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STRESS ENGINEERING SERVICES INC.

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Report PN 1751225

Prepared for:

BP America Inc.
Houston, Texas

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0	22 Nov 2010	Final for Distribution	KDY	JRL	N/A
Draft B	17 Nov 2010	Revised Draft for Review	KDY	JRL	N/A
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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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STRESS ENGINEERING SERVICES INC.

Texas Registered Engineering Firm F-195

Limitations of this Report

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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 in^3/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. Post-test 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 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.

Table of Contents

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 × 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 StrainDAQ™ 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 standard[3] for this type of downhole equipment. As required by the API standard, the

[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.

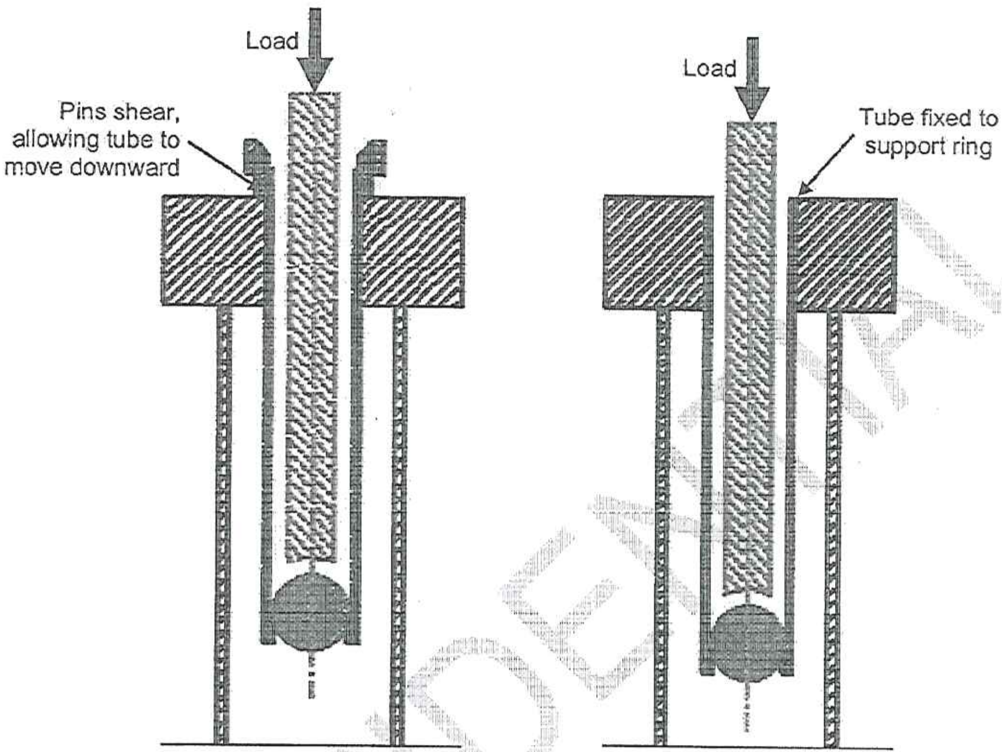


Figure 2: First Failure Test of Auto-Fill Tube

Figure 3: Second Failure Test of Auto-Fill Tube

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 ± 0.5% of full scale. This indicates that their accuracy is ±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.

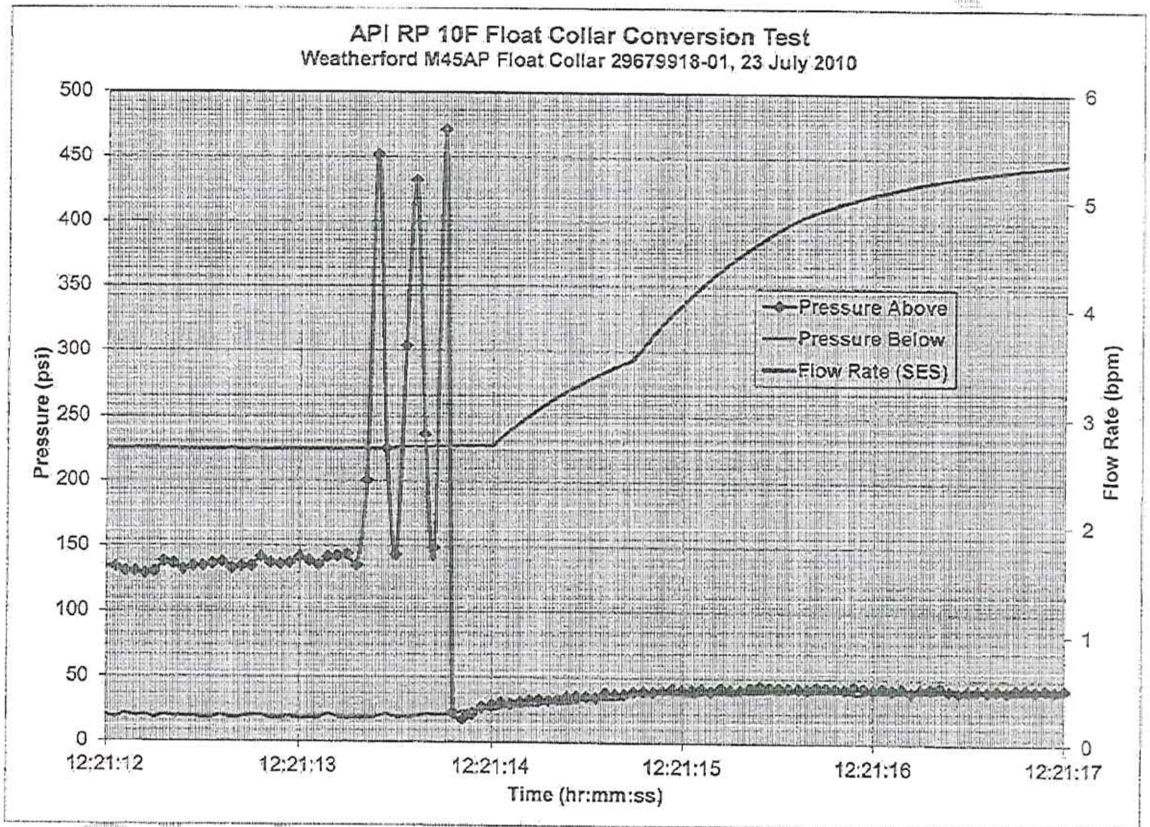


Figure 4: Conversion Test on Float Collar SN 29679918-01

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 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 in^3/stroke), the leakage rate from the float collar at 5000 psi was estimated as about 0.8 in^3/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

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

Flow Cycle	Start / Stop		Duration	Average				Data File
	Date	Time		Flow Rate	Pressure Above	Pressure Below	Temp	
	mm/dd/yr	h:mm:ss	hr	bpm	psi	psi	°F	
	7/29/10	13:51:59						
6	7/29/10	14:16:37	2.02	10.0	80	72	157	1601072-01-6
	7/29/10	16:17:31						
7	7/30/10	07:38:08	2.03	10.0	85	80	147	1601072-01-7
	7/30/10	09:39:42						
8	7/30/10	09:56:30	2.01	10.1	89	76	160	1601072-01-7
	7/30/10	11:57:23						
9	7/30/10	12:39:43	2.03	10.1	82	57	162	1601072-01-7
	7/30/10	14:41:35						
10	8/2/10	10:36:16	2.02	10.1	88	79	139	1601072-01-8
	8/2/10	12:37:30						
11	8/2/10	13:02:00	2.03	10.1	85	75	157	1601072-01-8
	8/2/10	15:03:47						
12	8/2/10	15:30:14	2.05	10.0	83	71	166	1601072-01-8
	8/2/10	17:33:14						
Total / Average			24.40	10.0	86.9	74.2	150	

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

Cycle	Date	Beginning			Ending			Decline Rate	Data File
		Time	Pressure	Temp	Time	Pressure	Temp		
	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

Cycle	Date	Beginning			Ending			Decline Rate	Data File
		Time	Pressure	Temp	Time	Pressure	Temp		
	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

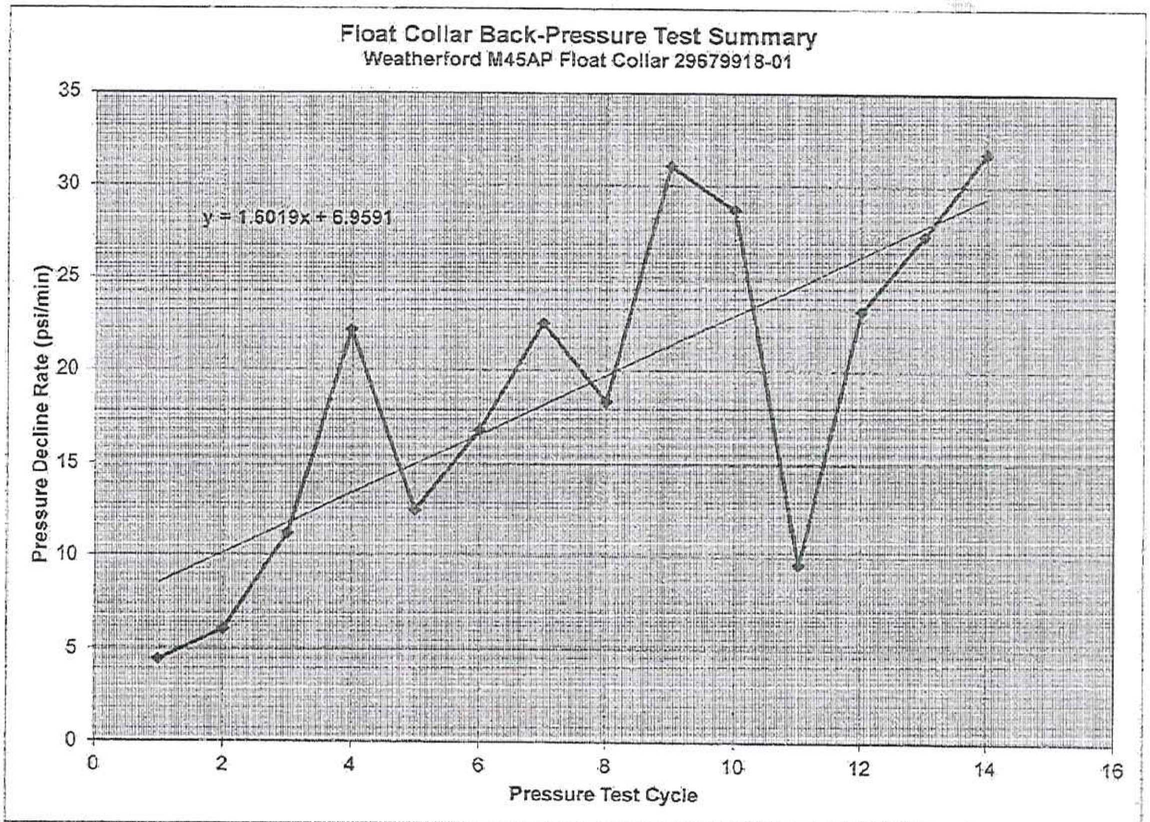


Figure 5: Summary of Back-Pressure Tests during Flow Cycling of SN-01

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 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).

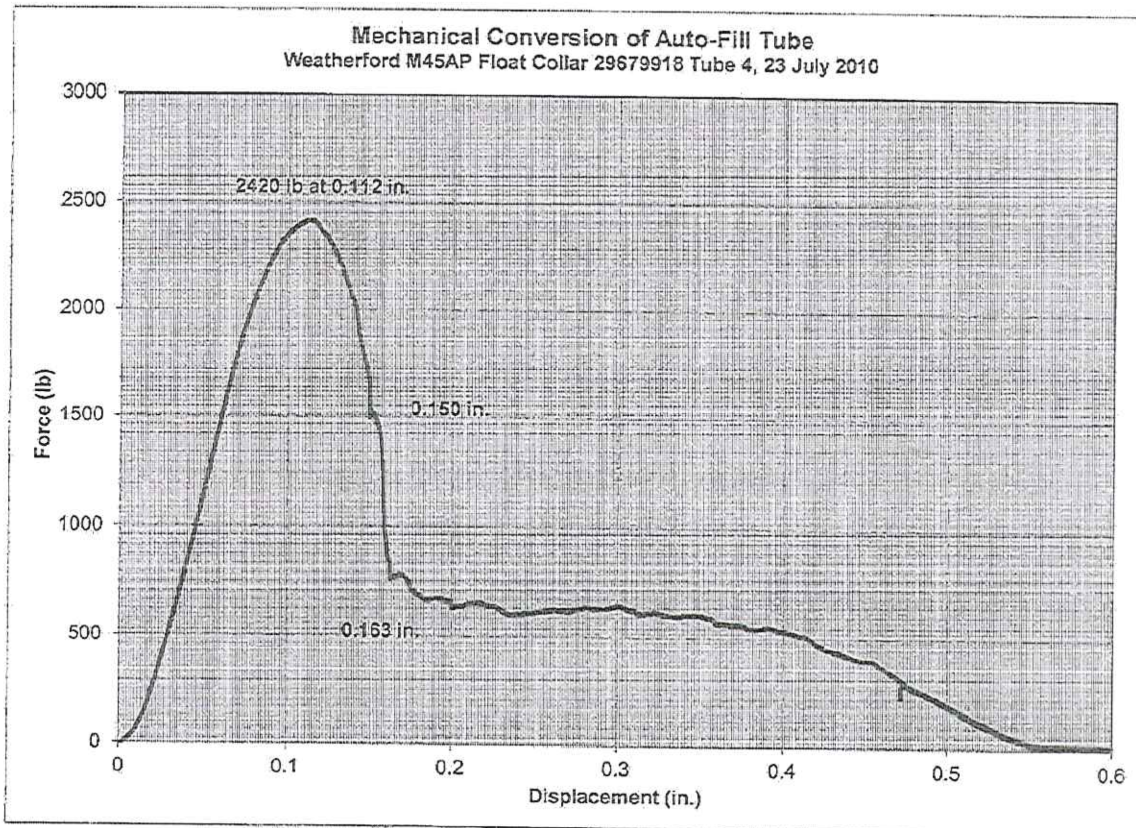


Figure 6: Conversion Mechanical Failure Test of Auto-Fill Tube

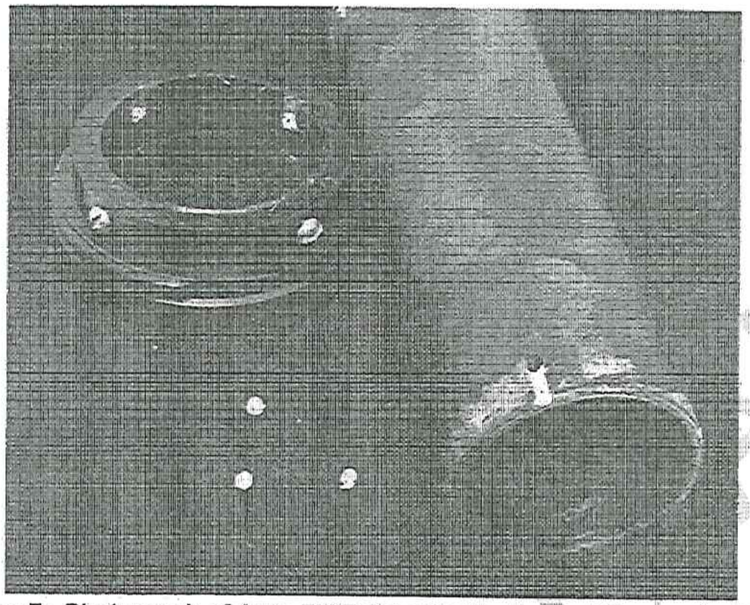


Figure 7: Photograph of Auto-Fill Tube after Mechanical Conversion Test

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 epoxy[4]. 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.

[4] Loctite and Hysol are registered trademarks of Henkel Corporation.

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.

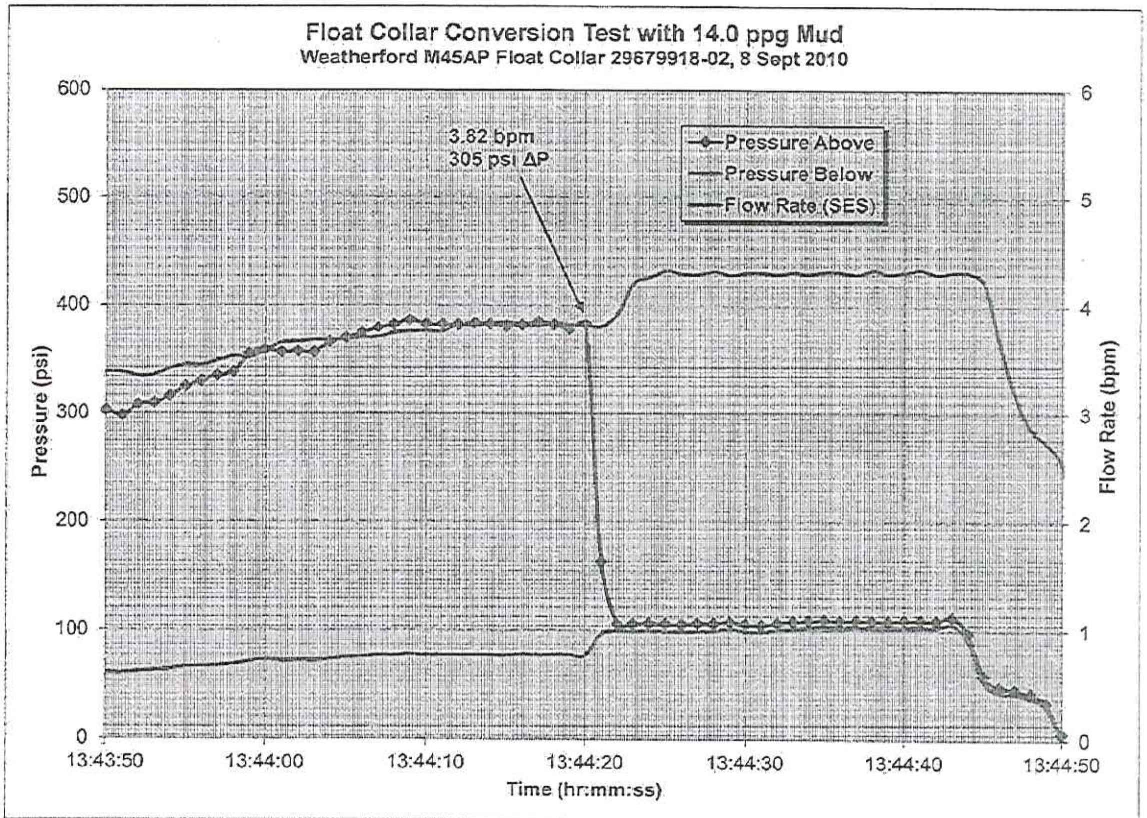


Figure 8: Conversion Test on Float Collar SN 29679918-02

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 in^3 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 in^3 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

Cycle	Date	Beginning			Ending			Decline Rate	Data File
		Time	Pressure	Temp	Time	Pressure	Temp		
	mm/dd/yr	h:mm:ss	psi	°F	h:mm:ss	psi	°F	psi/min	
1	9/8/10	14:19:29	39	107	14:24:29	27	105	2.4	1601072-02 BackPress1
	9/8/10	14:25:11	44	105	14:30:11	30	103	2.8	
	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 BackPress1
	9/8/10	17:19:17	252	110	17:24:17	165	107	17.4	
3	9/9/10	13:46:24	40	132	13:51:24	27	129	2.6	1601072-02 BackPress2
	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	

Table 4: Summary of SN-02 Flow Testing

Flow Cycle	Start / Stop		Time Duration	Average				Data File
	Date	Time		Flow Rate	Pressure Above	Pressure Below	Temp	
	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						
1	9/8/10	14:50:06	2.04	4.5	95	90	126	1601072-02 BackPress1
	9/8/10	16:52:44						
2	9/9/10	11:12:34	2.10	4.1	95	91	142	1601072-02 BackPress2
	9/9/10	13:28:38						

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.

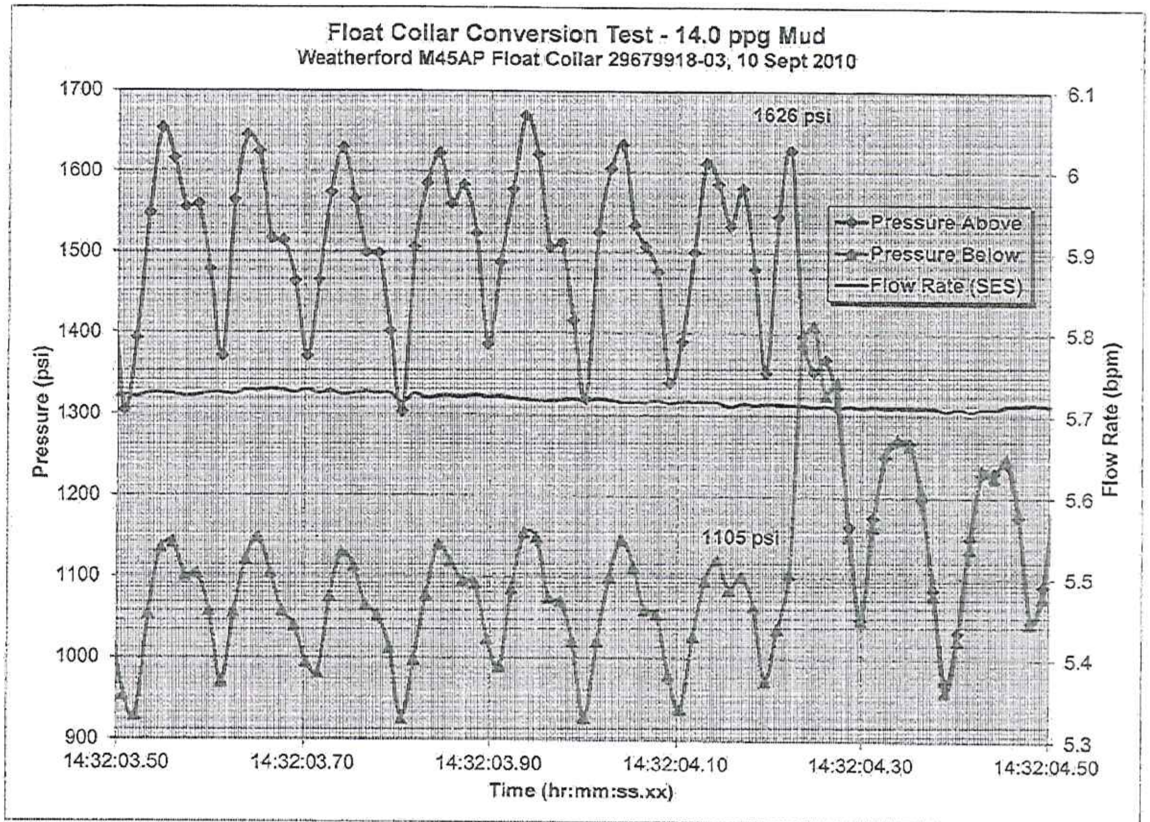


Figure 9: Conversion Test on Float Collar SN 29679918-03

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.

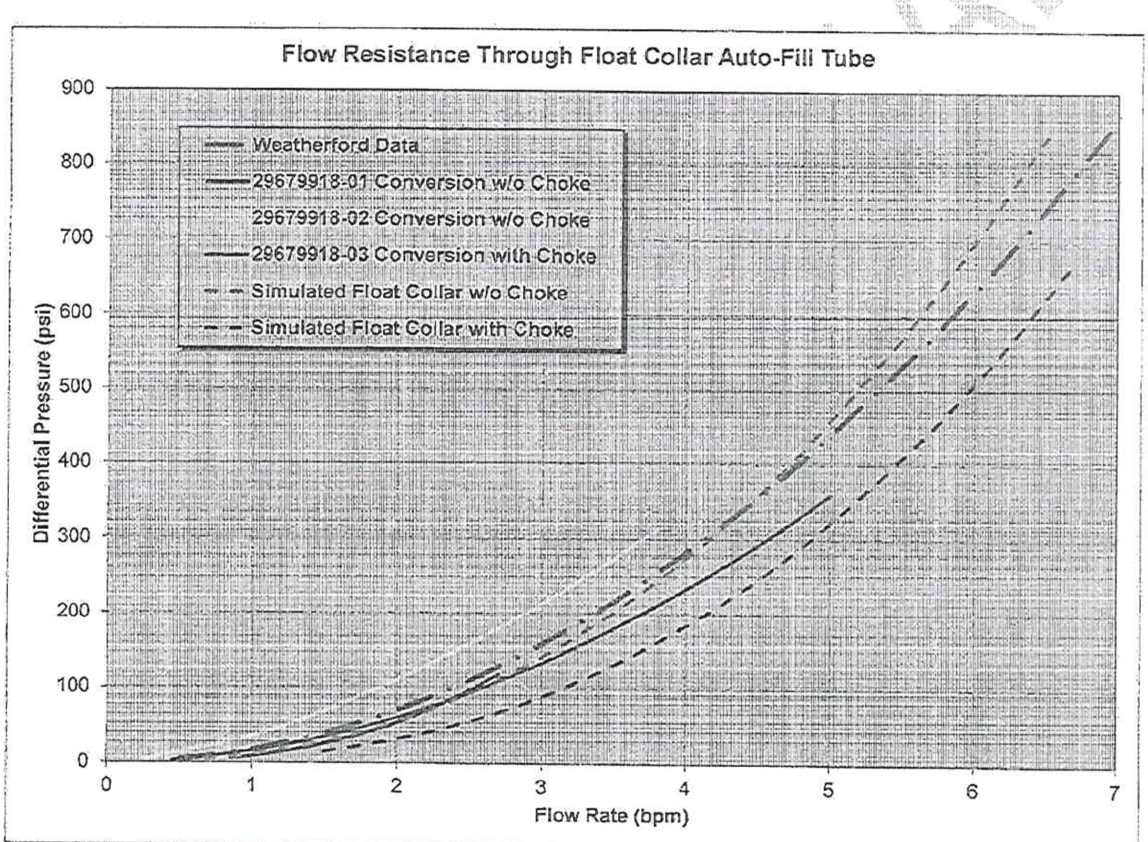


Figure 10: Summary of Flow Resistance Tests

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.

