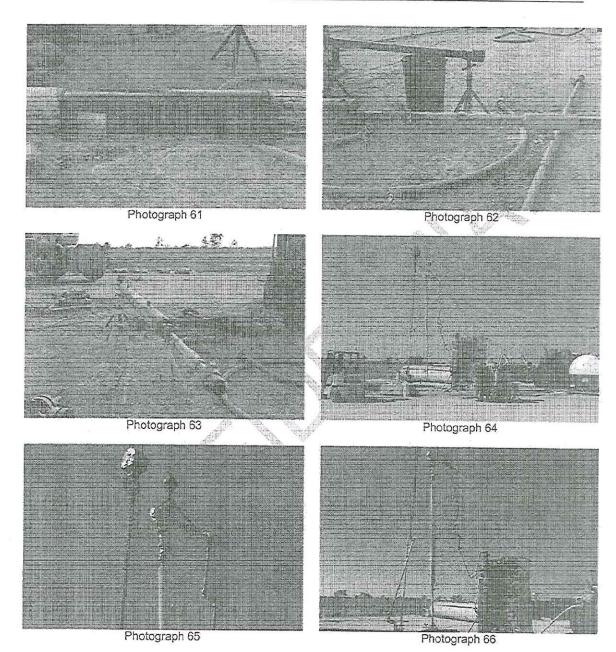
Photograph 58

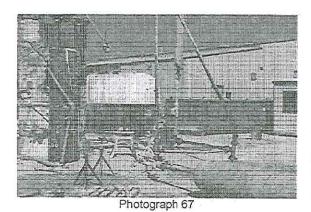


Photograph 59



Photograph 60

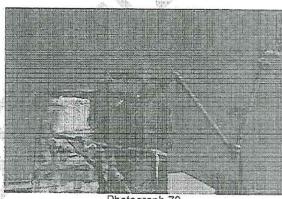




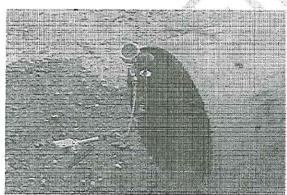




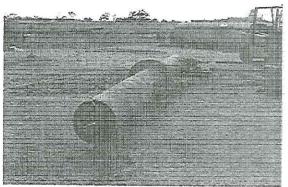
Photograph 69



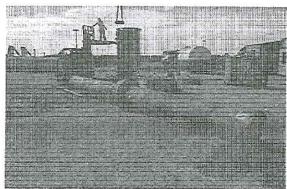
Photograph 70



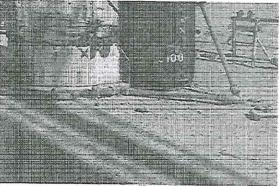
Photograph 71



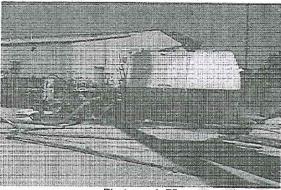
Photograph 72



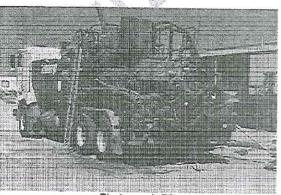
Photograph 73



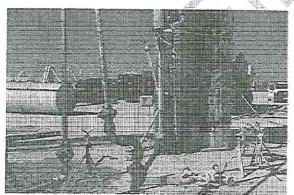
Photograph 74



Photograph 75



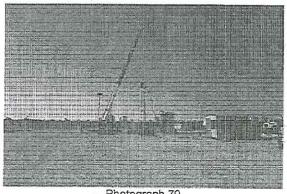
Photograph 76



Photograph 77



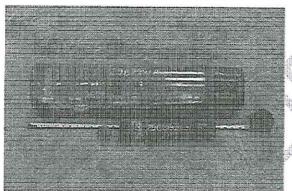
Photograph 78



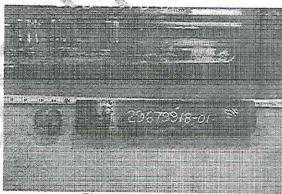
Photograph 79

Photograph 80

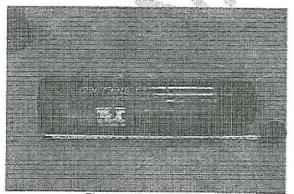
Post-Test Photographs of FC SN 29679918-01 through -05



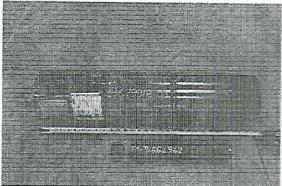
Photograph 81 (SN-01)



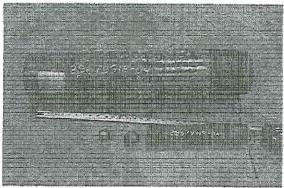
Photograph 82 (SN-01)



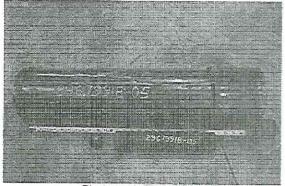
Photograph 83 (SN-02)



Photograph 84 (SN-03)

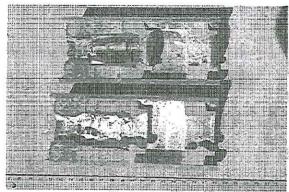


Photograph 85 (SN-04)

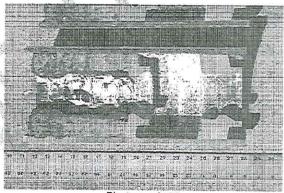


Photograph 86 (SN-05)