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.

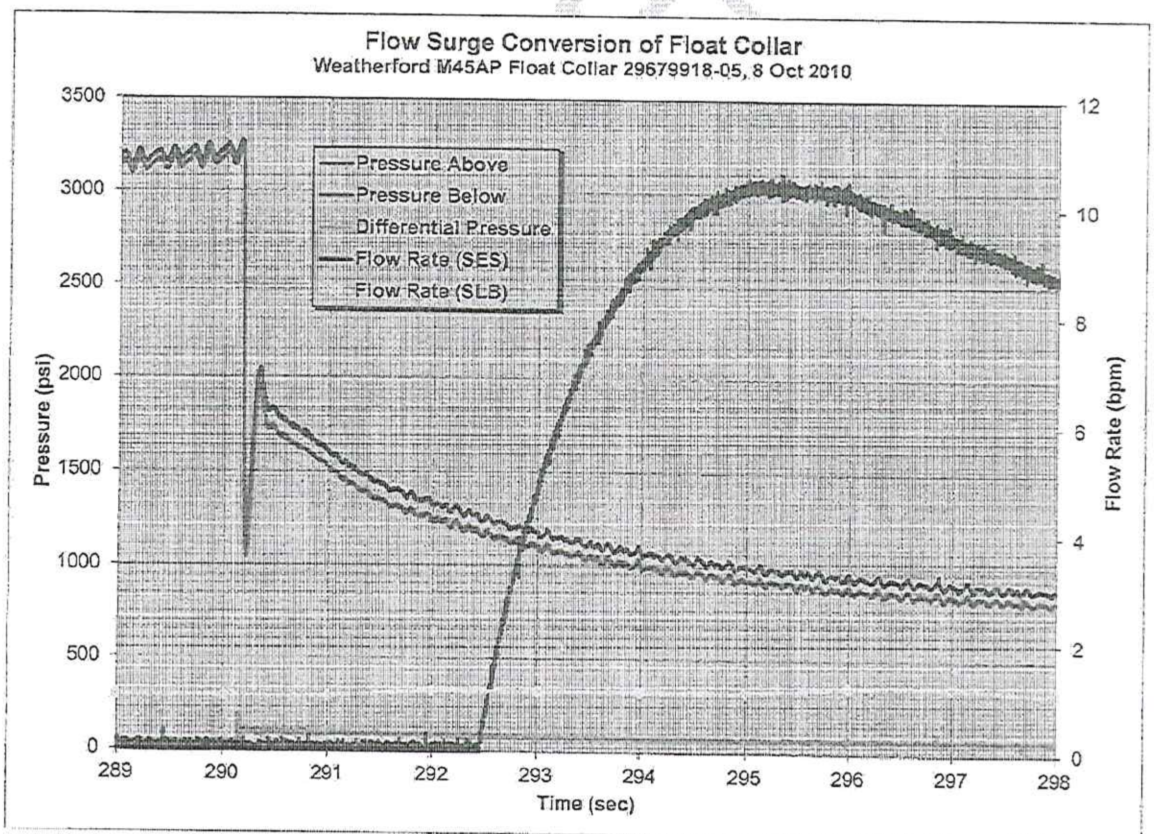


Figure 11: Conversion Test with Flow Surge on Float Collar SN 29679918-05

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.

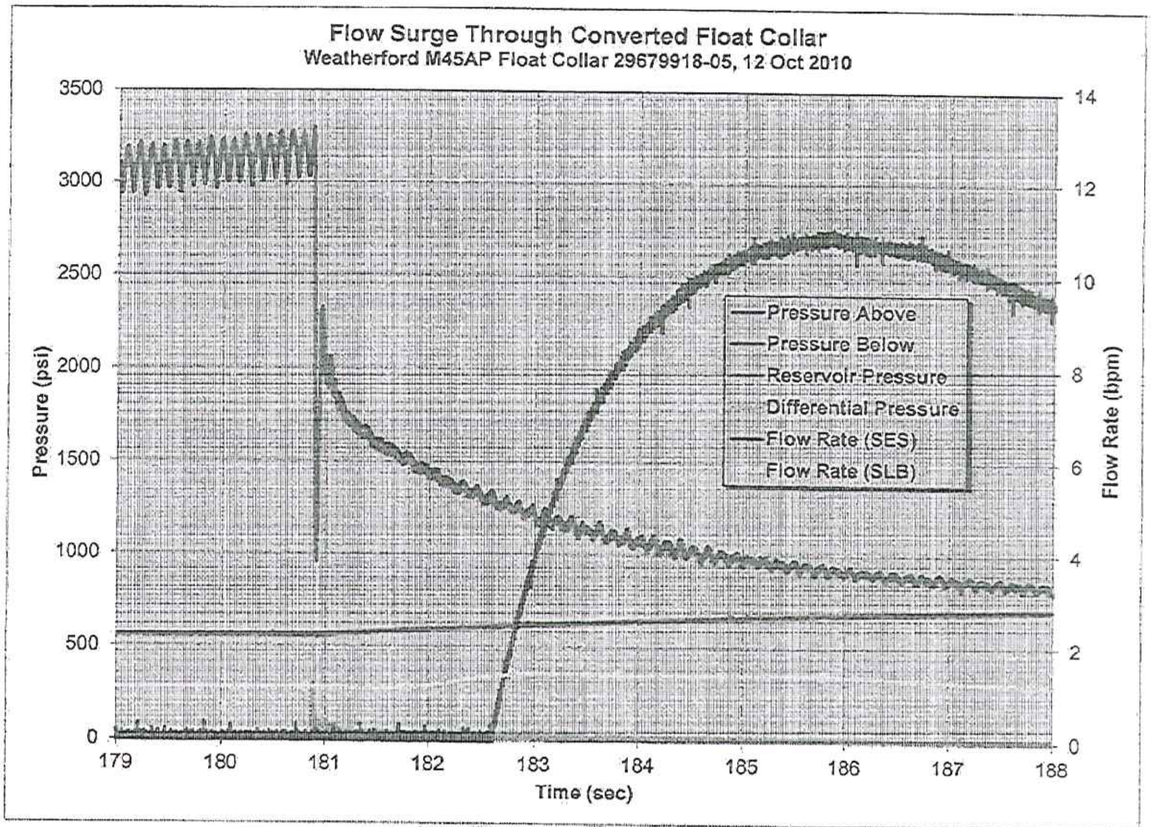


Figure 12: Second Flow Surge Test on Float Collar SN 29679918-05

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.

4.6.2 Flow Surge Tests (SN-04)

4.6.2.1 Flow Surge Conversion Test

A blockage flow surge test with an Allamon ball[5] 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.

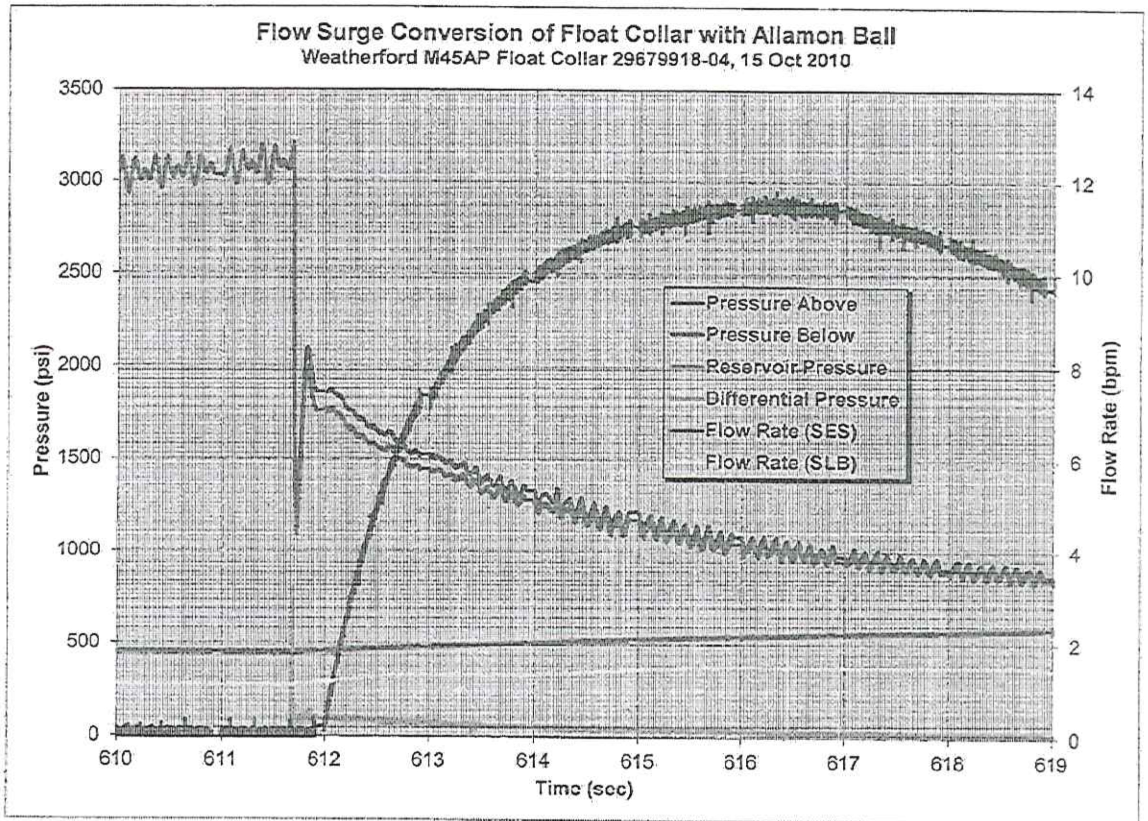


Figure 13: Conversion Test with Allamon Ball on Float Collar SN 29679918-04

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.

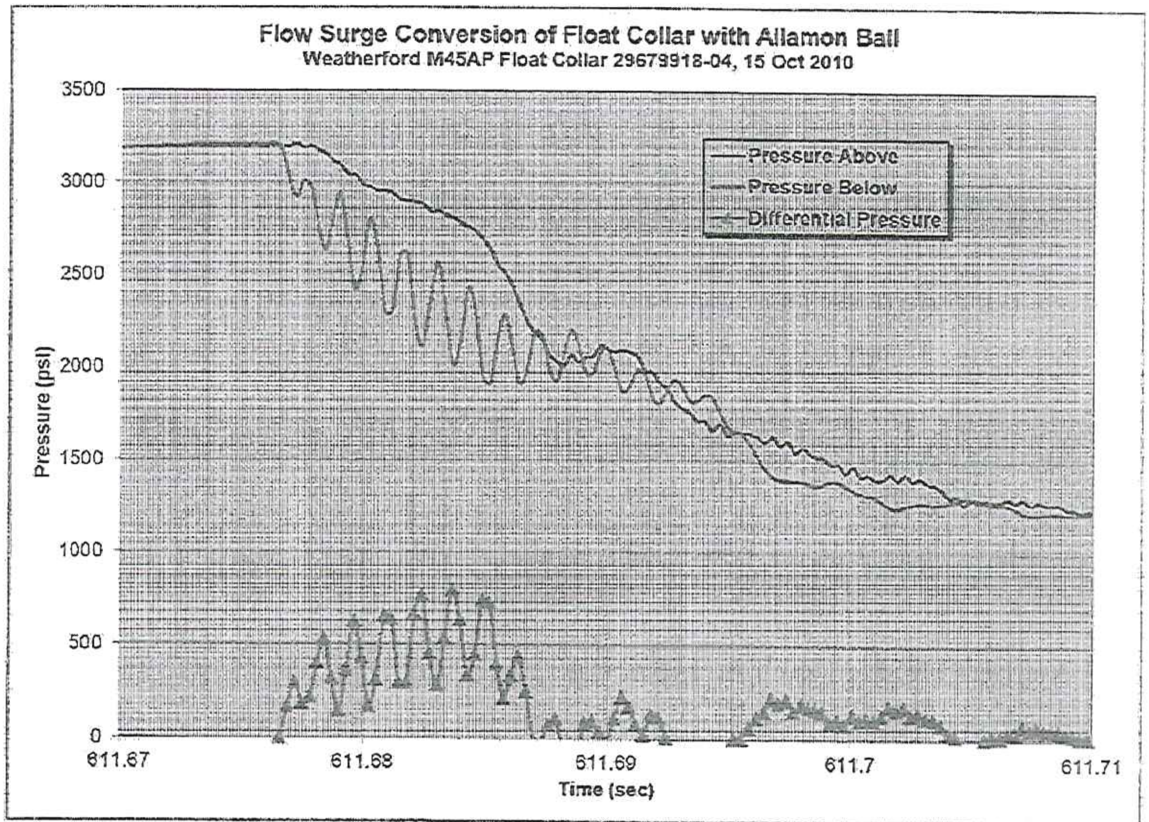


Figure 14: Flow Surge Test with Allamon Ball on Float Collar SN 29679918-04 (note spikes in differential pressure)

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).

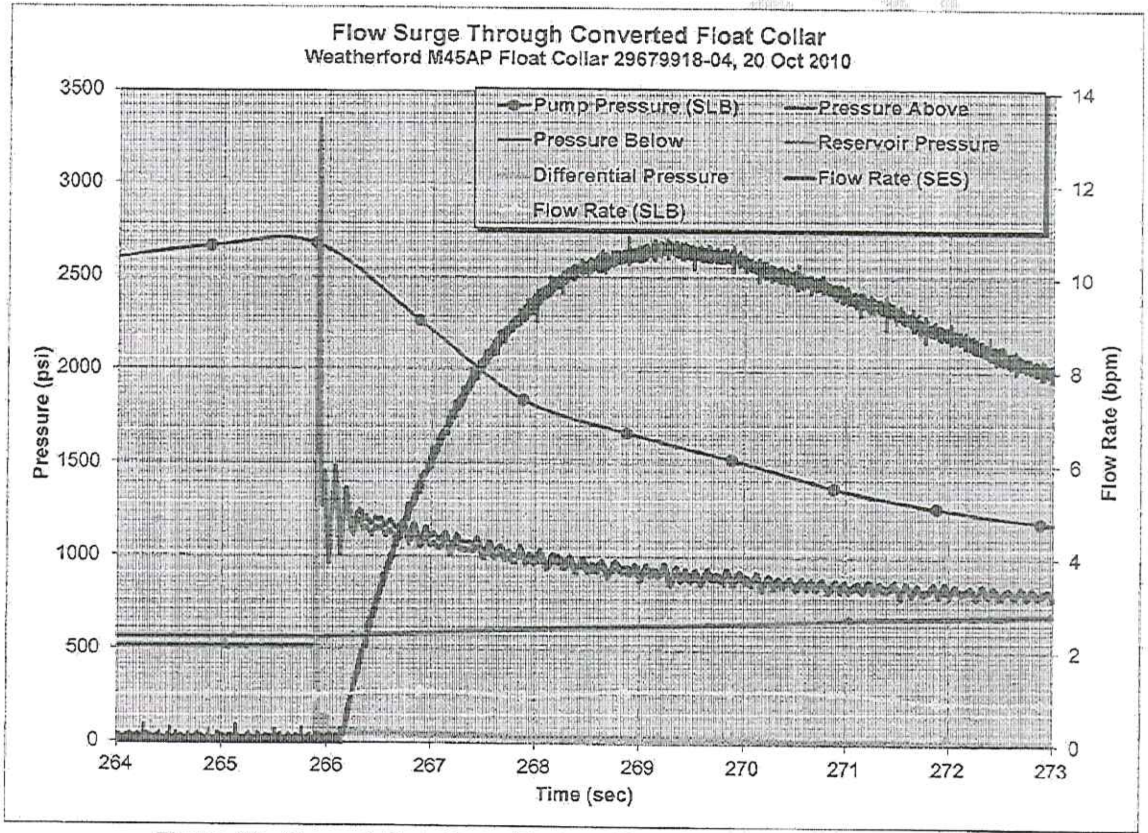


Figure 15: Second Flow Surge Test on Float Collar SN 29679918-04 with Blockage above Float Collar

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 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

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

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 Blkge Rehearsal
10/1/2010	Flow resistance w/ choke	Simulated test toll	1601072 Blkge Rehearsal Day 2c
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

A

Annex A API Flow Endurance Tests (SN-01)

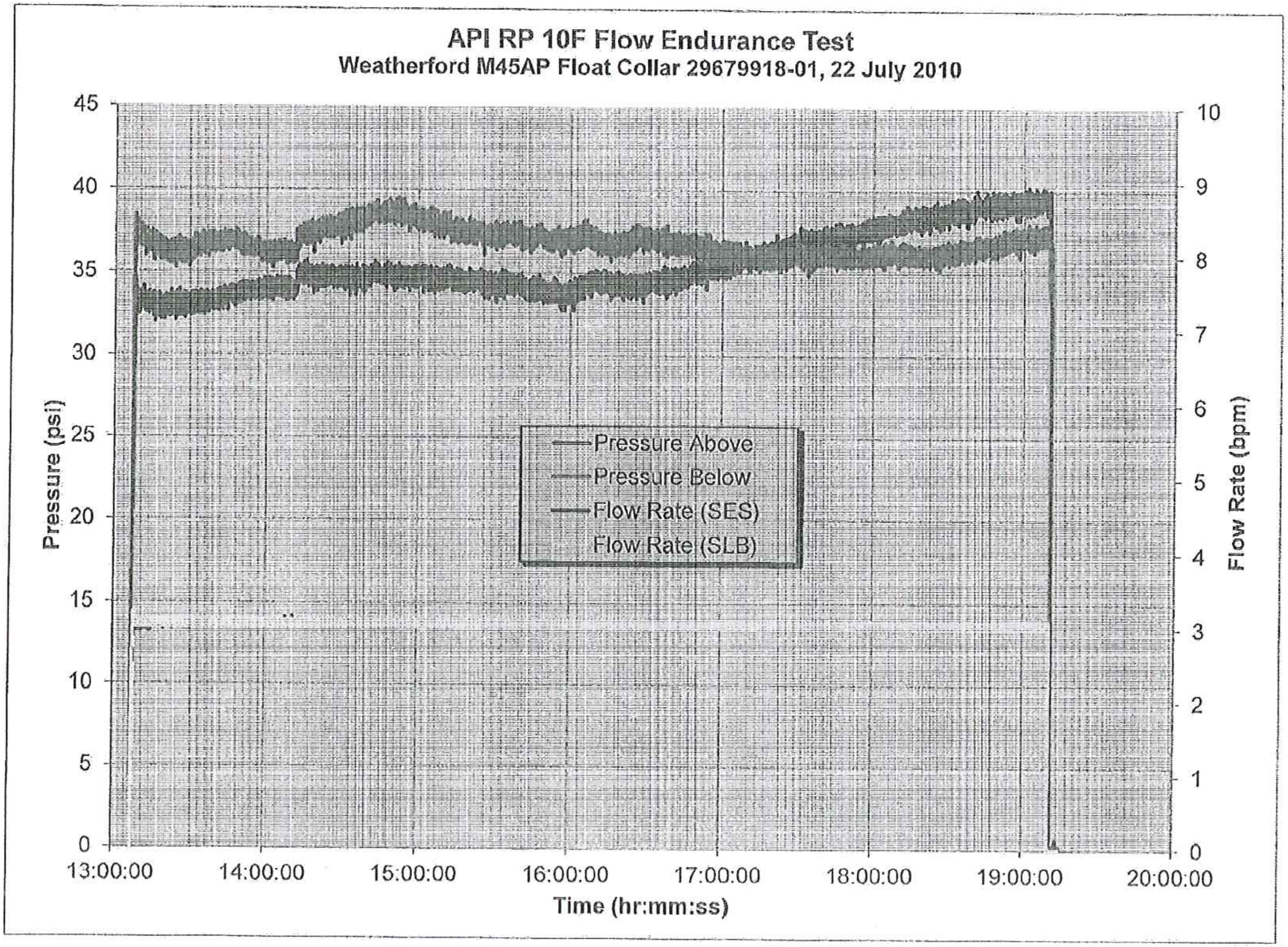


Figure A-1

1601072-01-1 Endurance.xlsx

11/18/2010

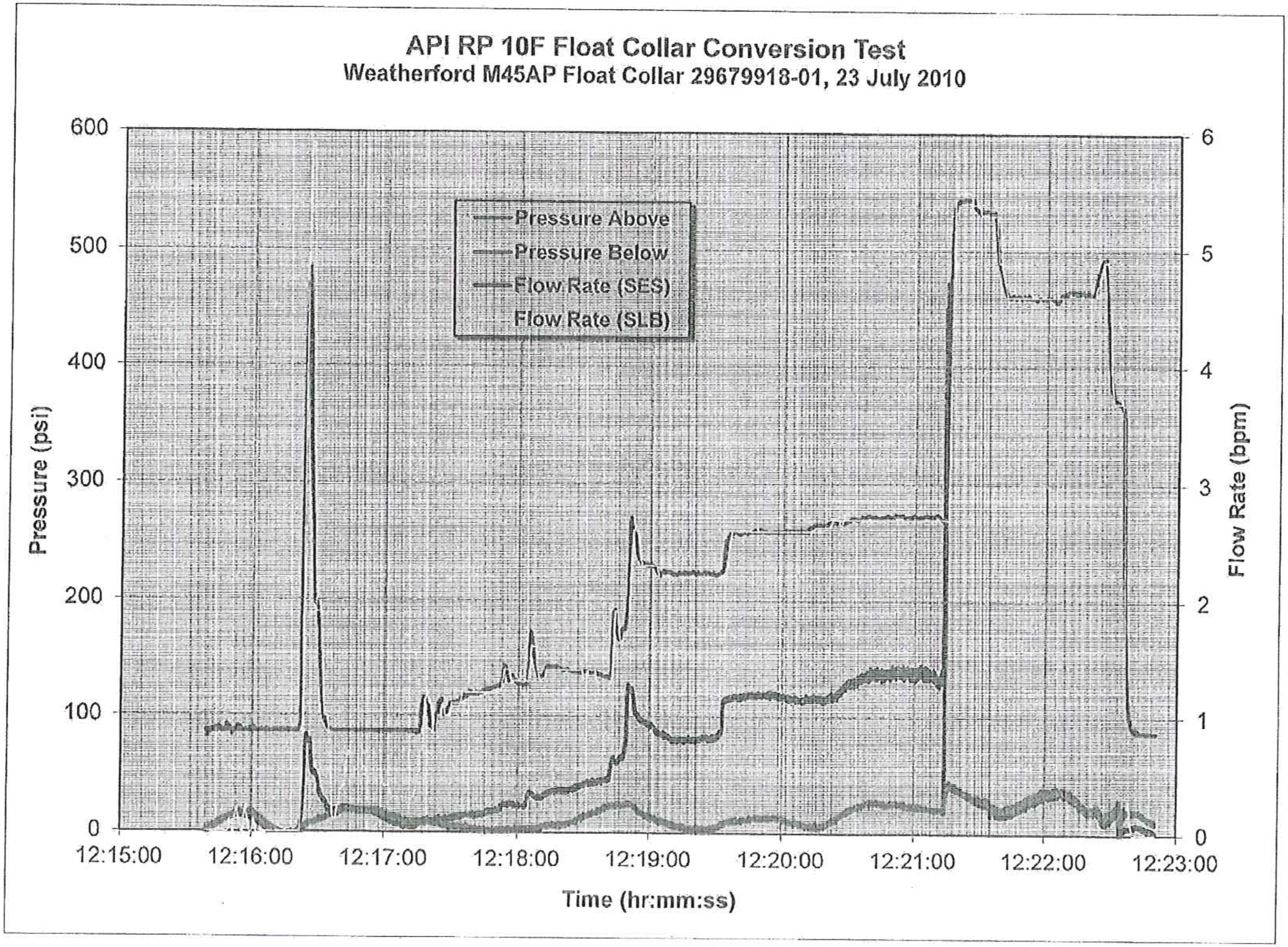


Figure A-2 1601072-01-2 Endurance.xlsx 11/18/2010

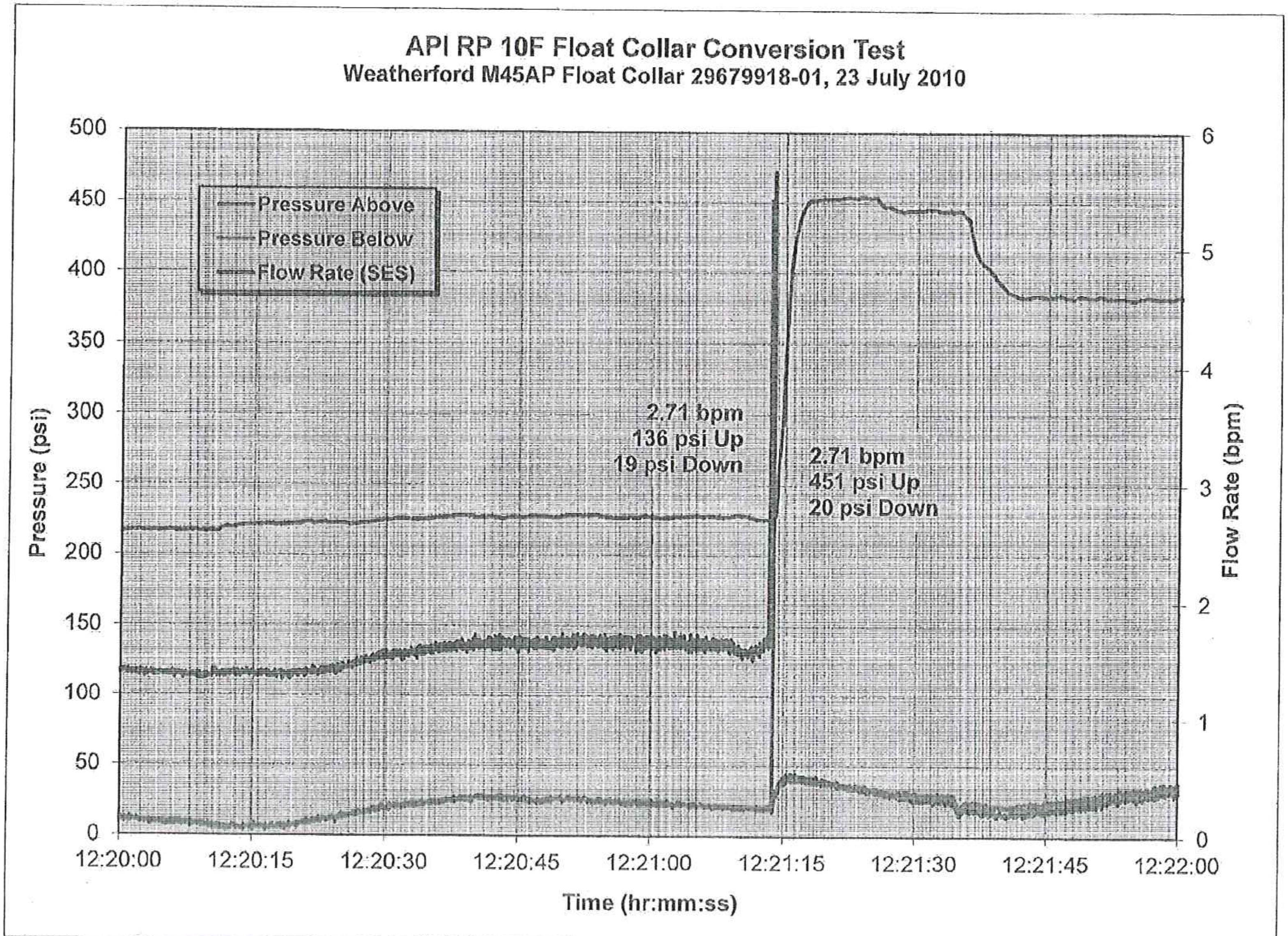


Figure A-3

1601072-01-2 Endurance.xlsx

11/18/2010

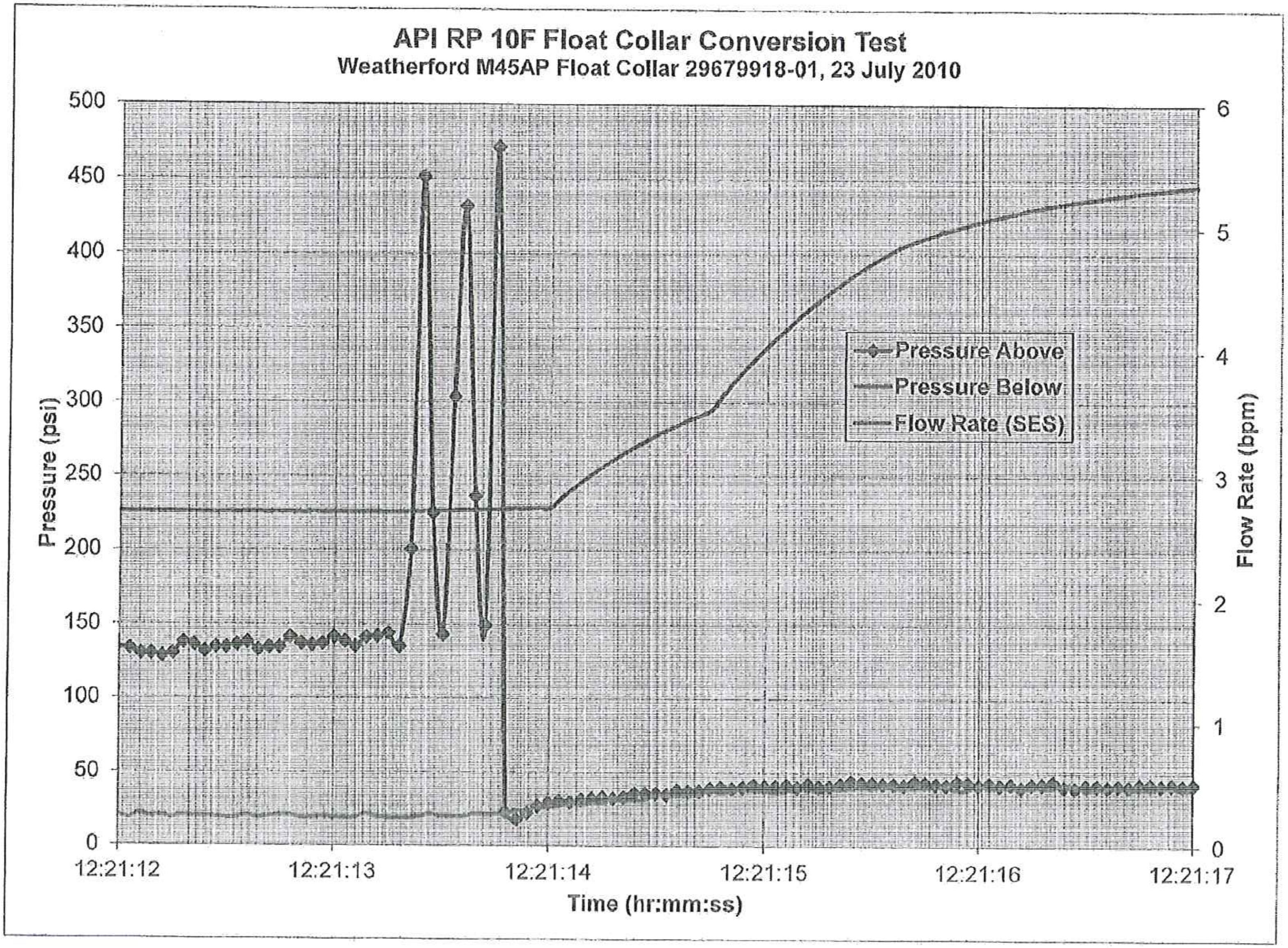


Figure A-4

1601072-01-2 Endurance.xlsx

11/18/2010

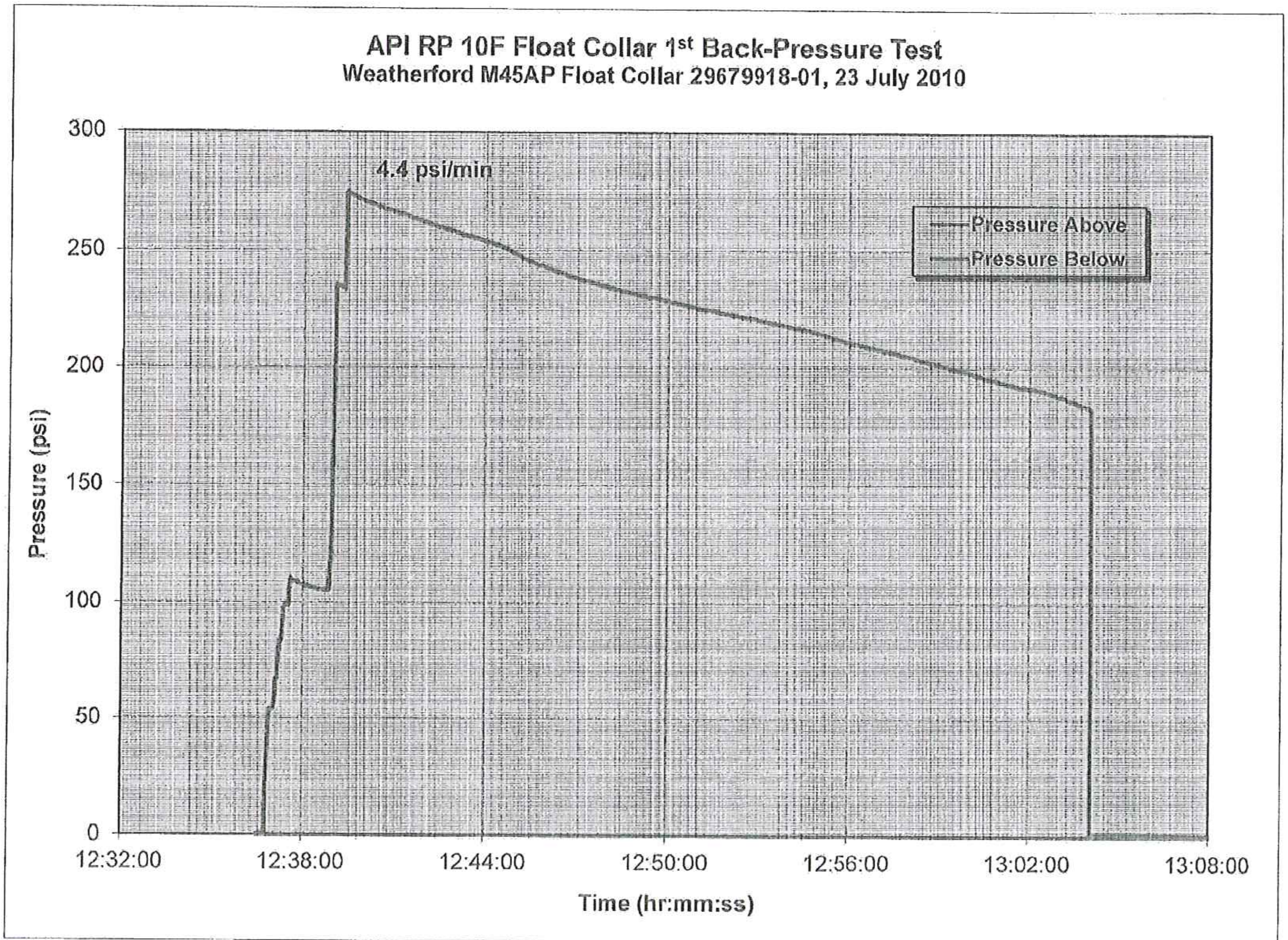

API RP 10F Float Collar 1st Back-Pressure Test
Weatherford M45AP Float Collar 29679918-01, 23 July 2010
4.4 psi/min
Pressure Above
Pressure Below
Pressure (psi)
300
250
200
150
100
50
0
12:32:00
12:38:00
12:44:00
12:50:00
12:56:00
13:02:00
13:08:00
Time (hr:mm:ss)