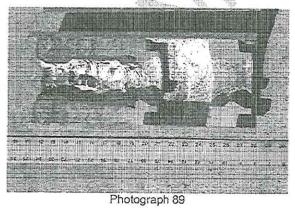
Inspection Photographs of FC SN 29679918-02 after Sectioning

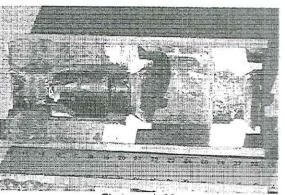


Photograph 87

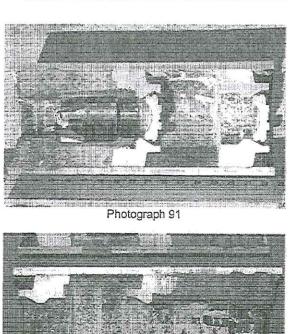


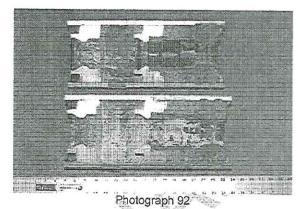
Photograph 88

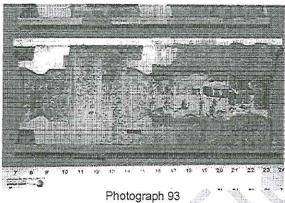


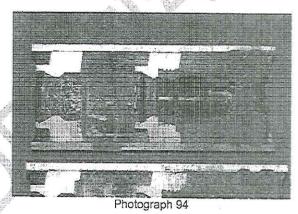


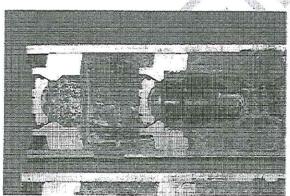
Photograph 90

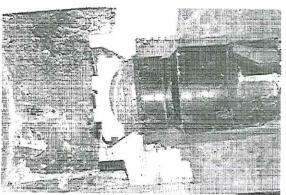






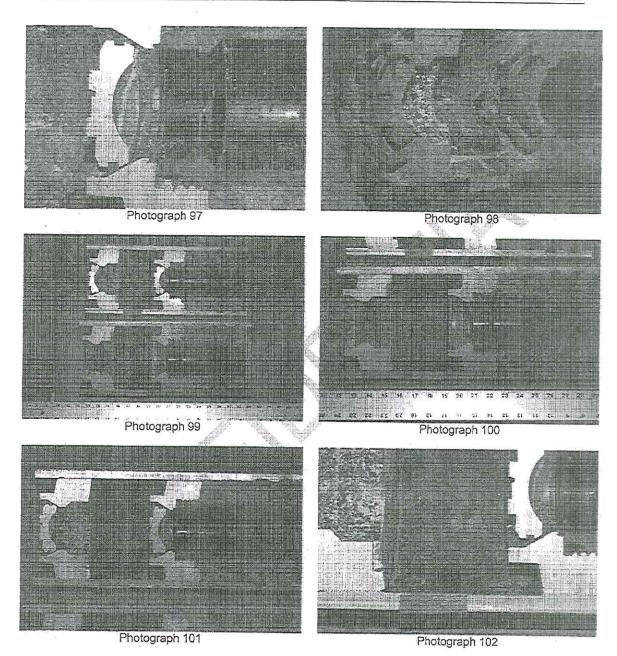


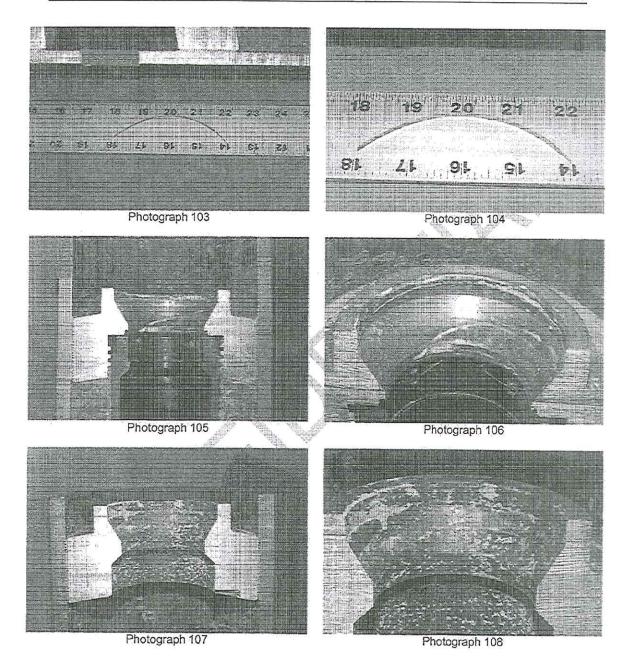


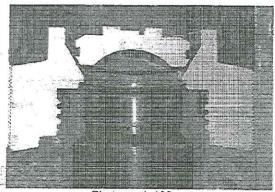


Photograph 95

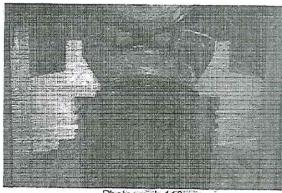
Photograph 96







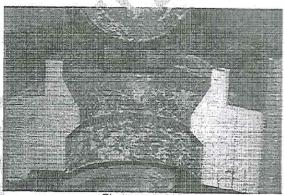
Photograph 109



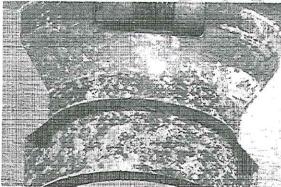
Photograph 110



Photograph 111



Photograph 112



Photograph 113