Figure A-5

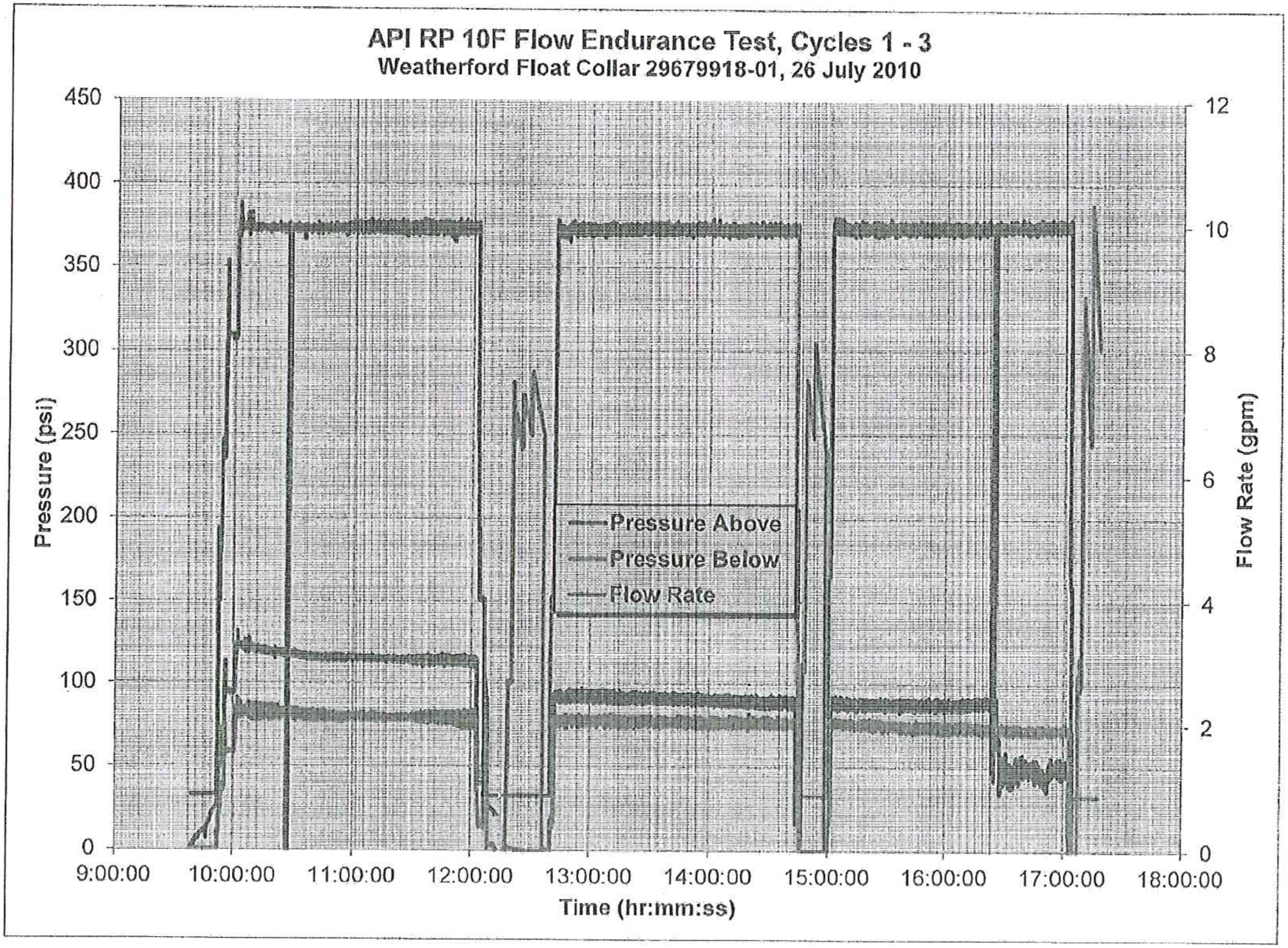


Figure A-6

1601072-01-4 Endurance.xlsx

11/18/2010

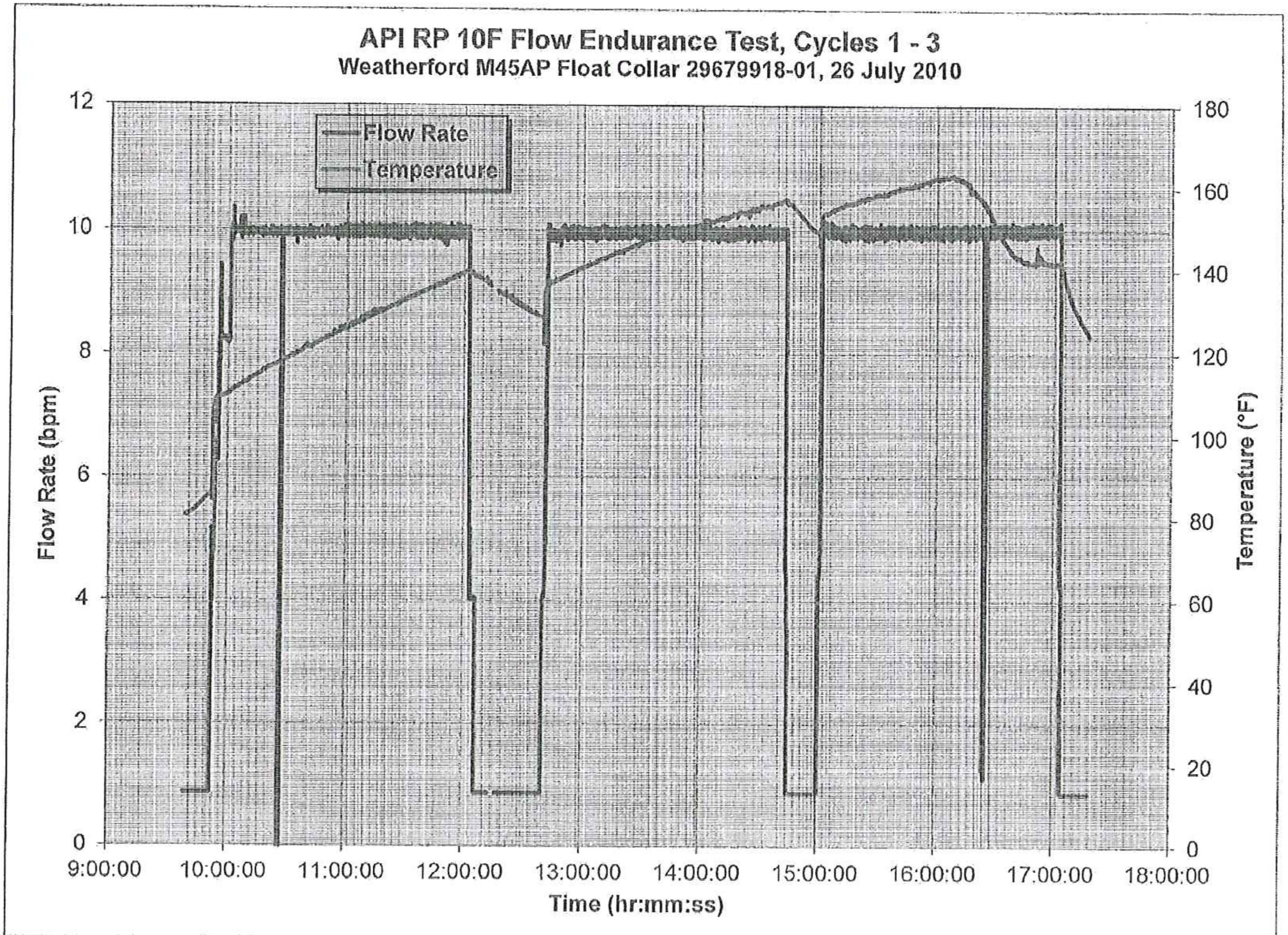


Figure A-7

1601072-01-4 Endurance.xlsx

11/18/2010

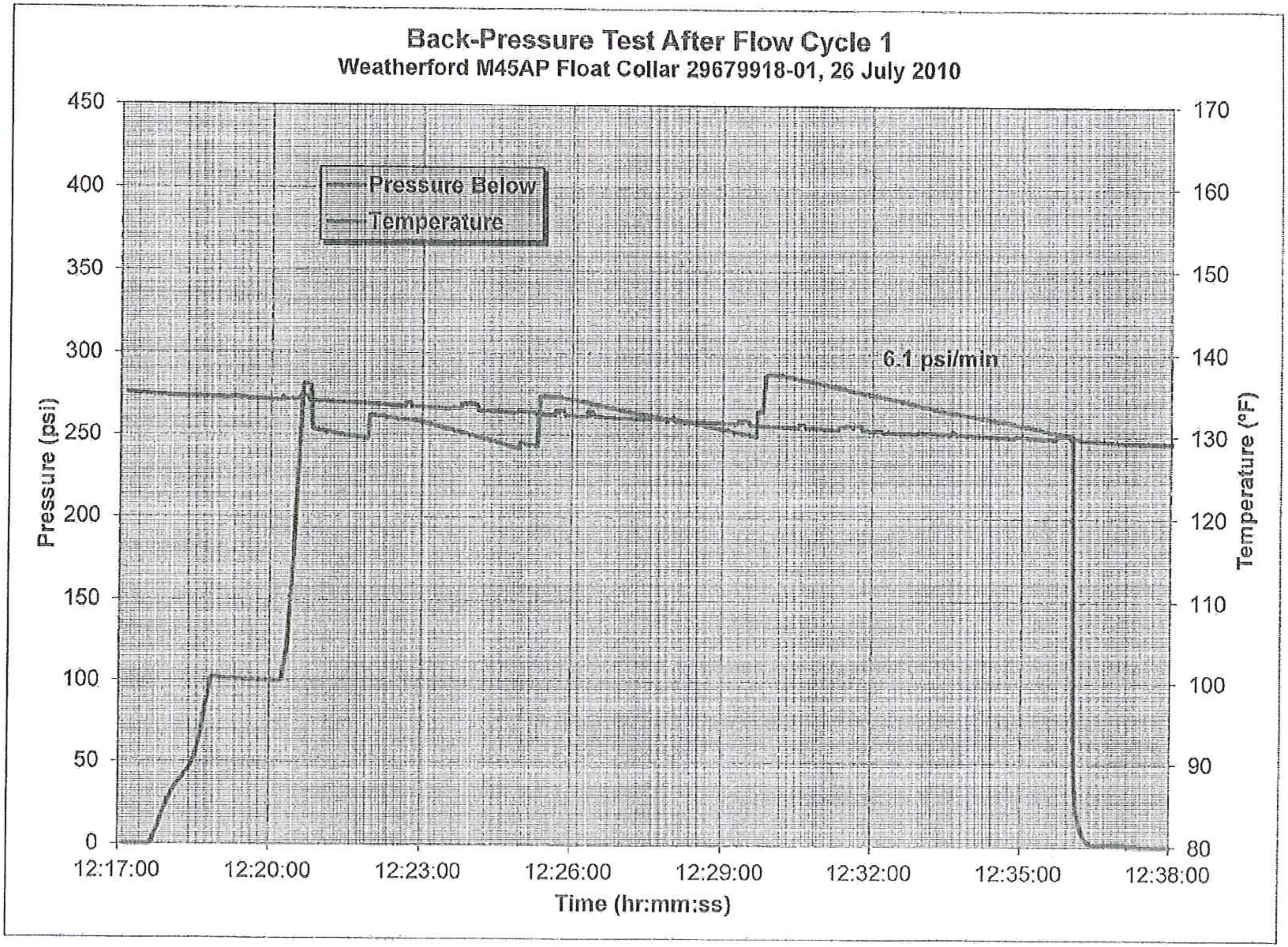


Figure A-8

1601072-01-4 Endurance.xlsx

11/18/2010

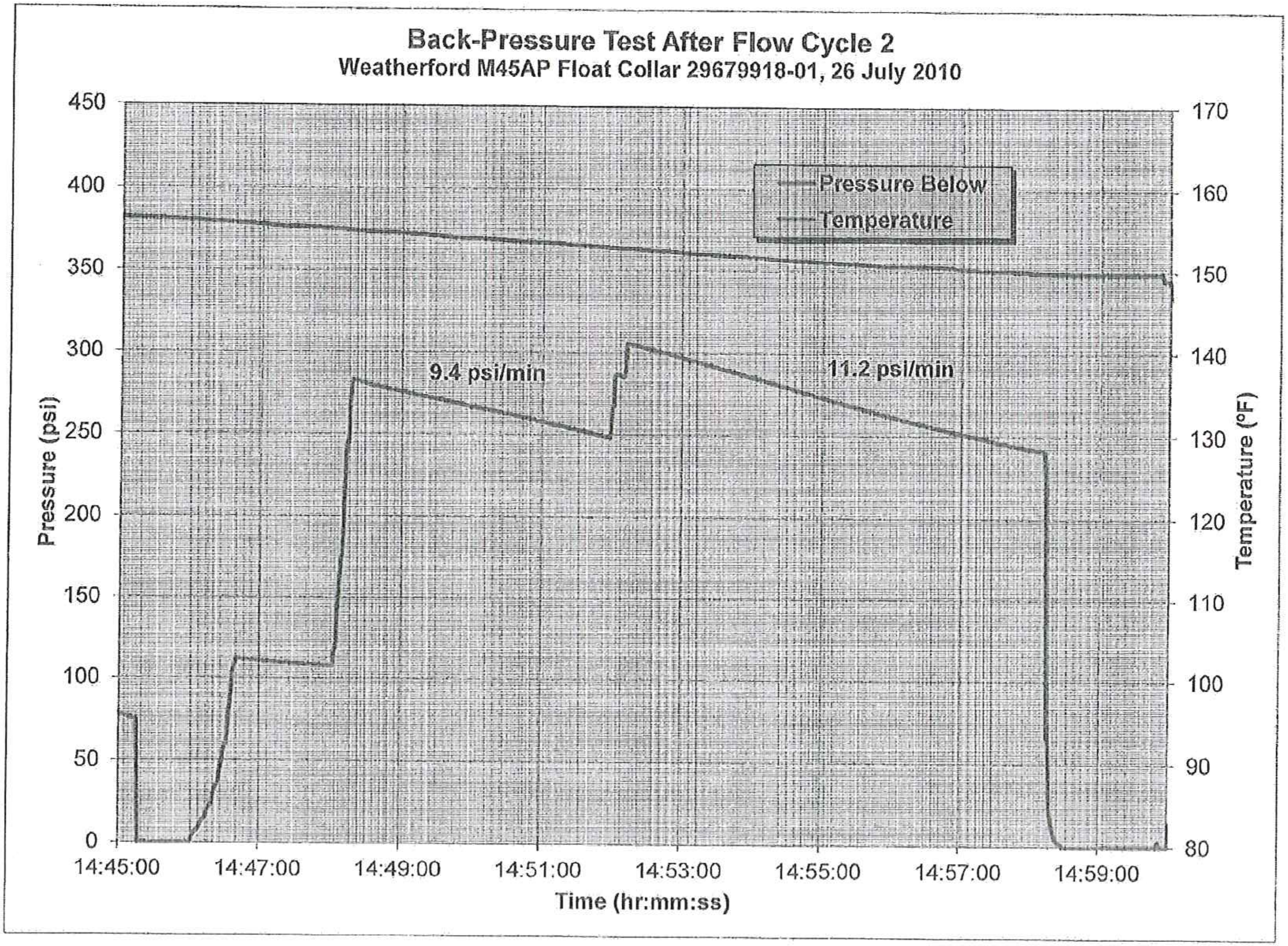


Figure A-9

1601072-01-4 Endurance.xlsx

11/18/2010

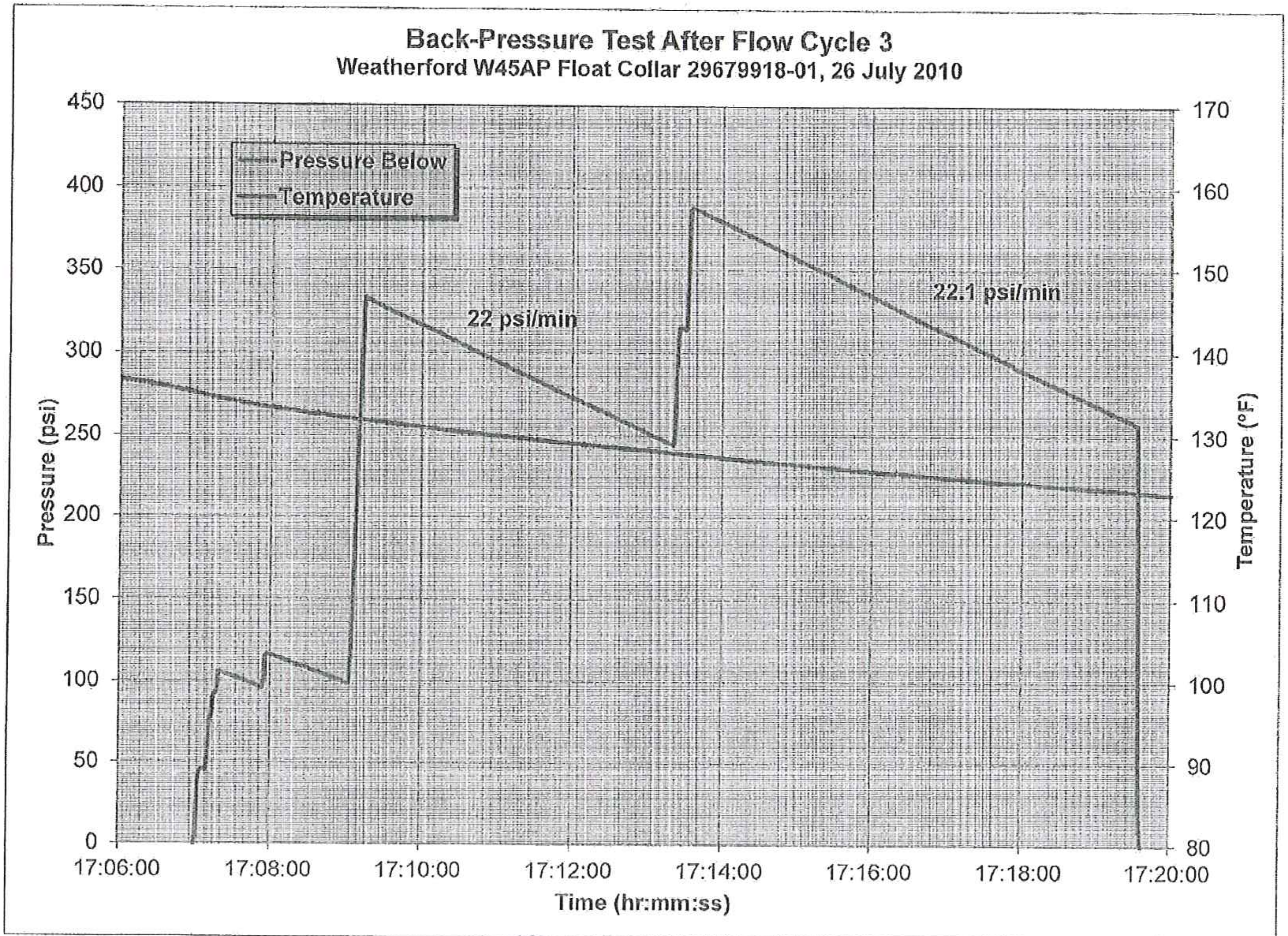


Figure A-10

1601072-01-4 Endurance.xlsx

11/18/2010

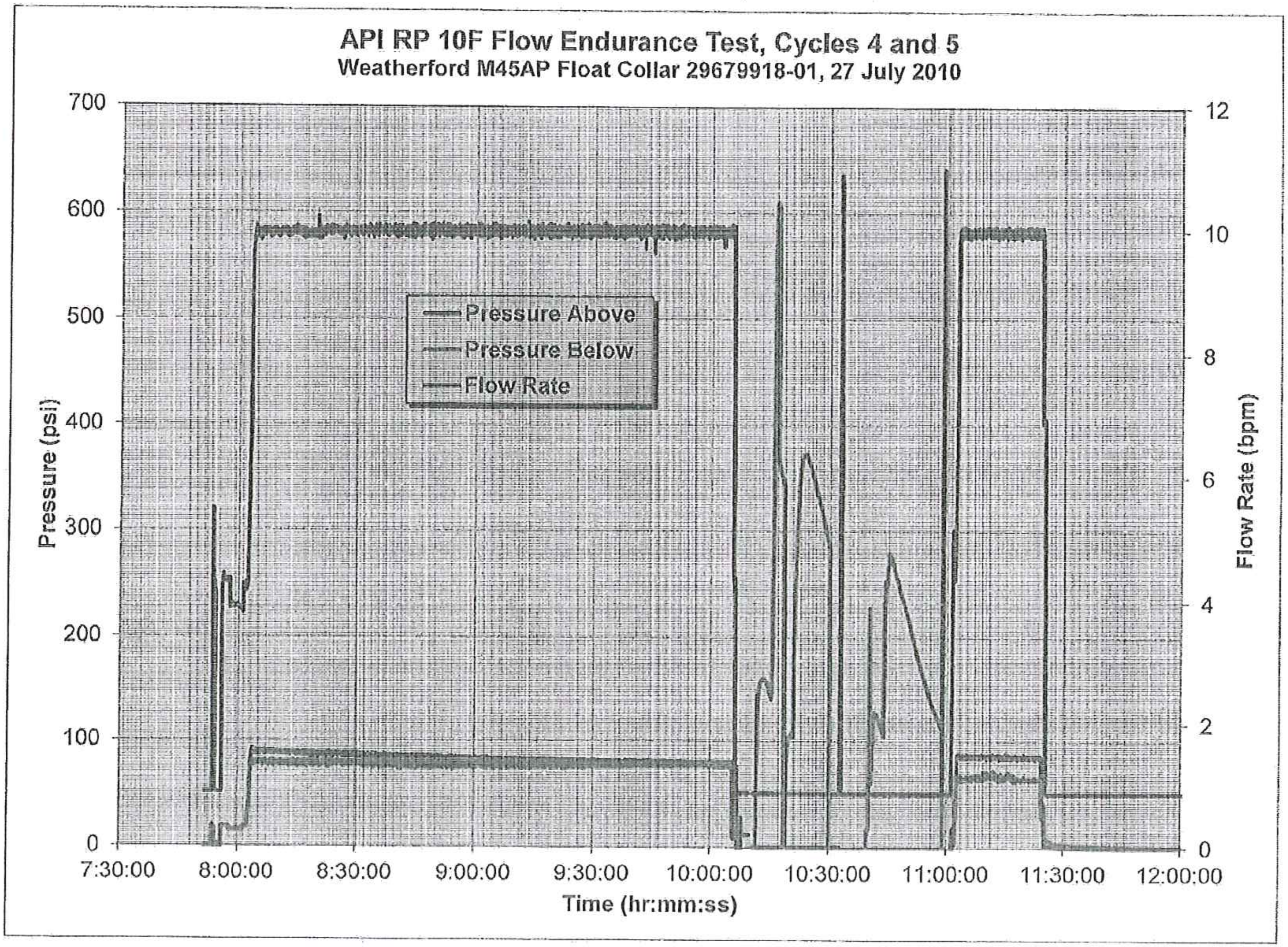


Figure A-11 1601072-01-5 Endurance.xlsx 11/18/2010

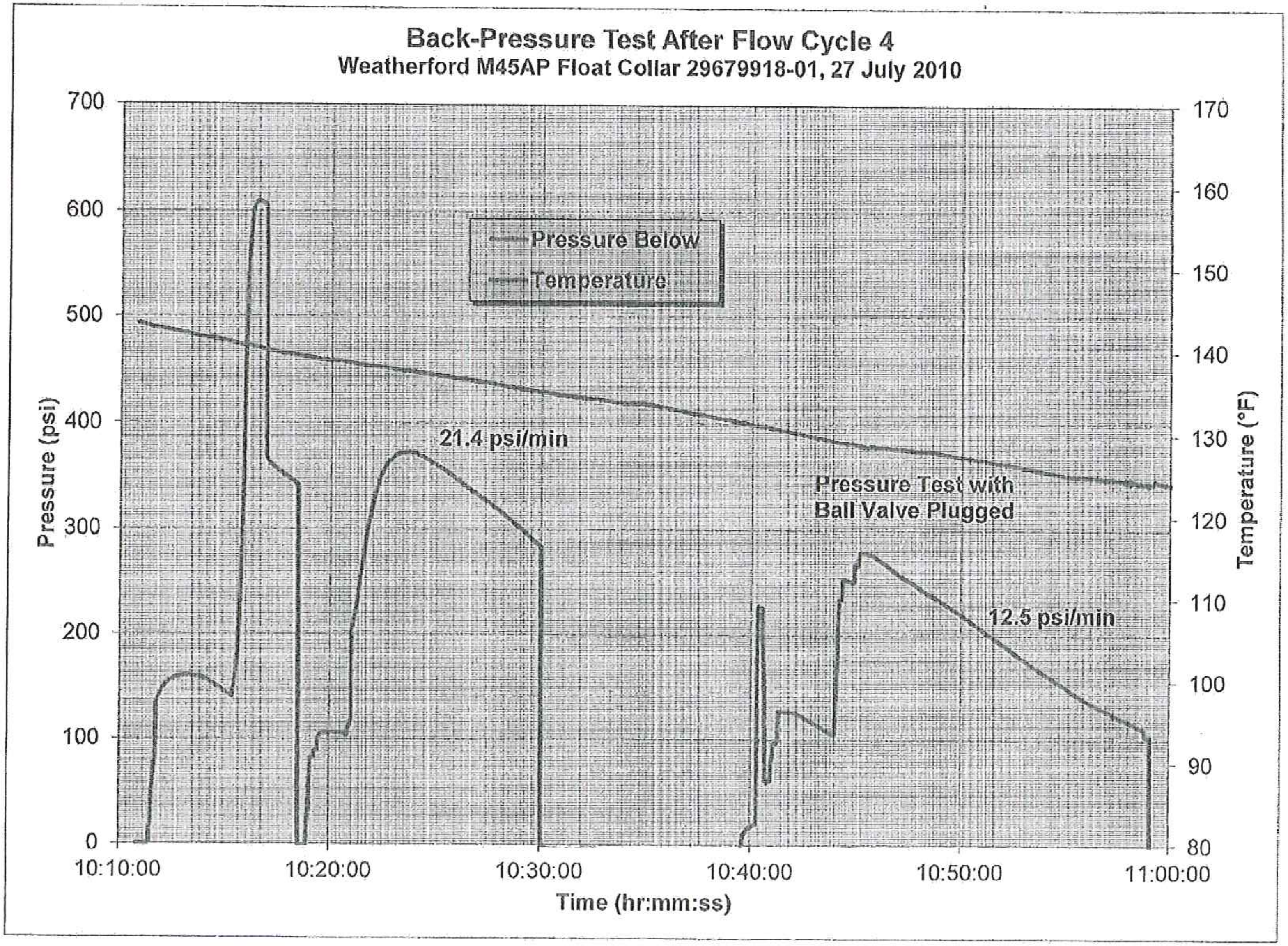

Back-Pressure Test After Flow Cycle 4
Weatherford M45AP Float Collar 29679918-01, 27 July 2010
Pressure Below
Temperature
21.4 psi/min
Pressure Test with
Ball Valve Plugged
12.5 psi/min
Pressure (psi)
Temperature (°F)
Time (hr:mm:ss)
0
100
200
300
400
500
600
700
80
90
100
110
120
130
140
150
160
170
10:10:00
10:20:00
10:30:00
10:40:00
10:50:00
11:00:00

Figure A-12

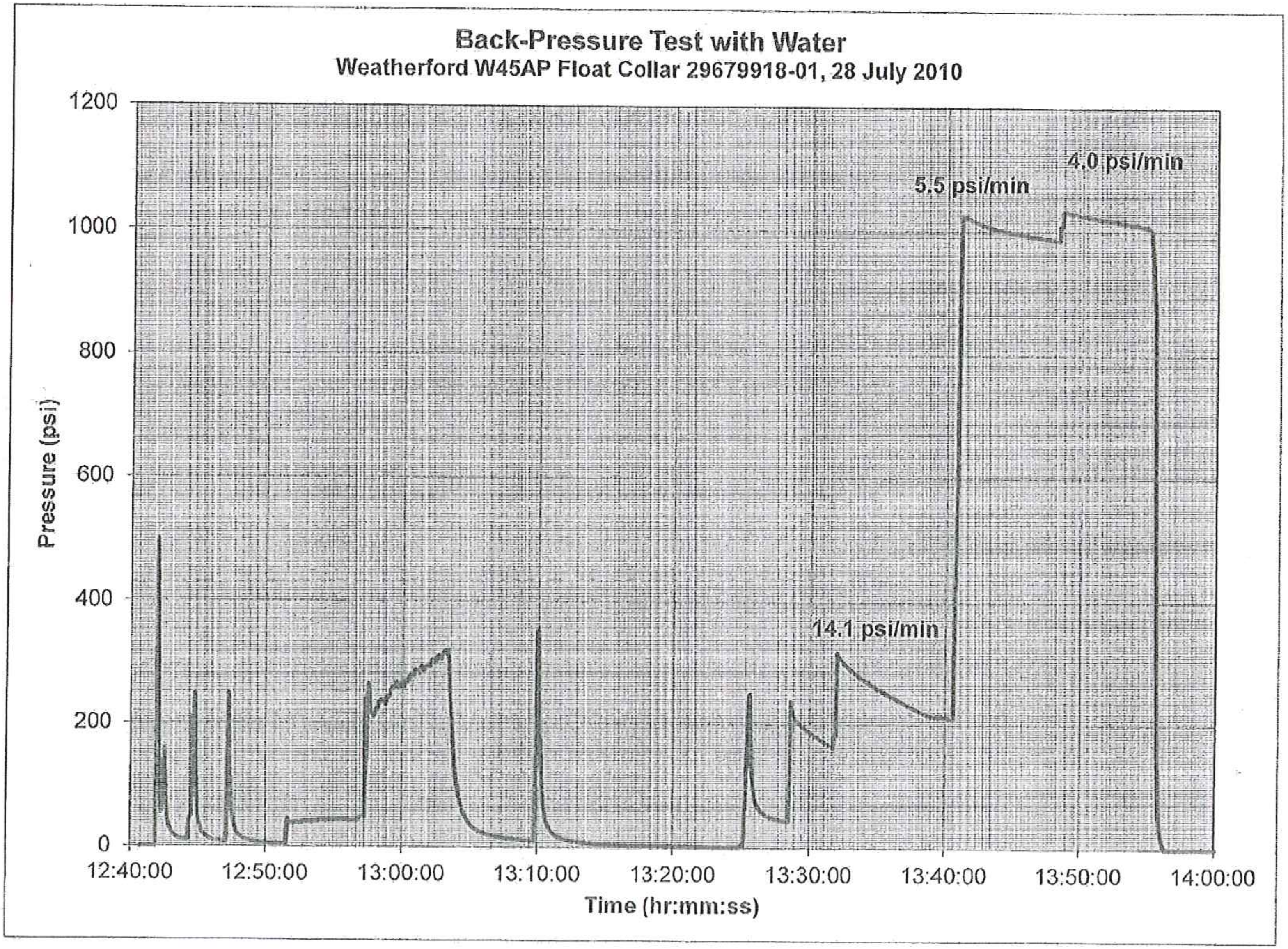


Figure A-13 1601072 7-28-10.xlsx 11/18/2010

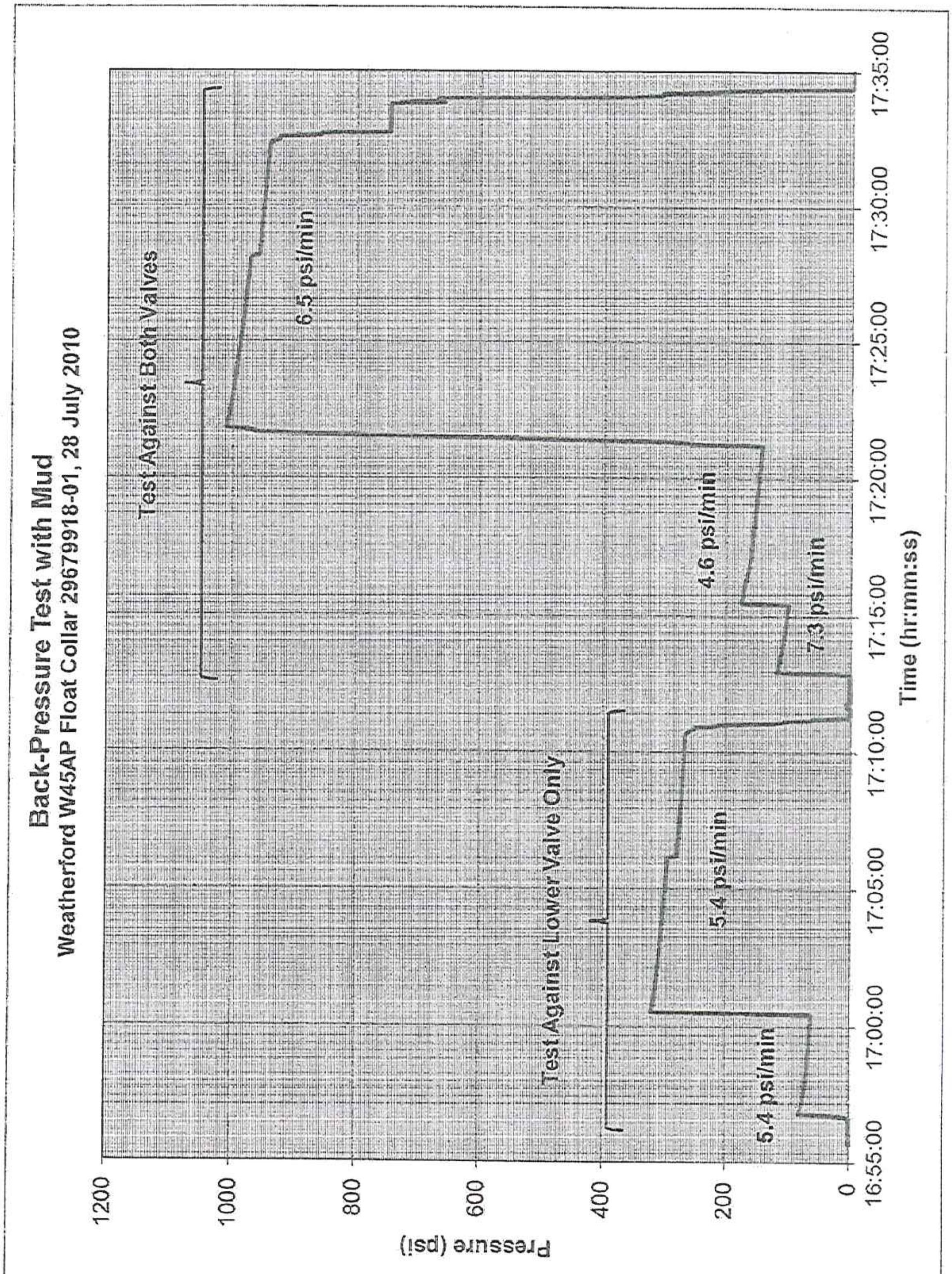
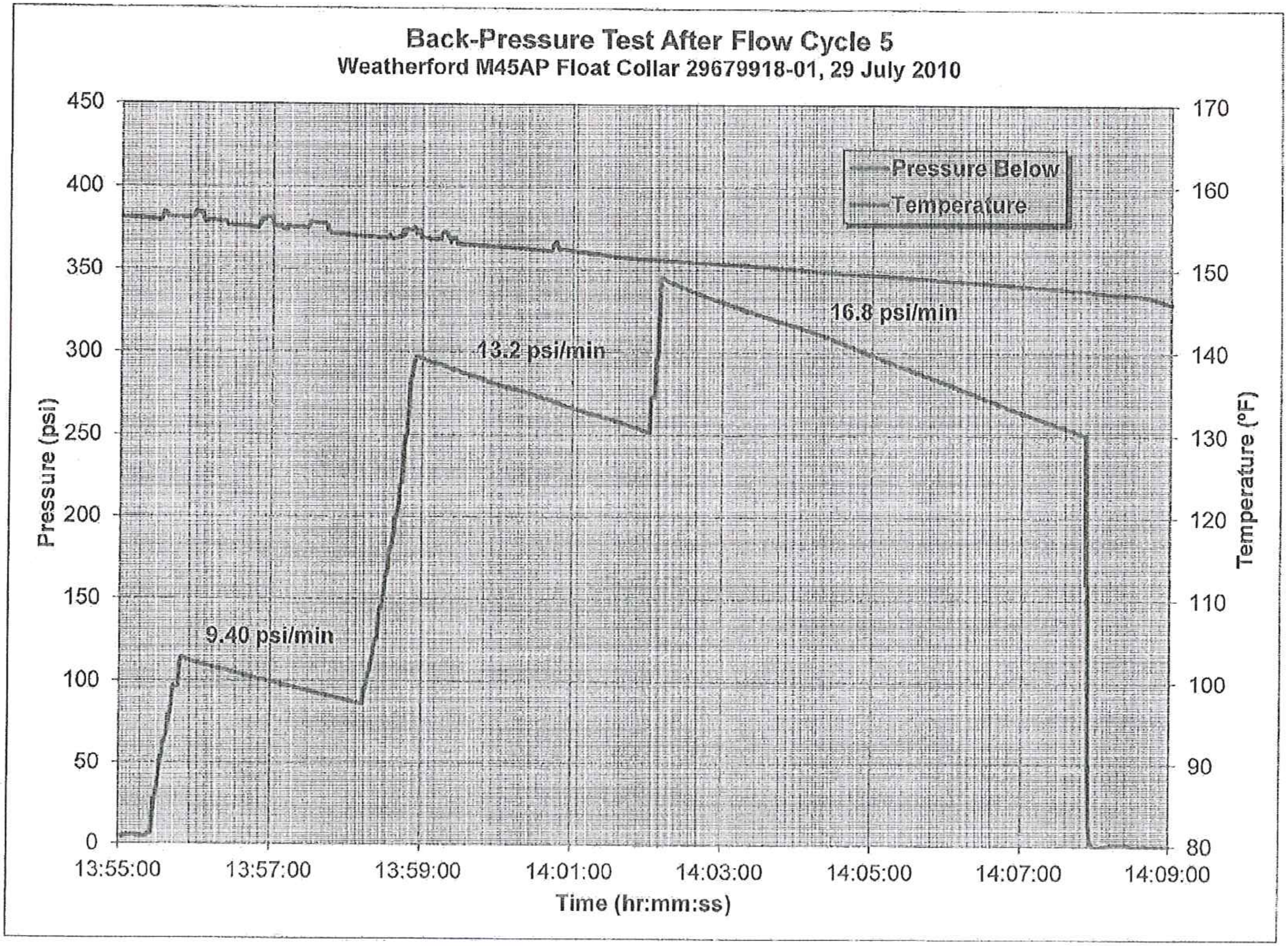


Figure A-14

1601072 7-28-10.xlsx

11/18/2010


Back-Pressure Test After Flow Cycle 5
Weatherford M45AP Float Collar 29679918-01, 29 July 2010
Pressure Below
Temperature
9.40 psi/min
13.2 psi/min
16.8 psi/min
Pressure (psi)
0
50
100
150
200
250
300
350
400
450
Temperature (°F)
80
90
100
110
120
130
140
150
160
170
13:55:00
13:57:00
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14:01:00
14:03:00
14:05:00
14:07:00
14:09:00
Time (hr:mm:ss)

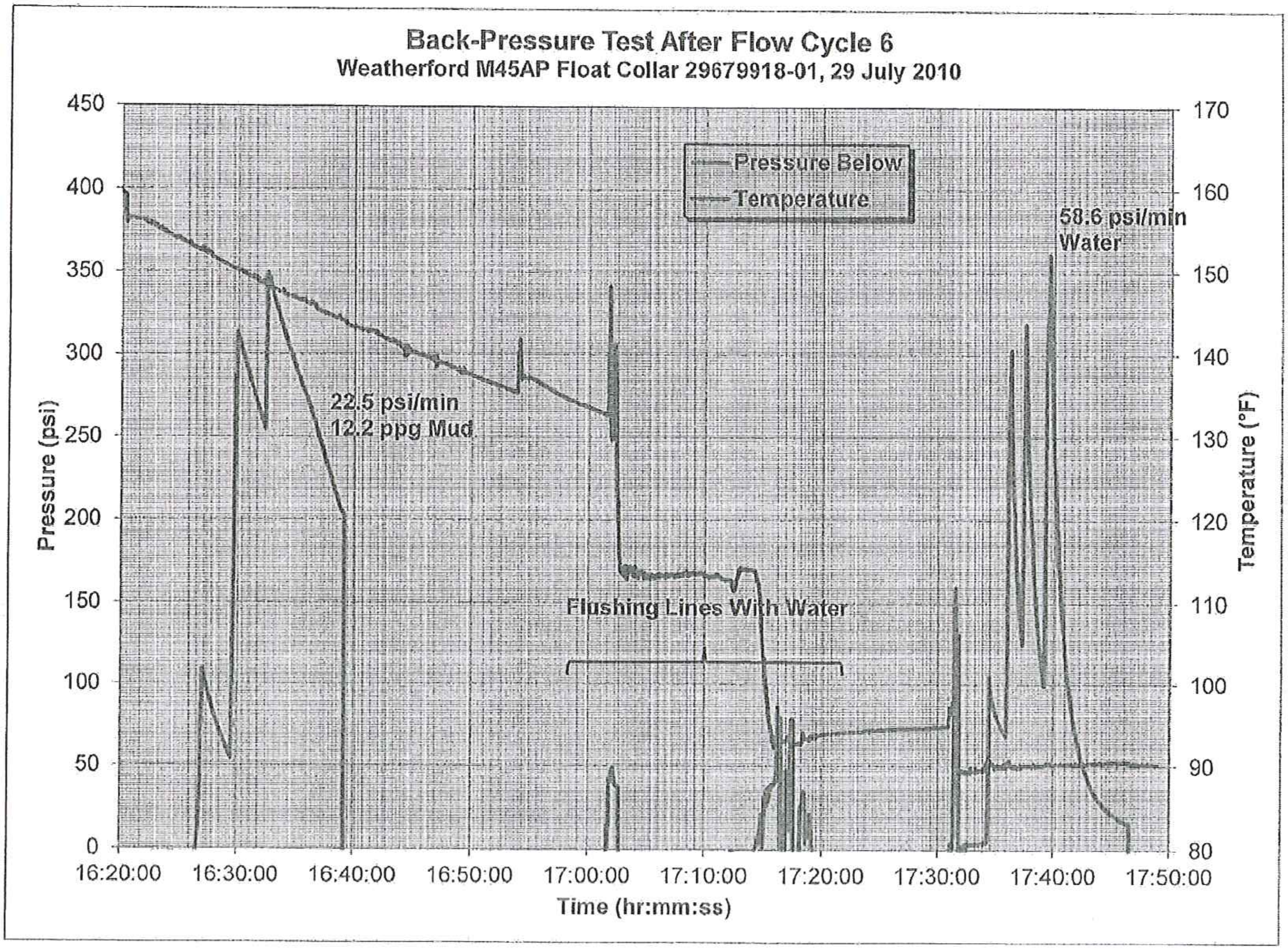


Figure A-17

1601072-01-6 Endurance.xlsx

11/18/2010

API RP 10F Flow Endurance Test, Cycle 7
Weatherford M45AP Float Collar 29679918-01, 30 July 2010

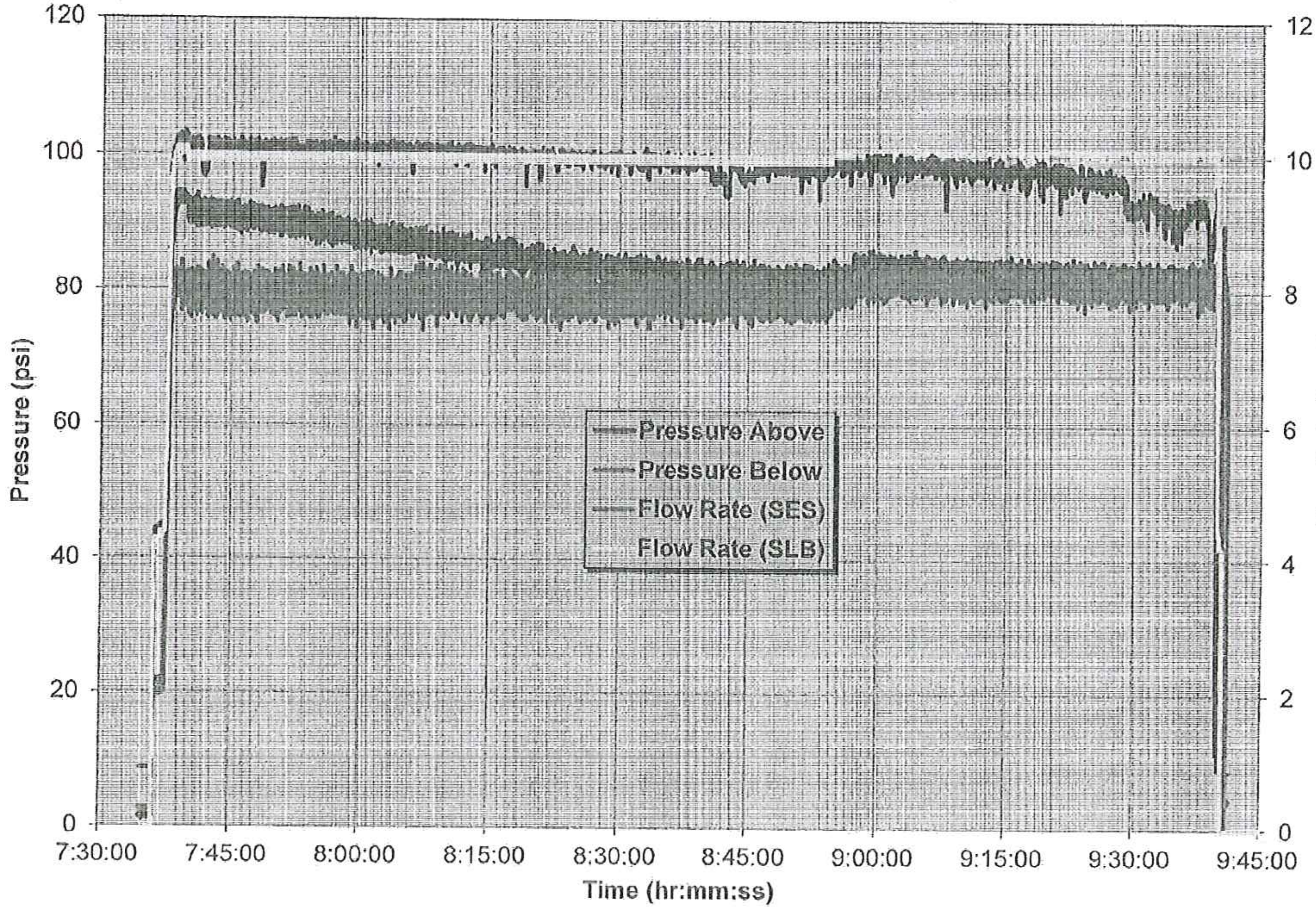


Figure A-18

1601072-01-7 Endurance.xlsx

11/18/2010

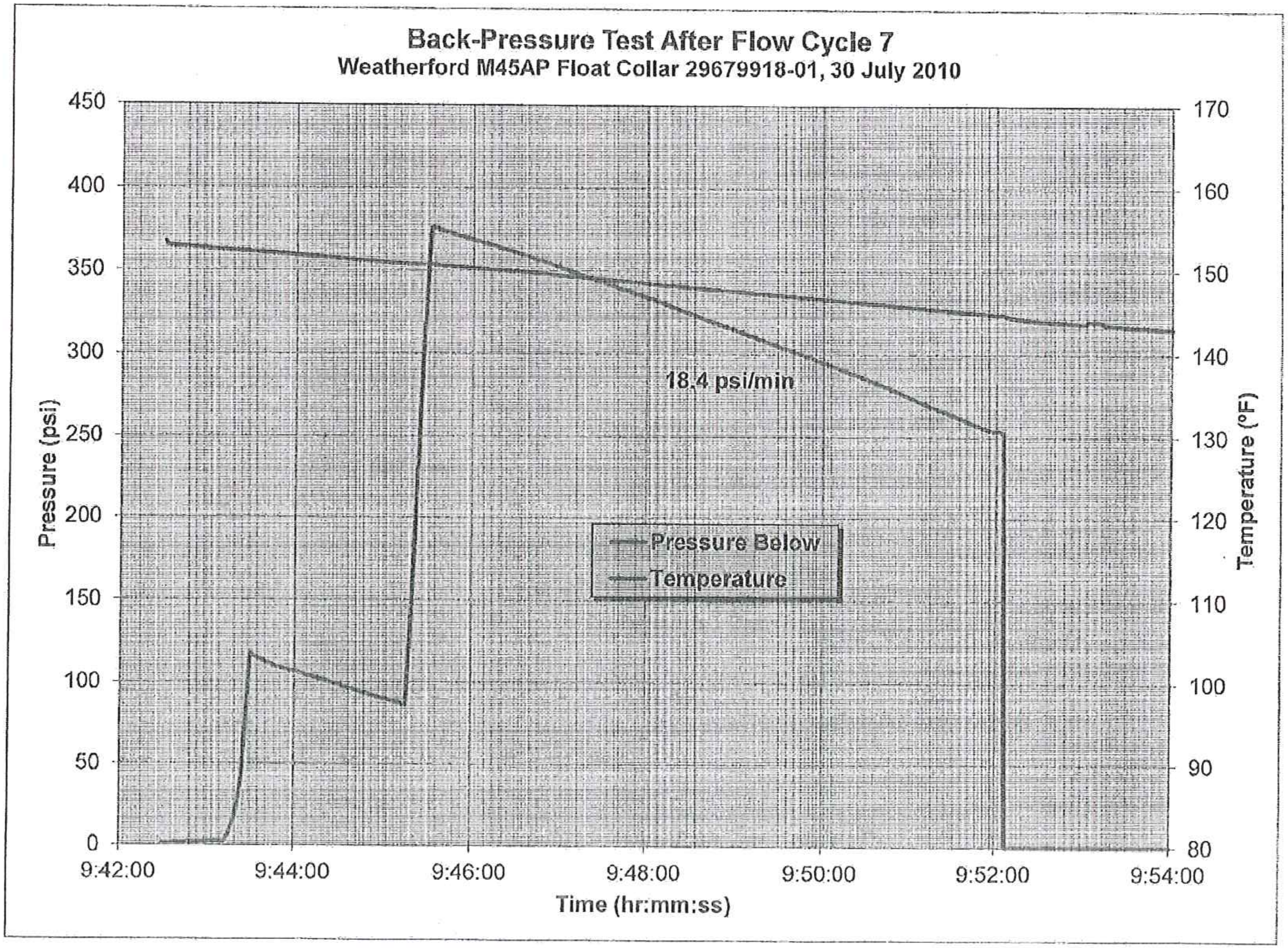


Figure A-19

1601072-01-7 Endurance.xlsx

11/10/2010

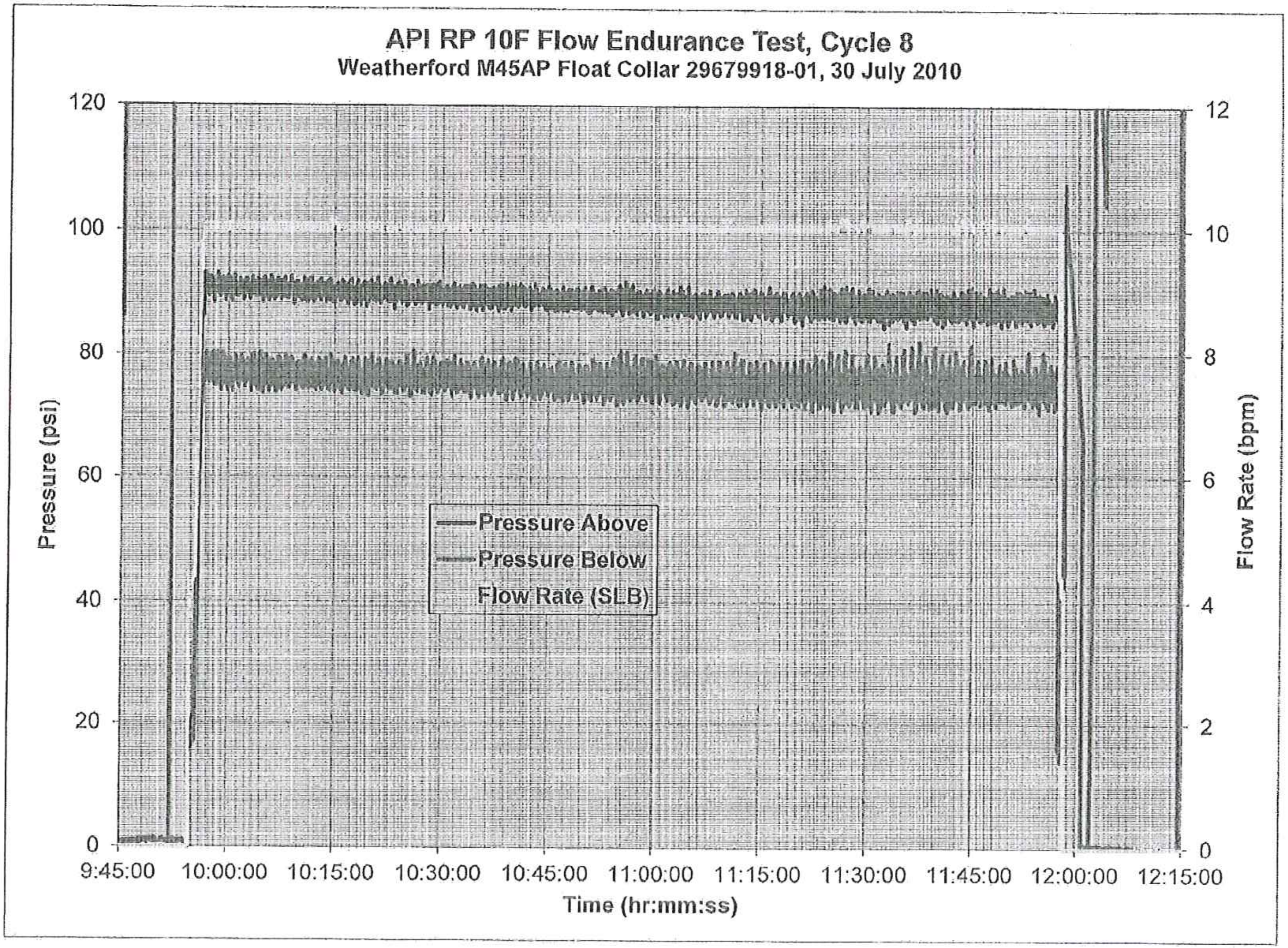


Figure A-20

1601072-01-7 Endurance.xlsx

11/18/2010

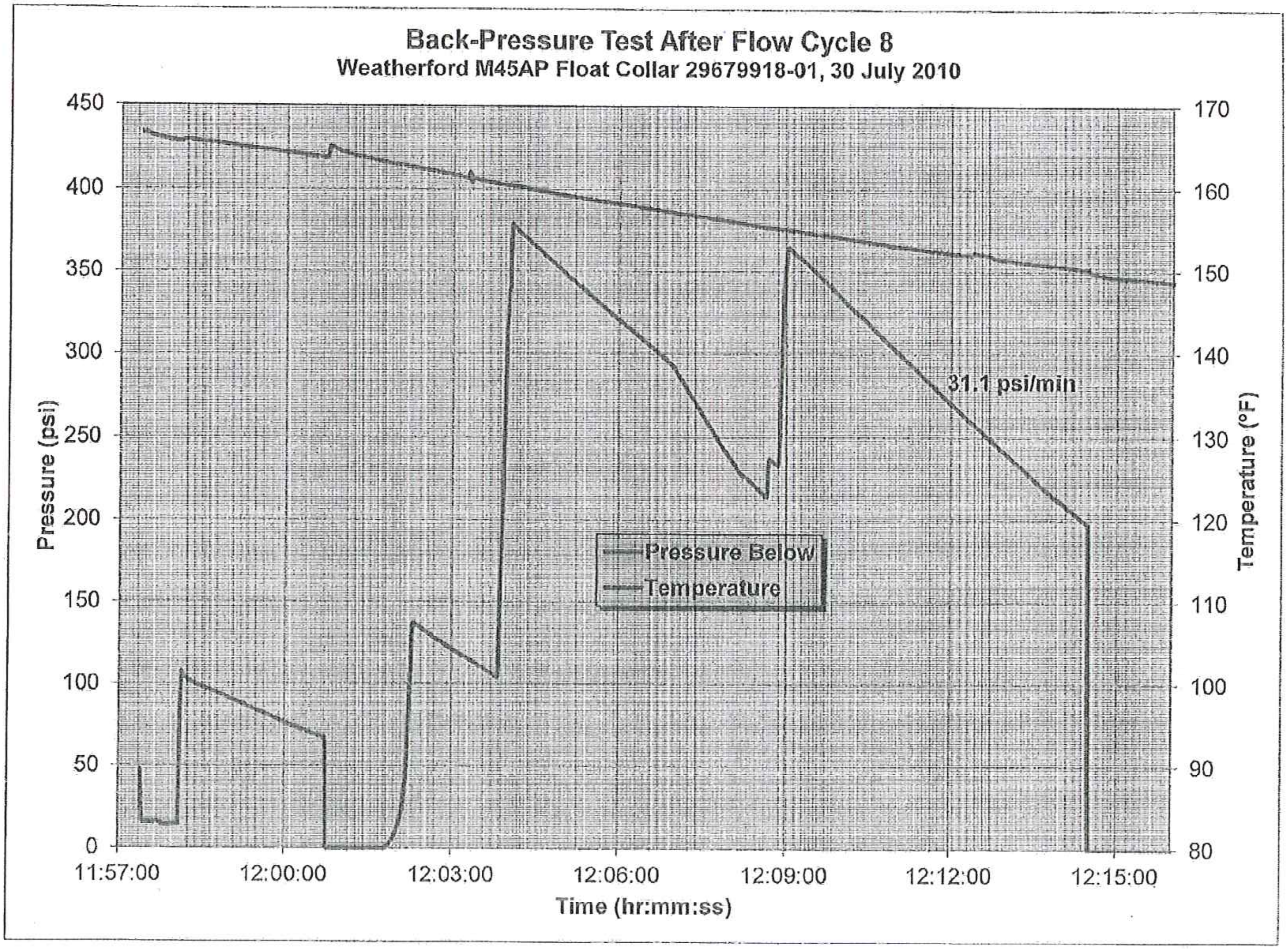


Figure A-21

1601072-01-7 Endurance.xlsx

11/18/2010

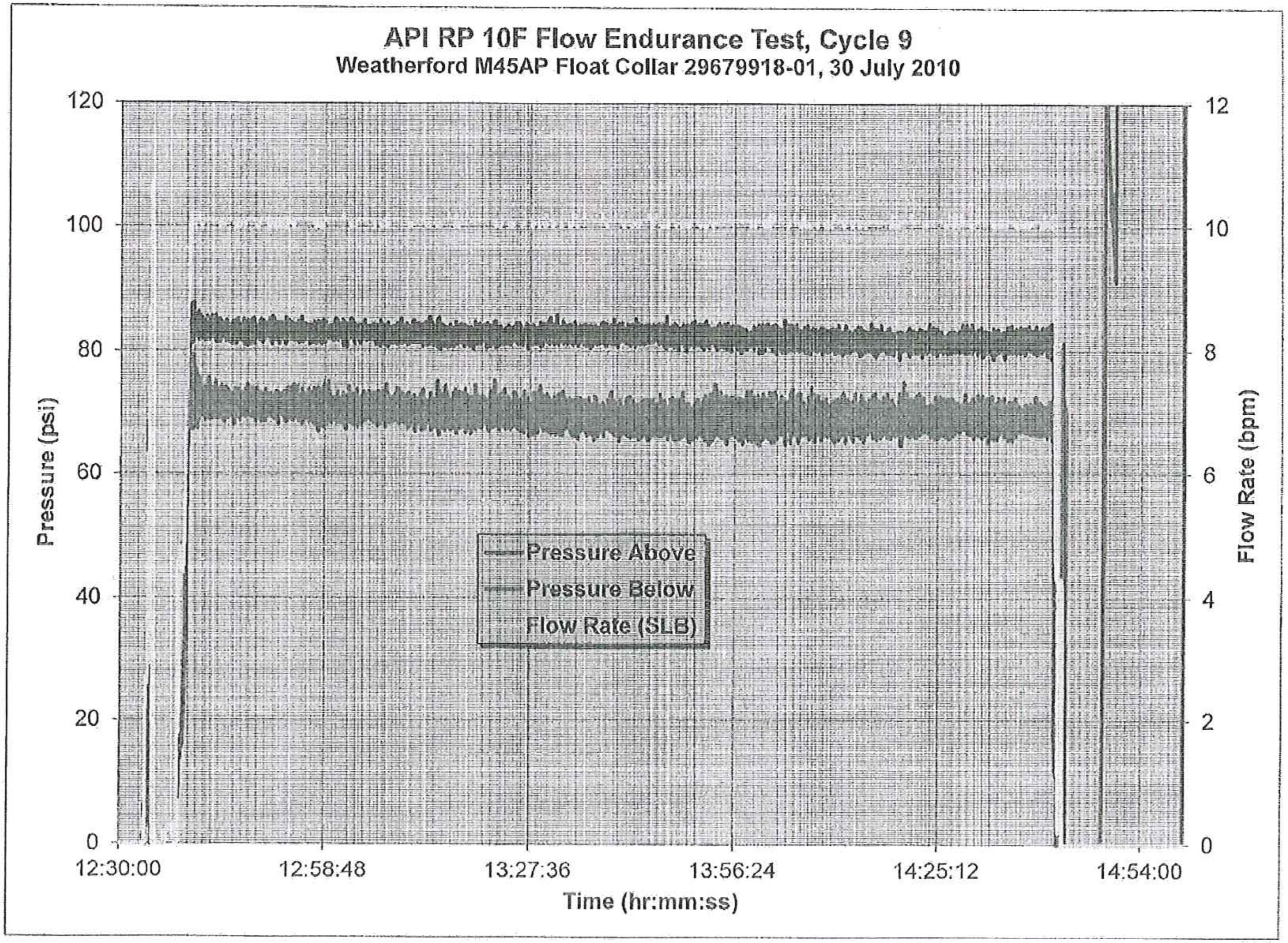


Figure A-22

1601072-01-7 Endurance.xlsx

11/18/2010

Back-Pressure After Flow Cycle 9

Weatherford M45AP Float Collar 29679918-01, 30 July 2010

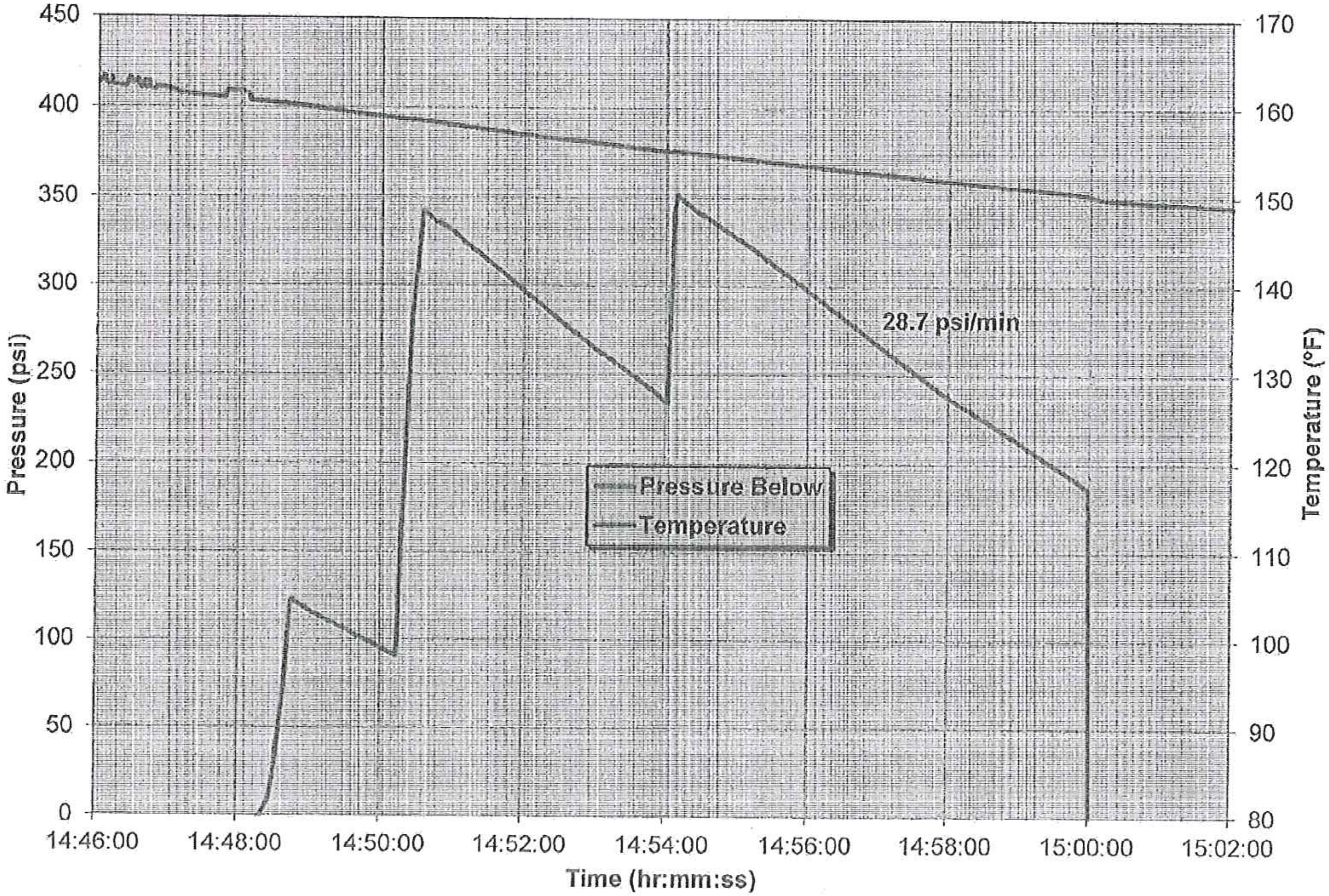


Figure A-23

1601072-01-7 Endurance.xlsx

11/18/2010

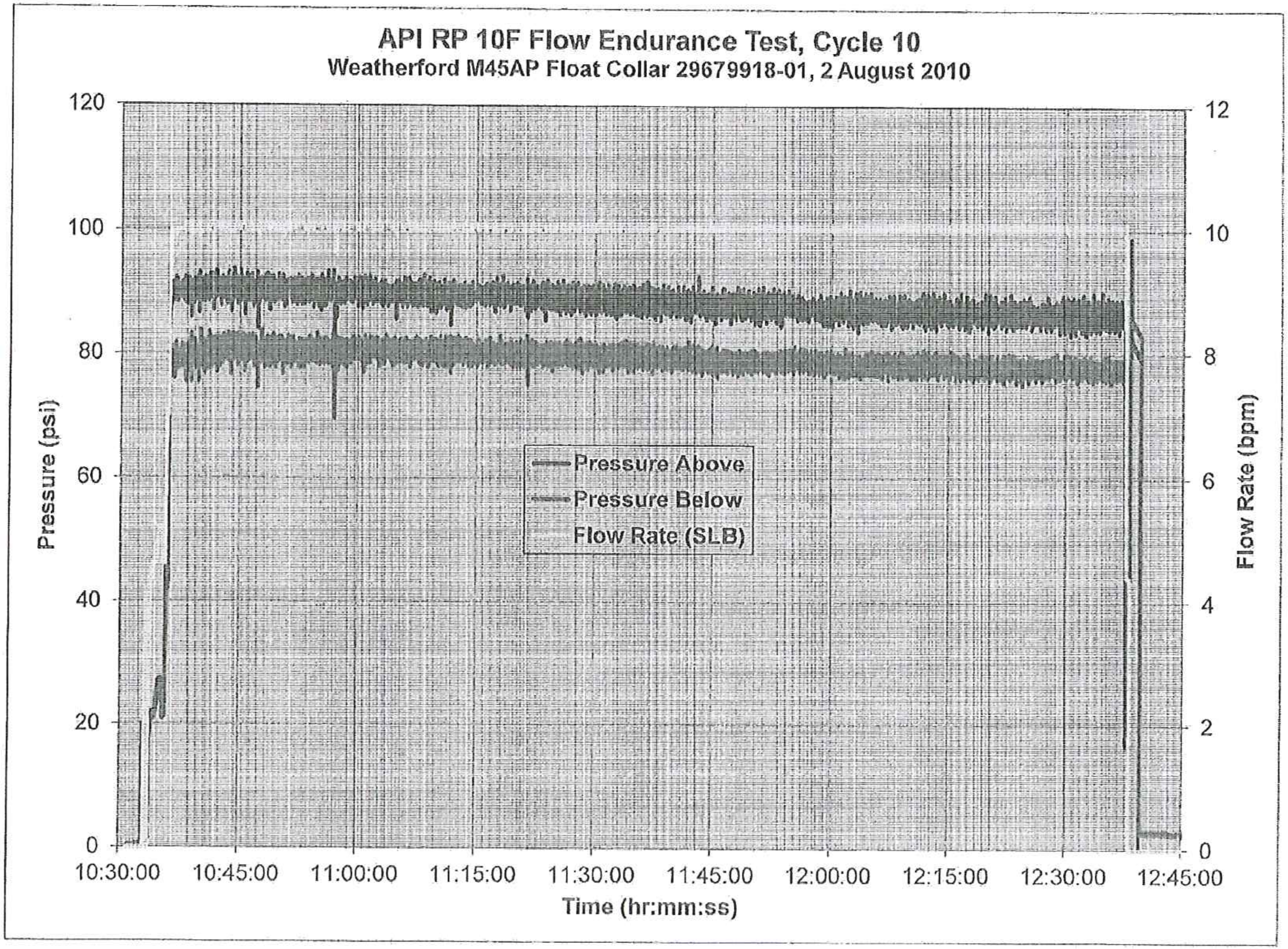


Figure A-24

1601072-01-8 Endurance.xlsx

11/18/2010

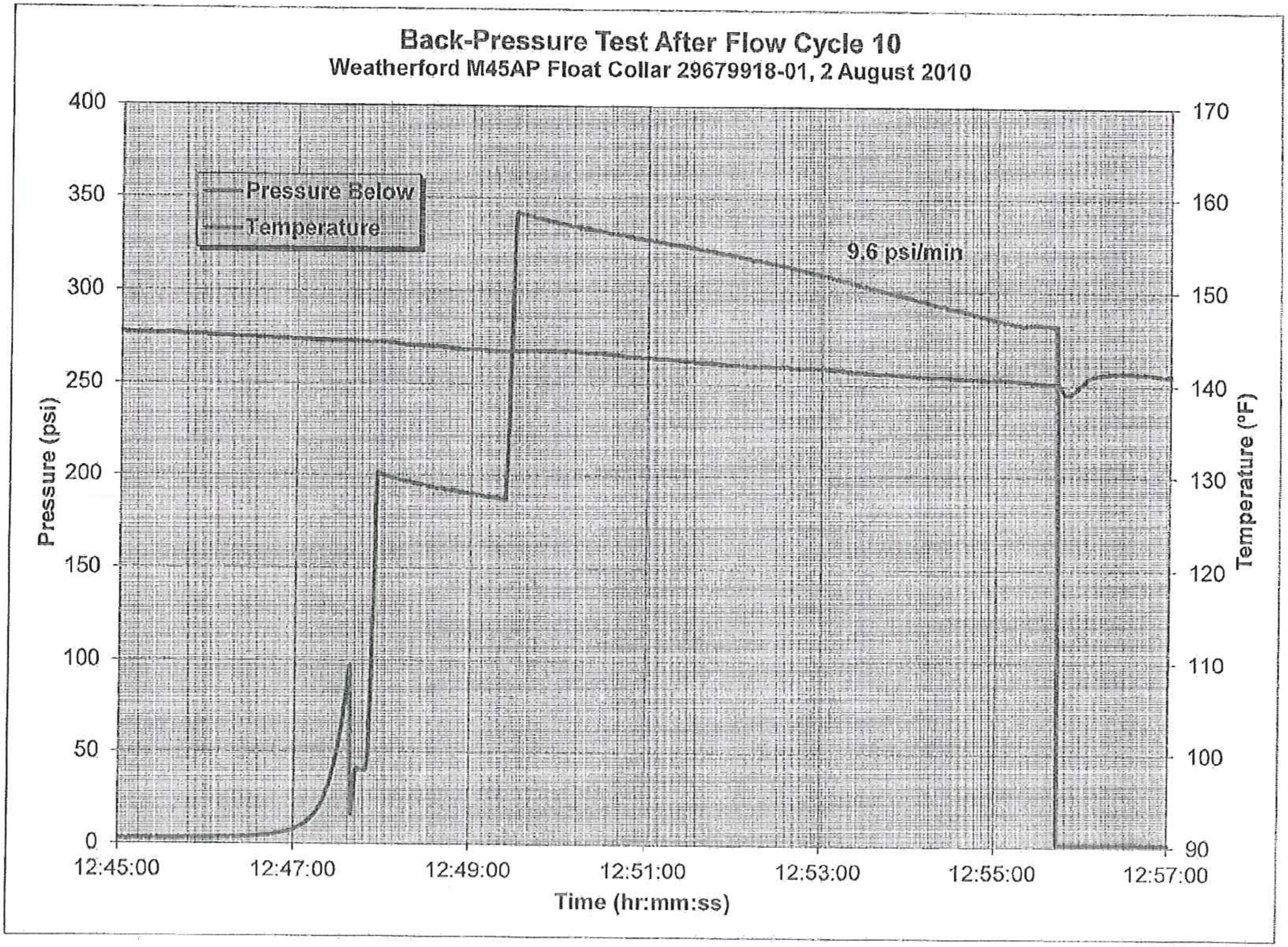


Figure A-25

1601072-01-8 Endurance.xlsx

11/18/2010

API RP 10F Flow Endurance Test, Cycle 11
Weatherford M45AP Float Collar 29679918-01, 2 August 2010

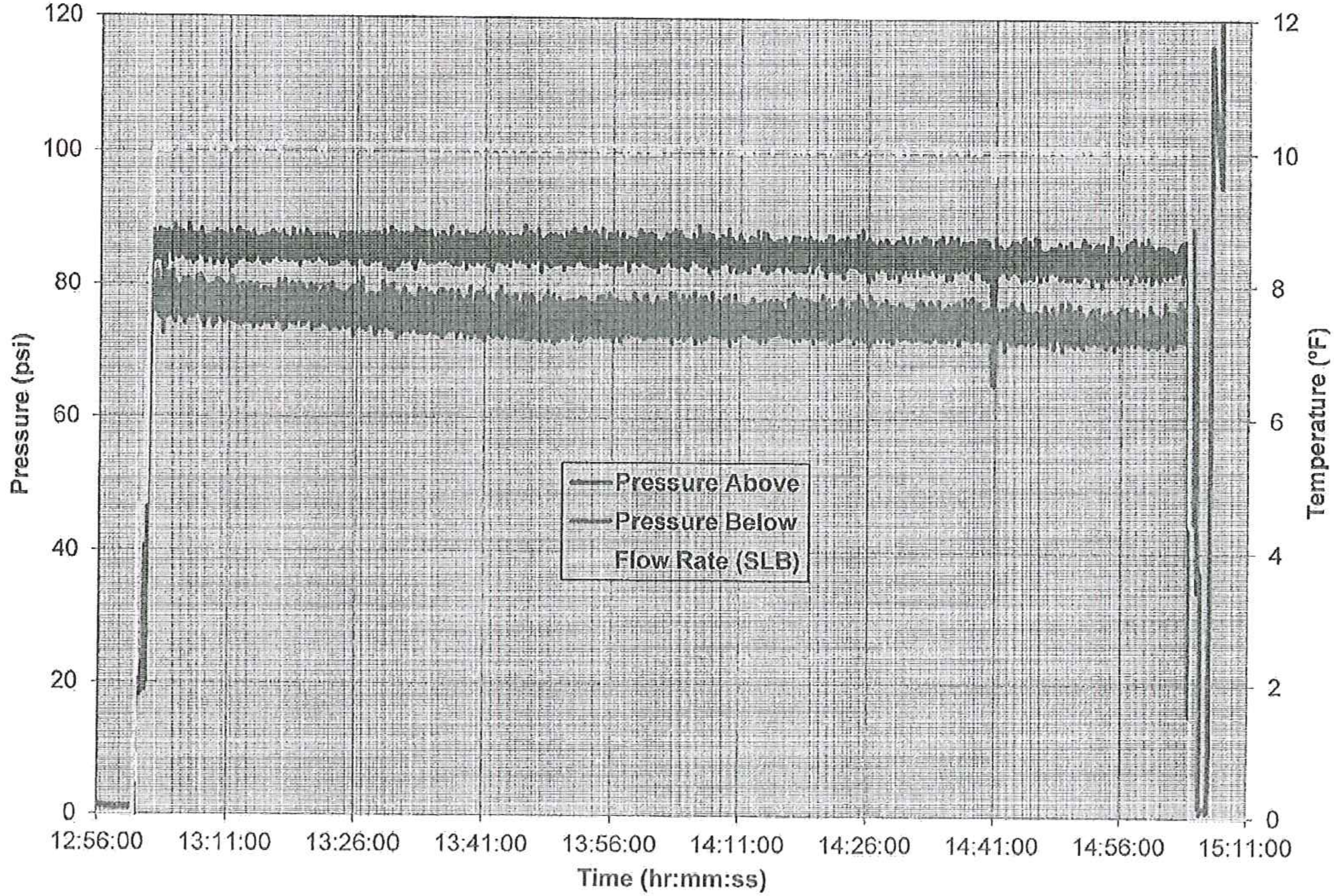


Figure A-28 1601072-01-8 Endurance.xlsx 11/18/2010

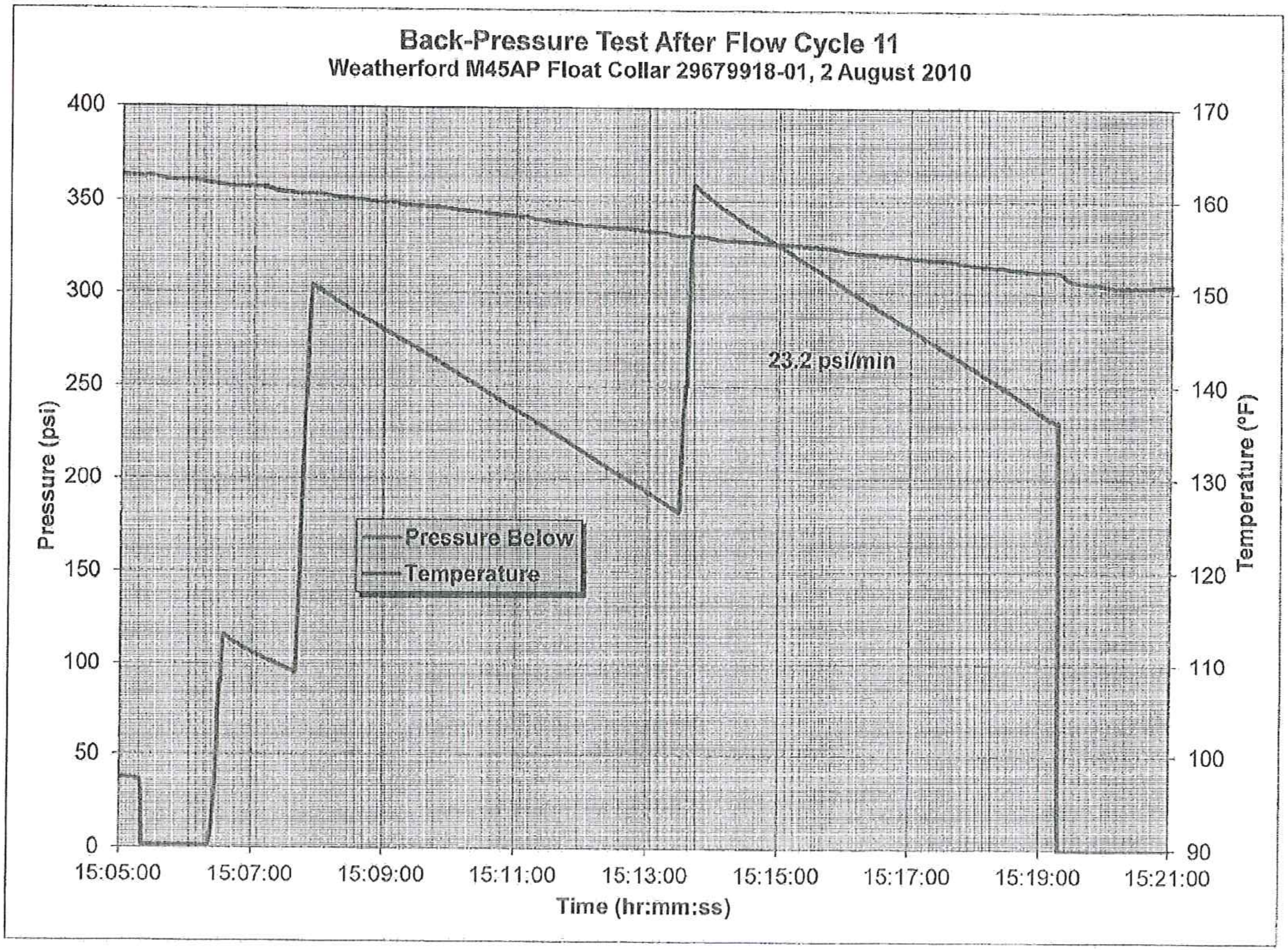


Figure A-27

1601072-01-8 Endurance.xlsx

11/18/2010

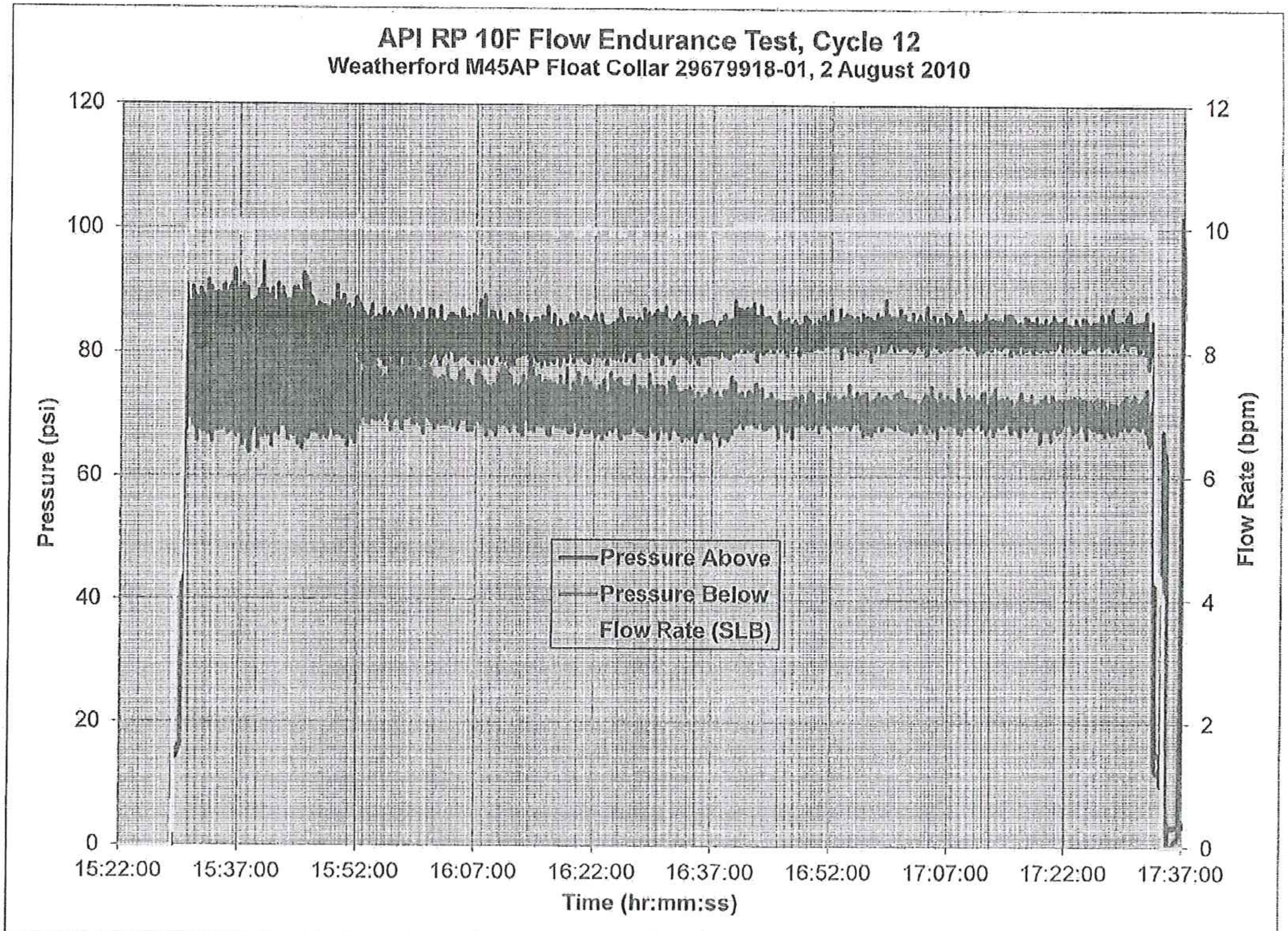

API RP 10F Flow Endurance Test, Cycle 12
Weatherford M45AP Float Collar 29679918-01, 2 August 2010
Pressure (psi)
120
100
80
60
40
20
0
Flow Rate (bpm)
12
10
8
6
4
2
0
15:22:00
15:37:00
15:52:00
16:07:00
16:22:00
16:37:00
16:52:00
17:07:00
17:22:00
17:37:00
Time (hr:mm:ss)
Pressure Above
Pressure Below
Flow Rate (SLB)

Figure A-28

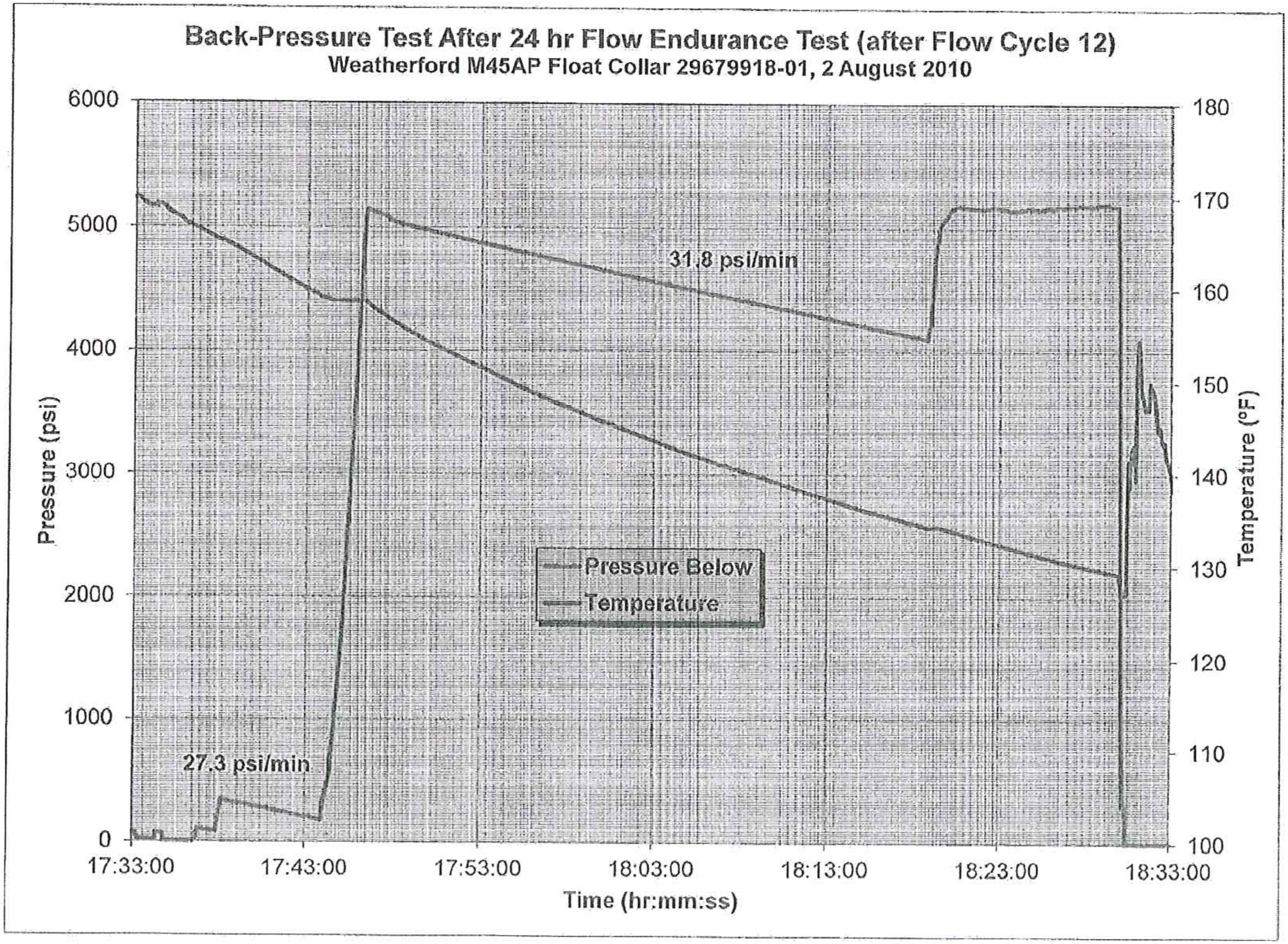


Figure A-29

1601072-01-8 Endurance.xlsx

11/19/2010

B

Annex B Mechanical Failure Tests

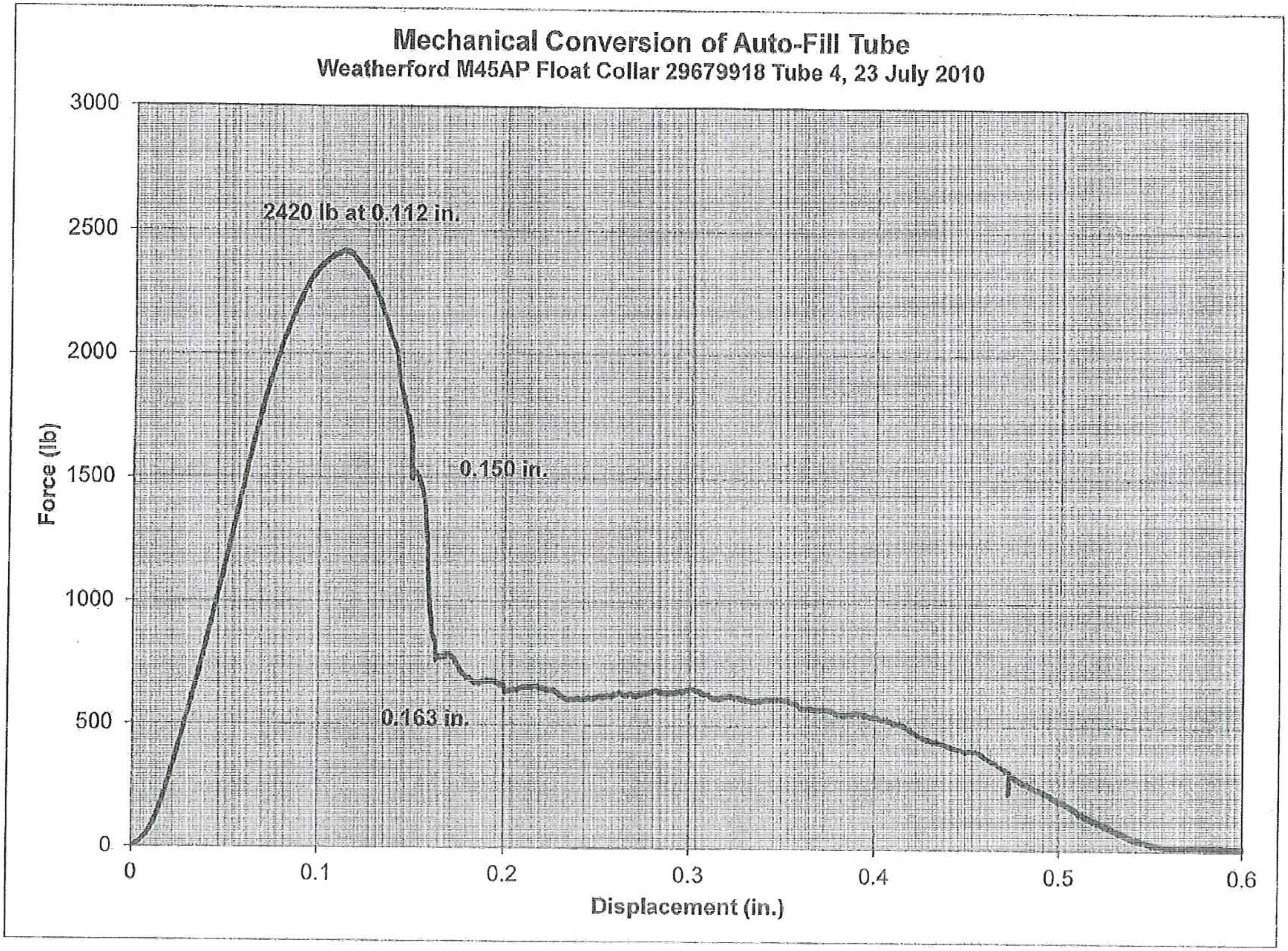


Figure B-1

1601072_tube4_toppinshear.xlsx

11/18/2010

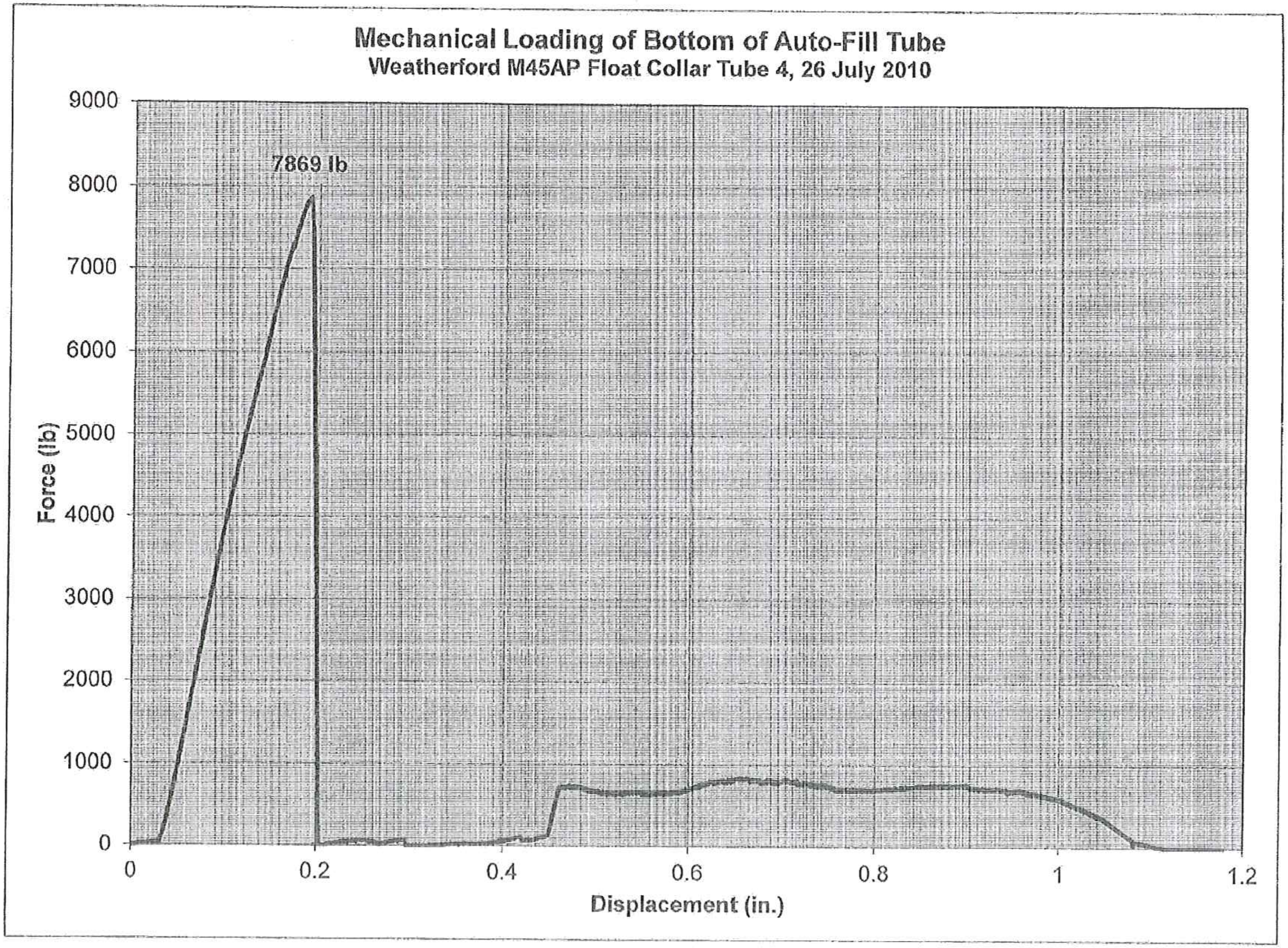


Figure B-2

1601072_tube4_bottmshear.xlsx

11/19/2010

C

Annex C Flow Endurance Test (SN-02)

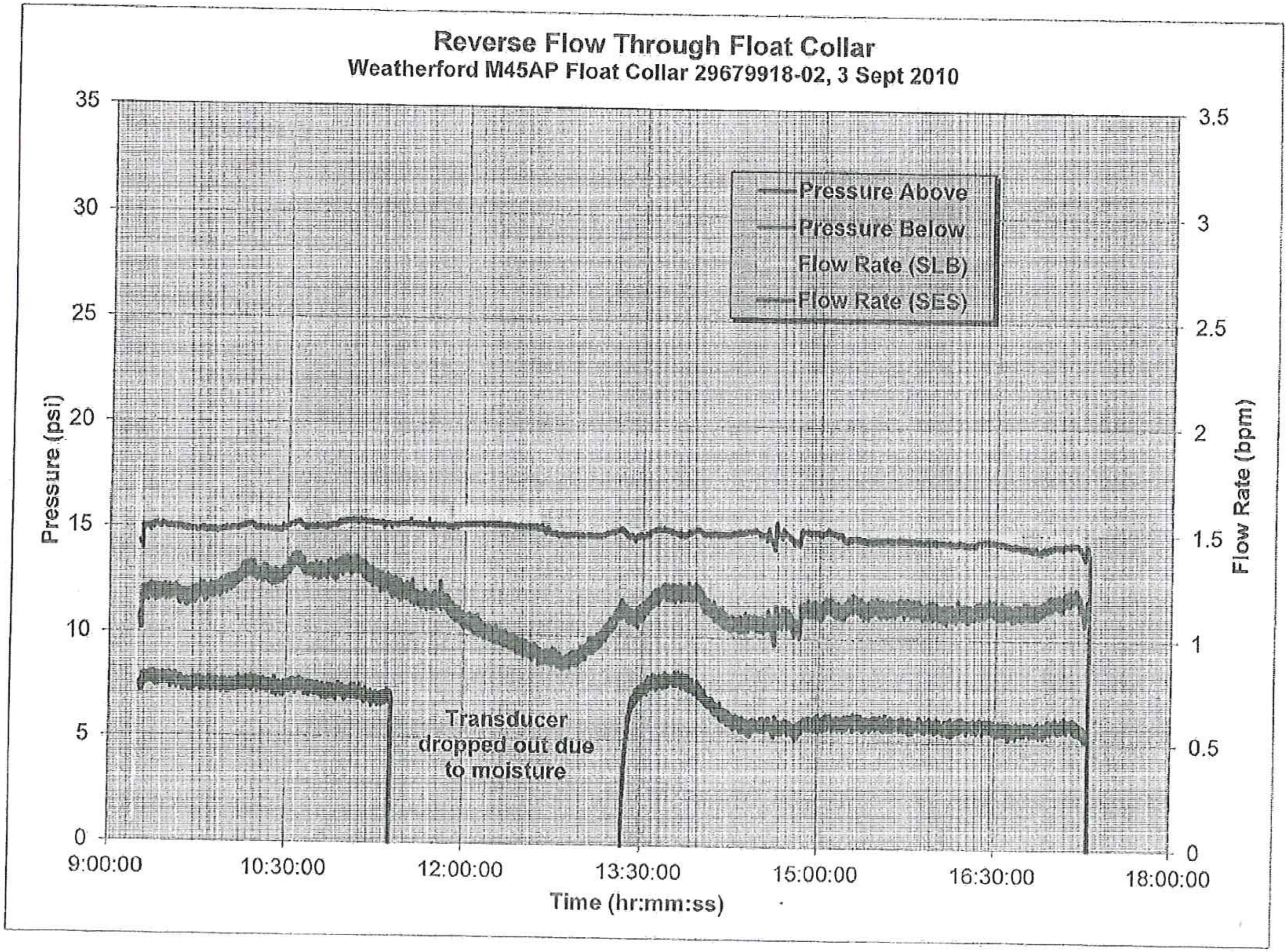
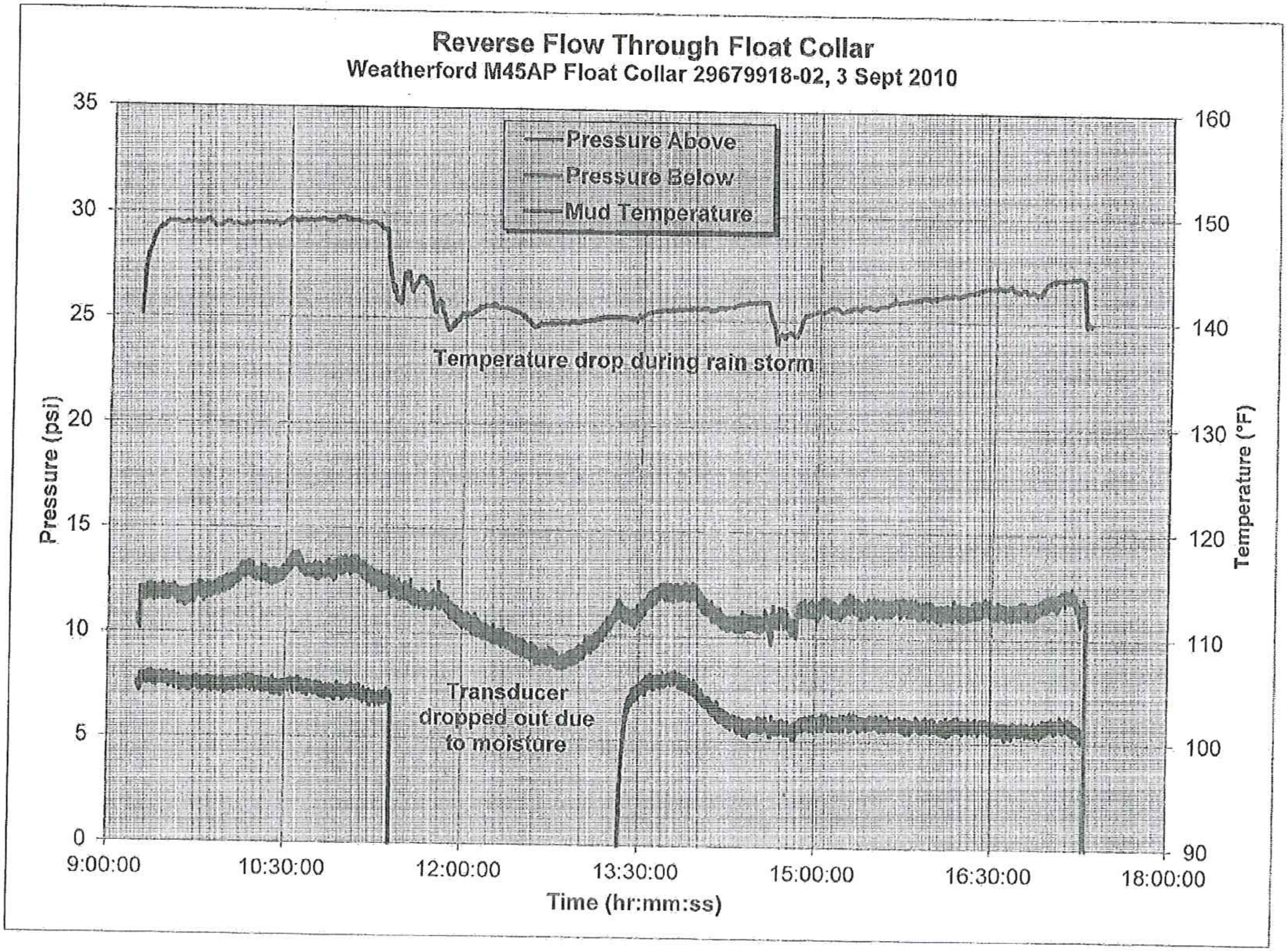


Figure C-1

1601072-02-Reverse Flow.xlsx

10/11/2010



Reverse Flow Through Float Collar
Weatherford M45AP Float Collar 29679918-02, 3 Sept 2010
Pressure Above
Pressure Below
Mud Temperature
Temperature drop during rain storm
Transducer dropped out due to moisture
Pressure (psi)
Temperature (°F)
Time (hr:mm:ss)
0
5
10
15
20
25
30
35
90
100
110
120
130
140
150
160
9:00:00
10:30:00
12:00:00
13:30:00
15:00:00
16:30:00
18:00:00

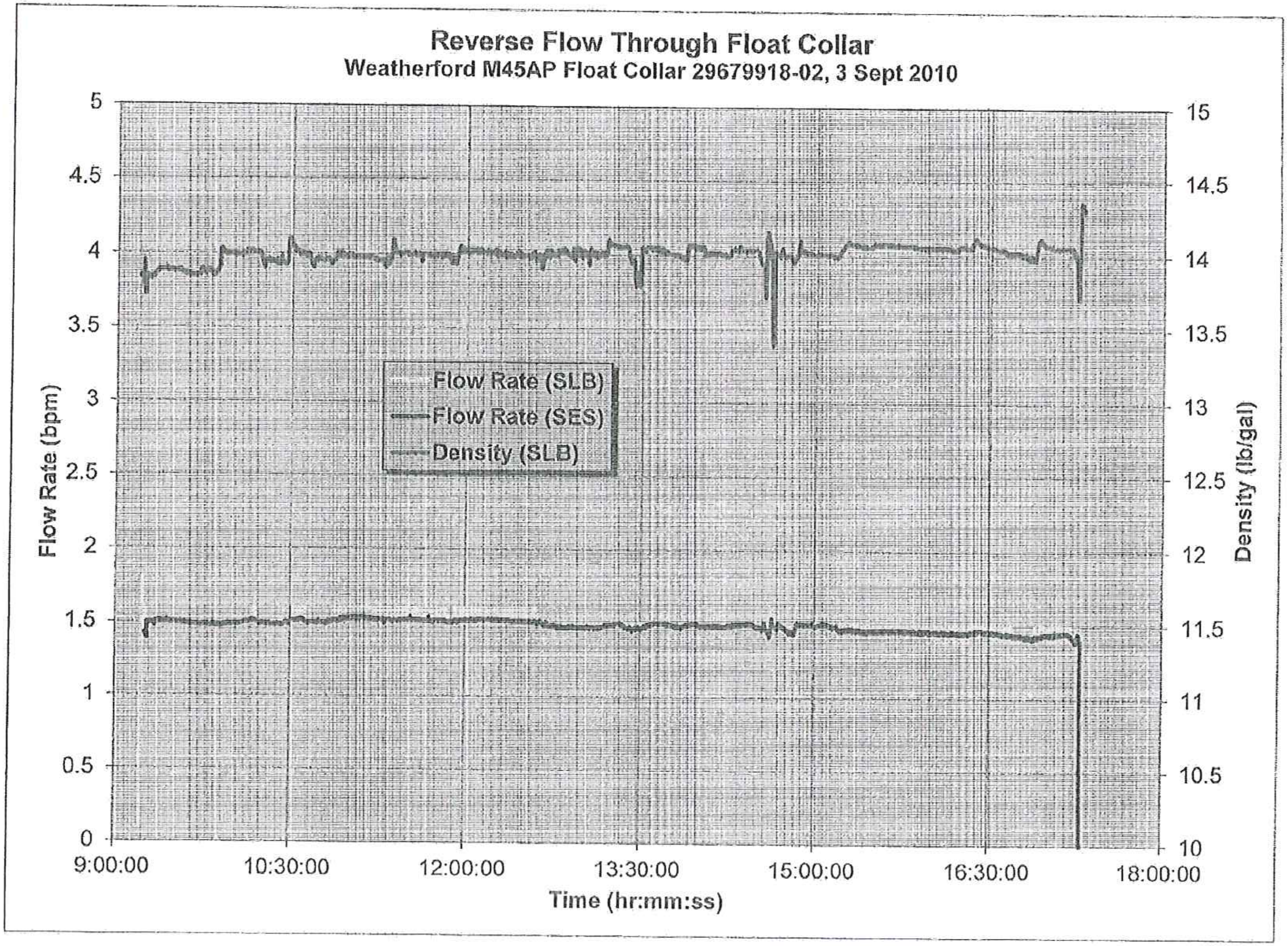


Figure C-3

1601072-02-Reverse Flow.xlsx

10/11/2010

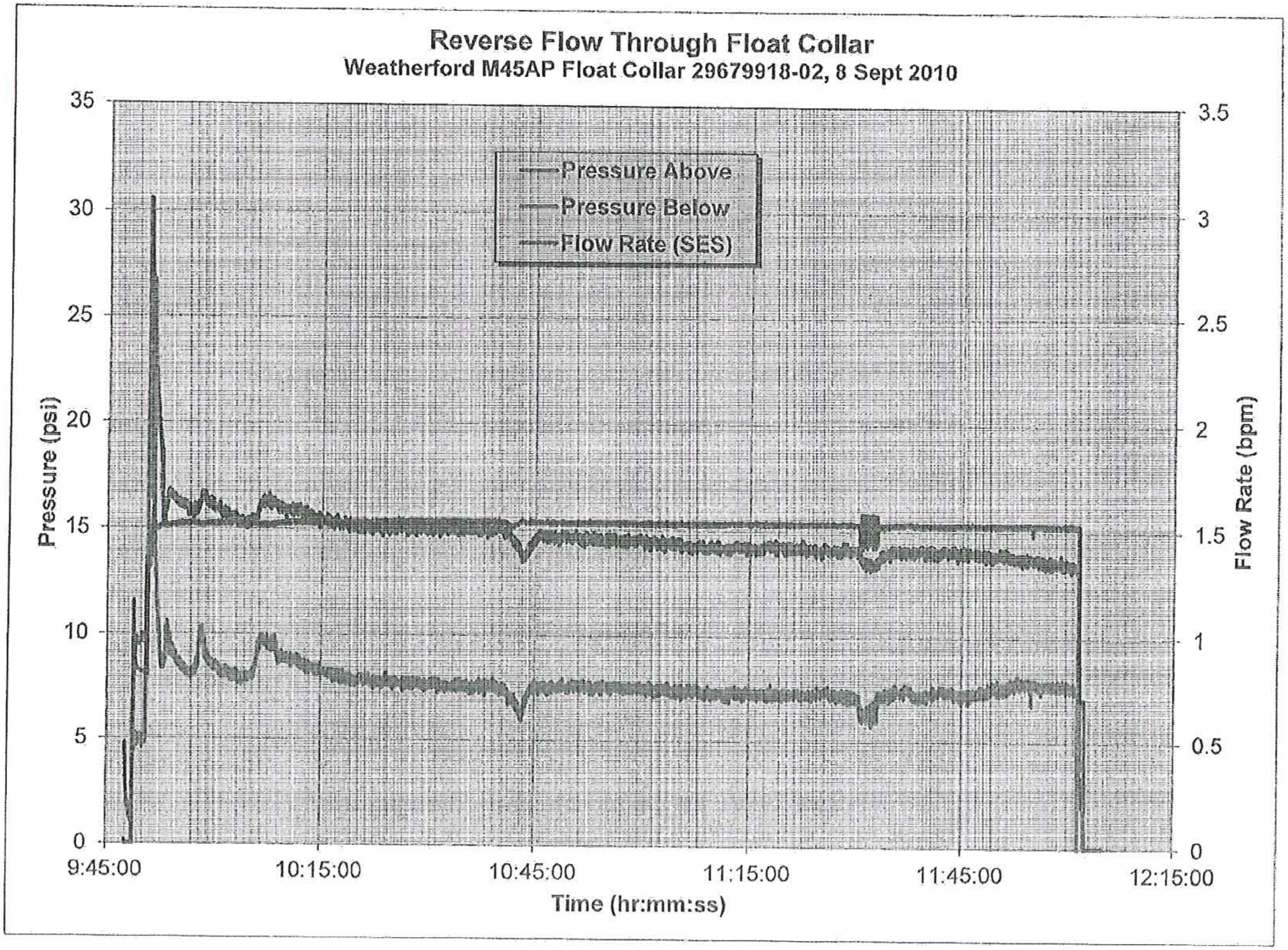


Figure C-4

1601072-02-Reverse Flow.xlsx

10/11/2010

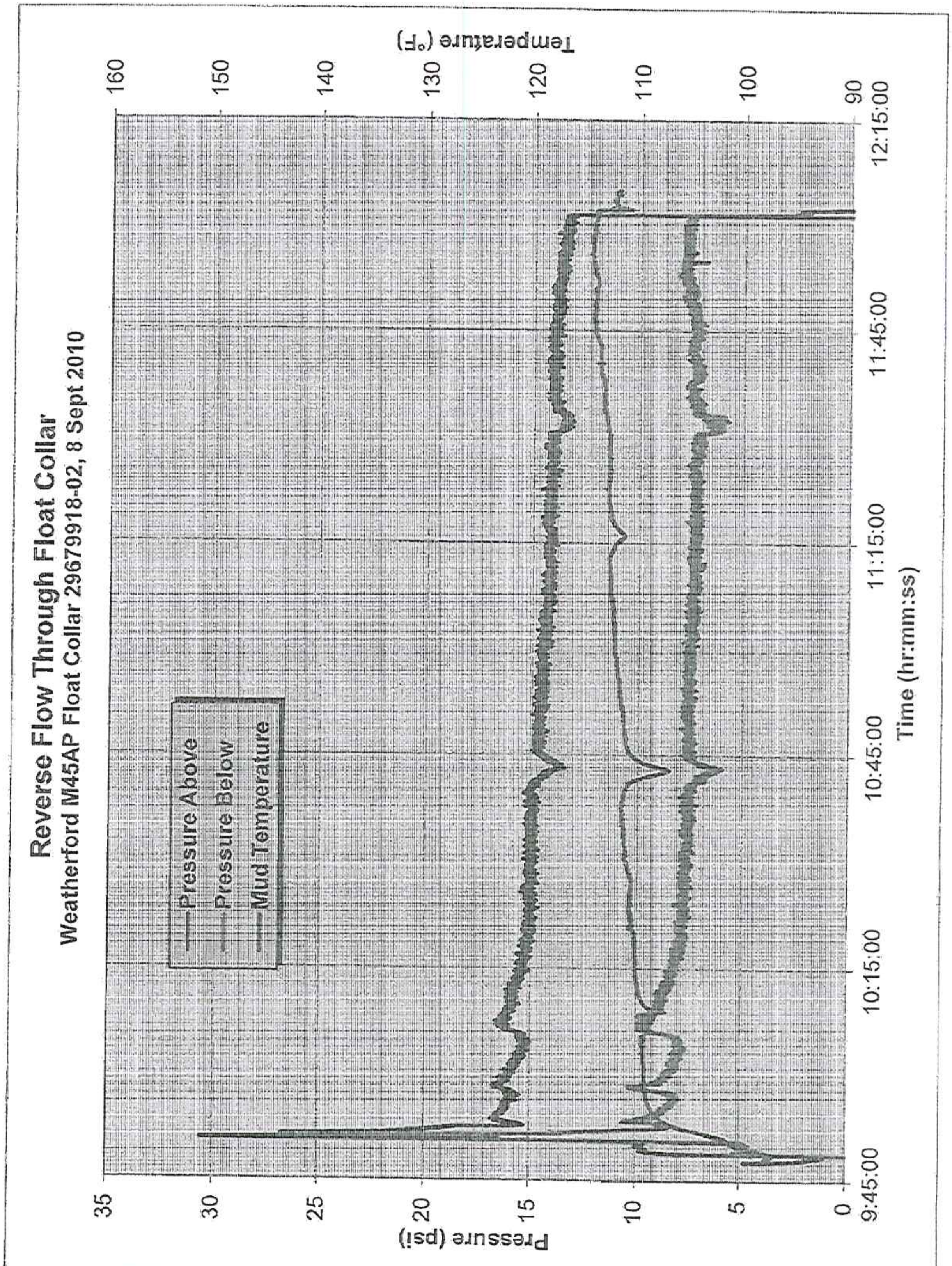


Figure C-5

1601072-02-Reverse Flow.xlsx

10/11/2010

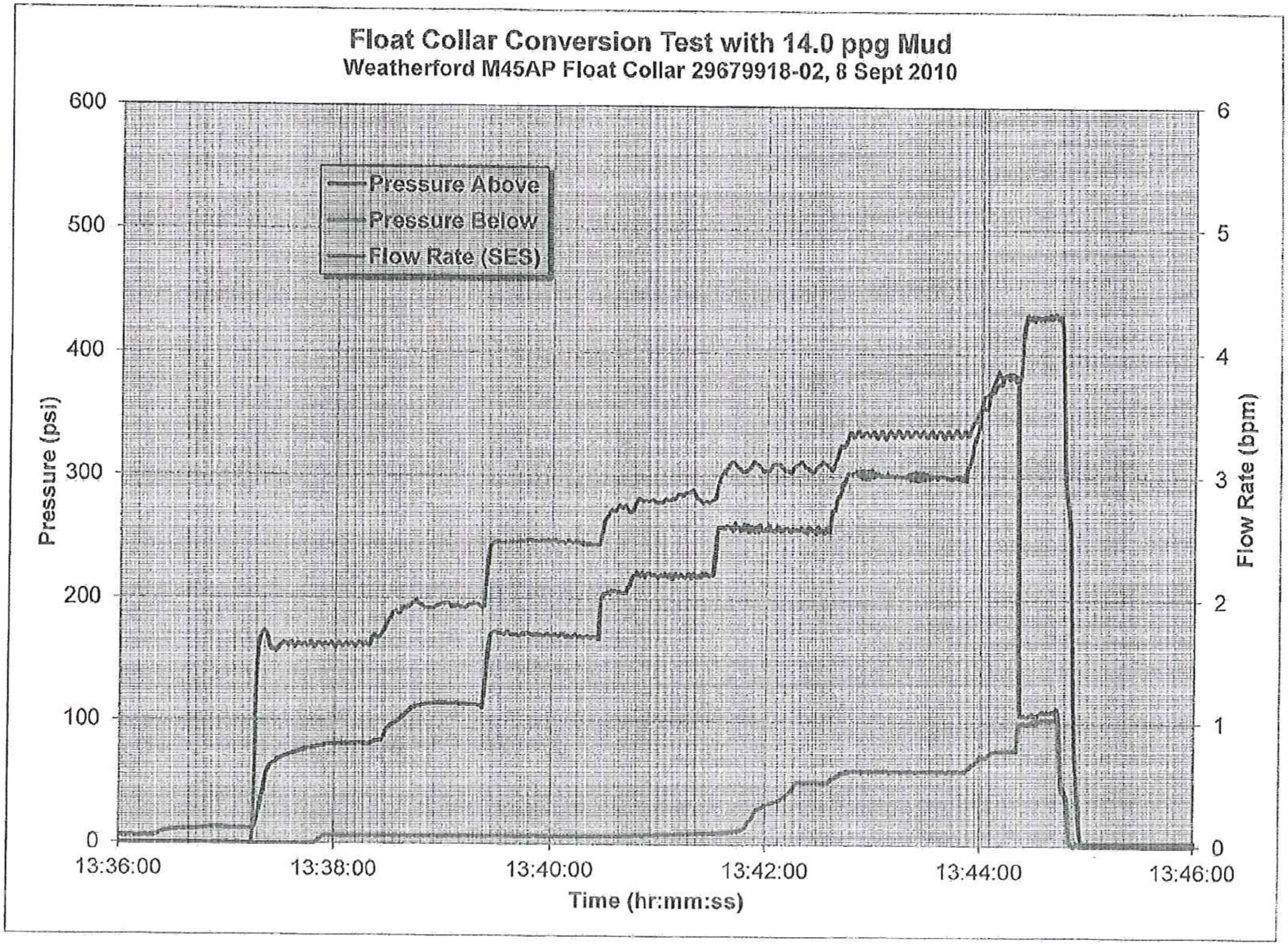


Figure C-6

1601072-02-Conversion.xlsx

10/11/2010

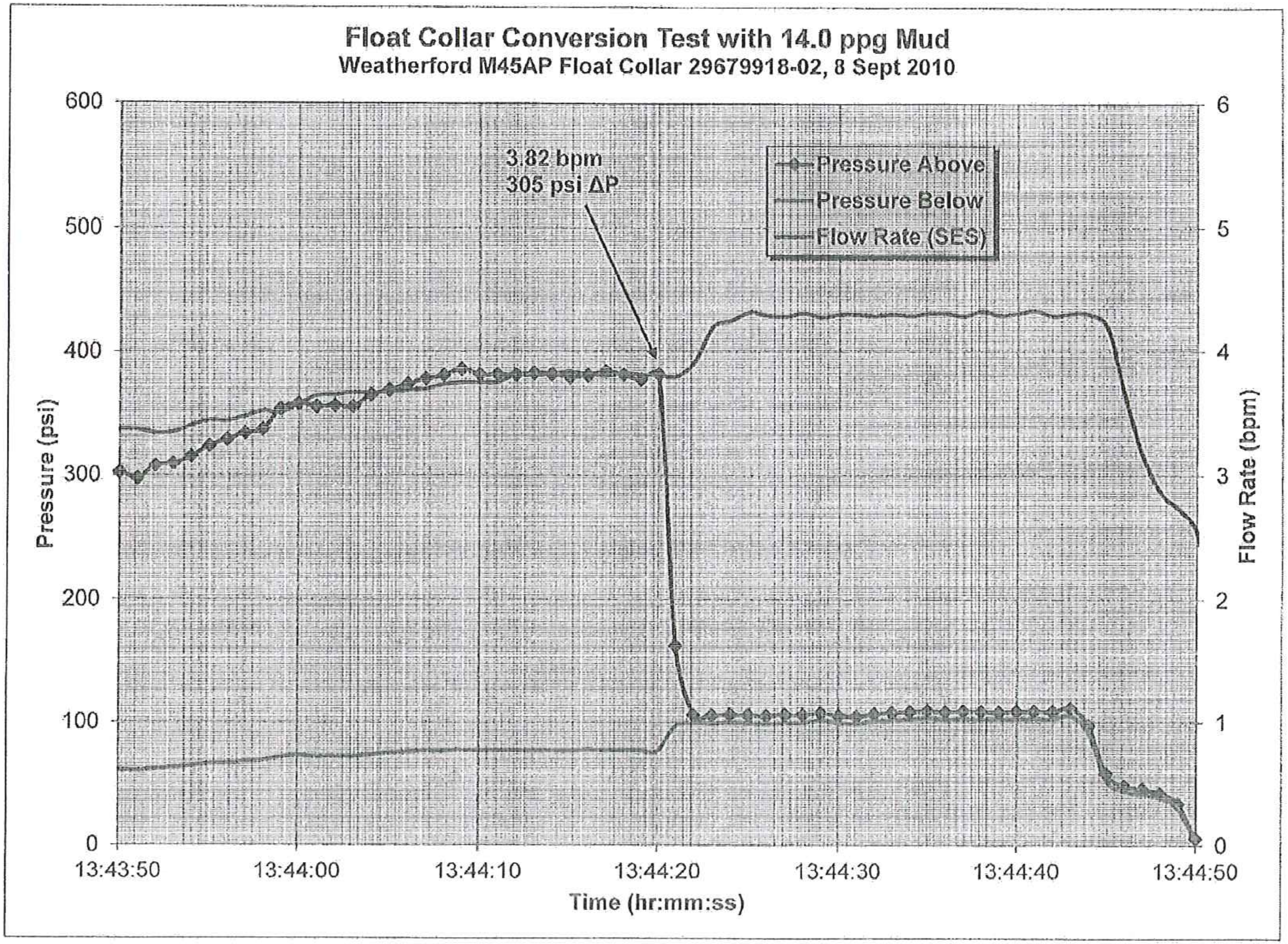


Figure C-7 1601072-02-Conversion.xlsx 10/11/2010

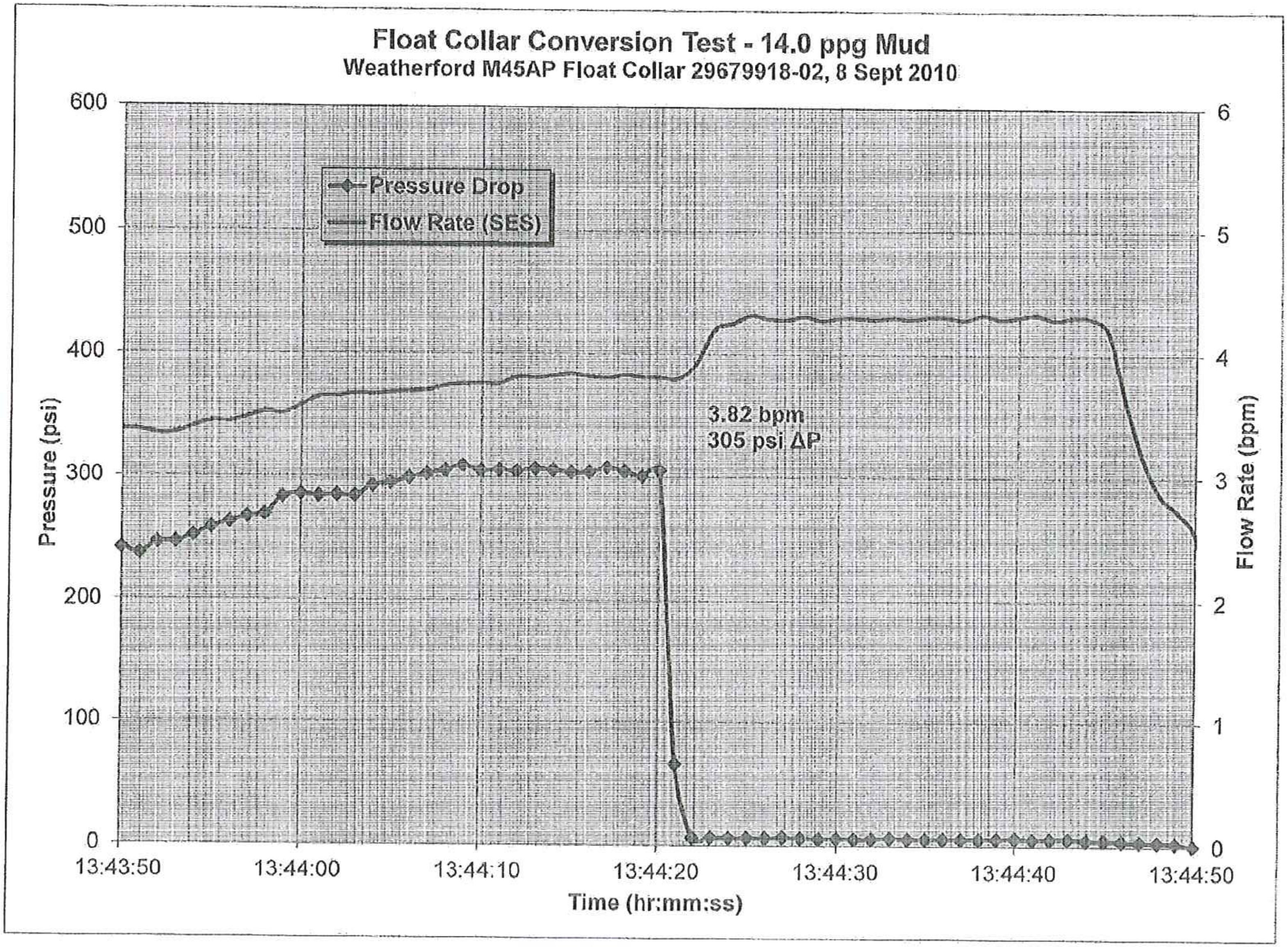


Figure C-8

1601072-02-Conversion.xlsx

10/11/2010

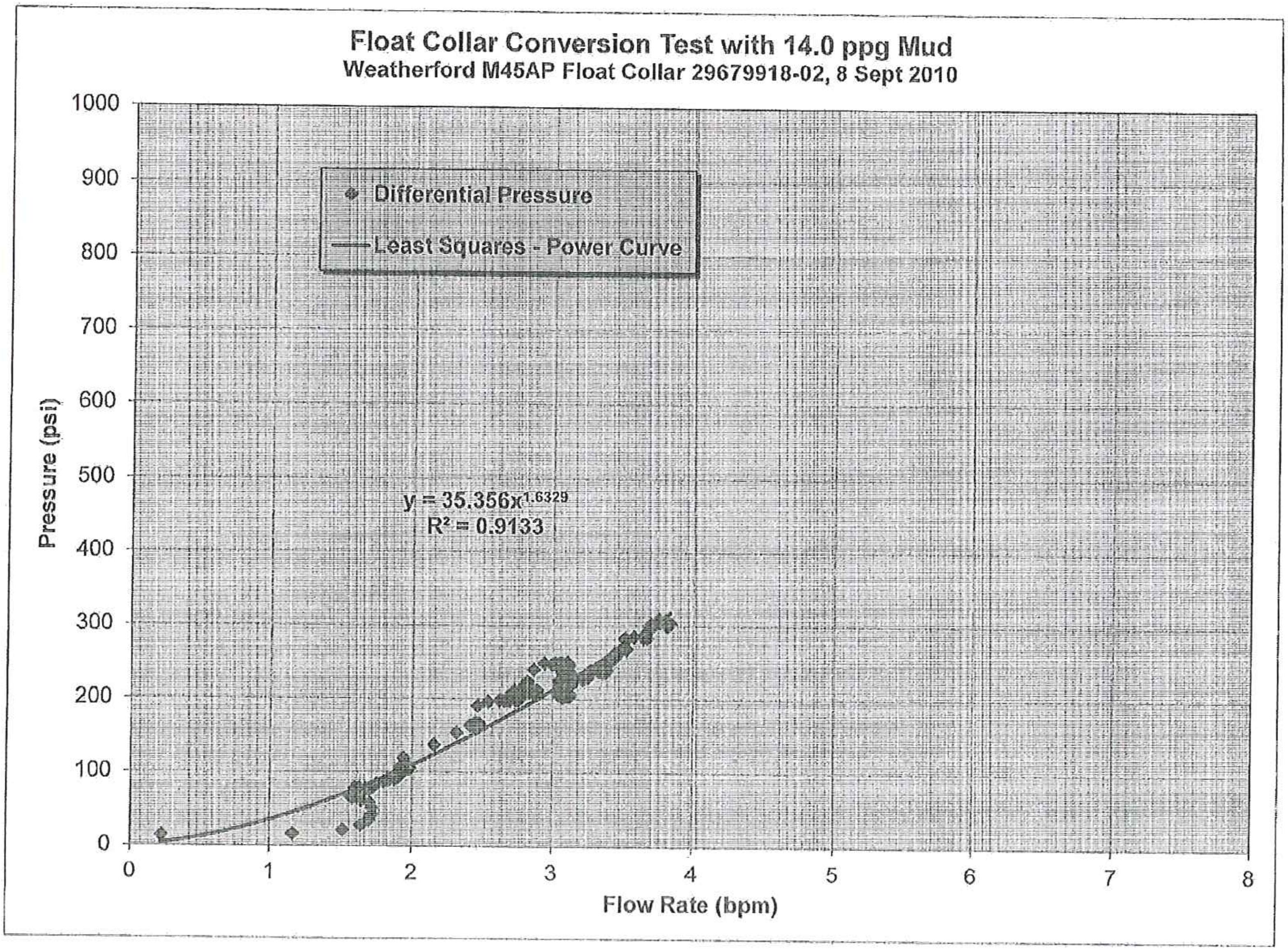


Figure C-9

1601072-02-Conversion.xlsx

11/19/2010

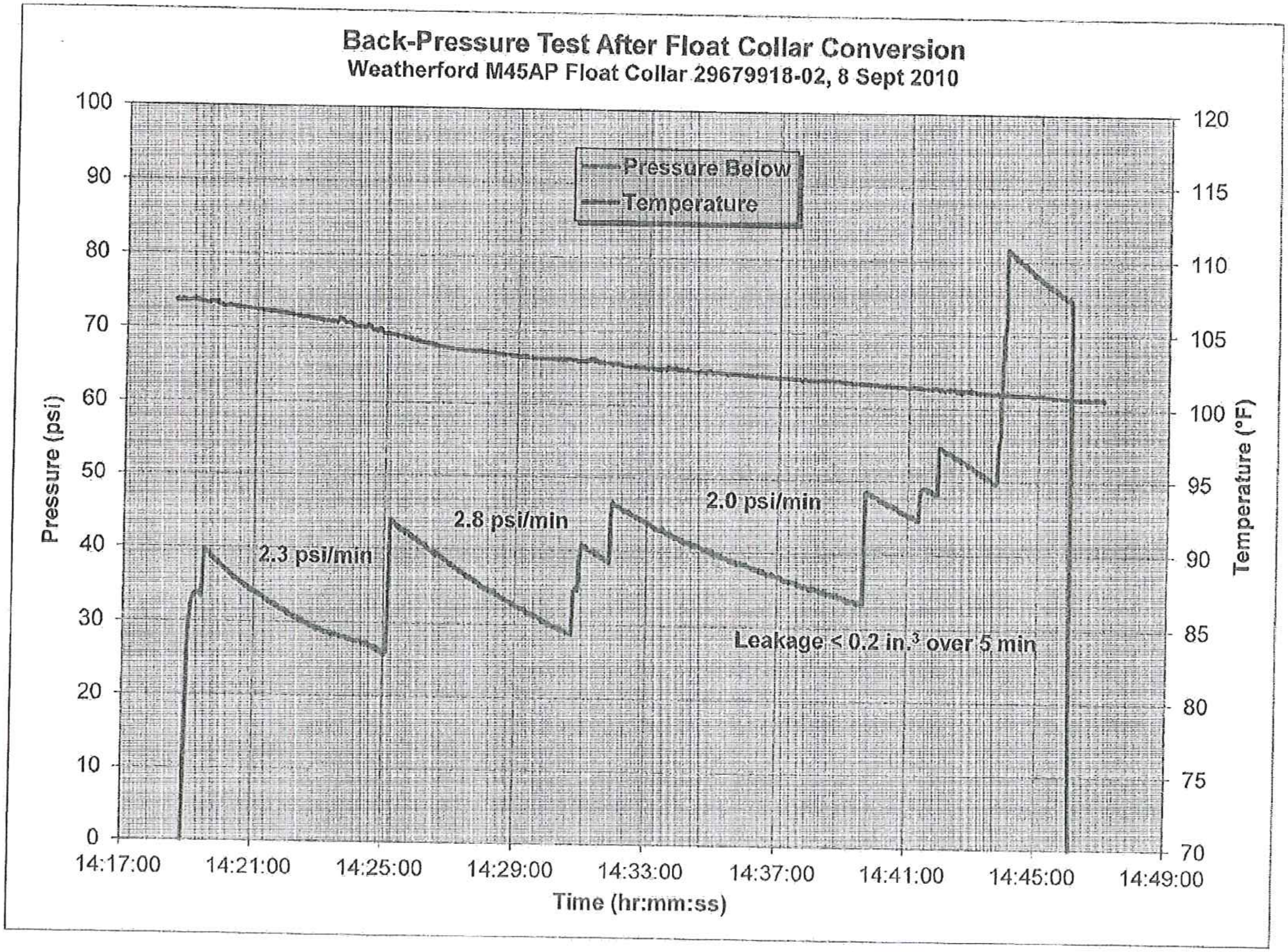


Figure C-10

1601072-02-BackPress1.xlsx

10/11/2010

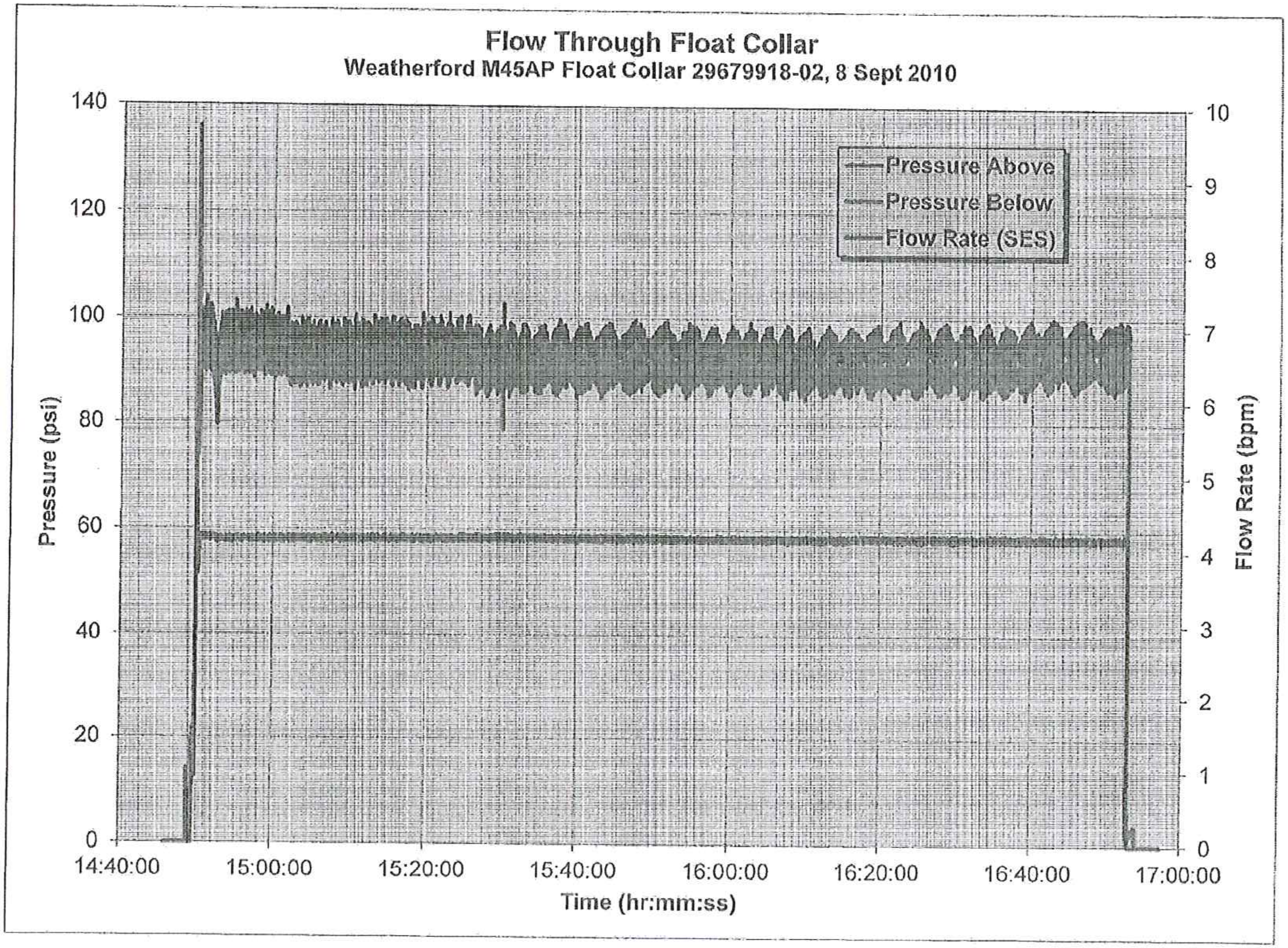


Figure C-11 1601072-02-BackPress1.xlsx 11/2/2010

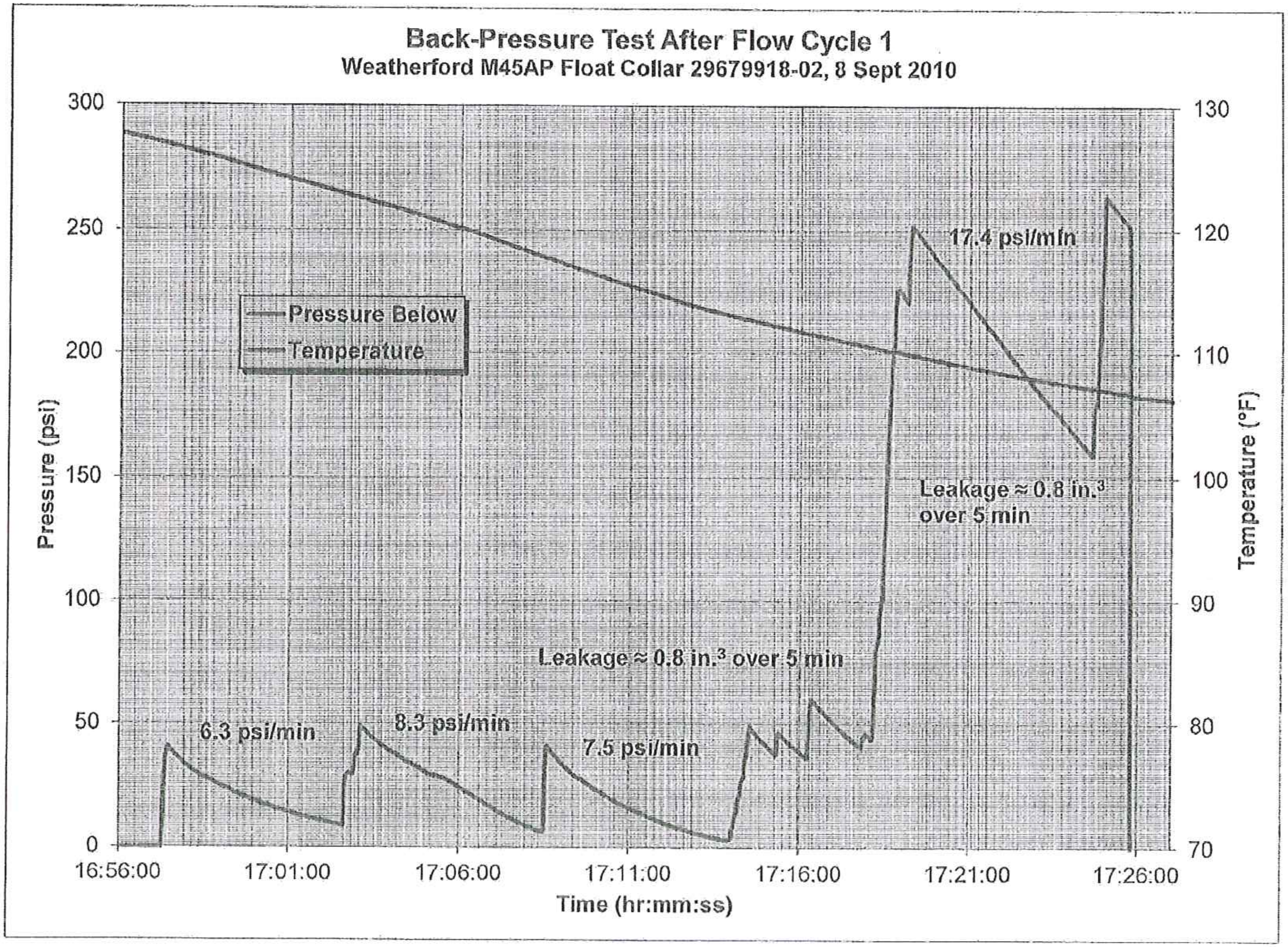

Back-Pressure Test After Flow Cycle 1
Weatherford M45AP Float Collar 29679918-02, 8 Sept 2010
Pressure Below
Temperature
Pressure (psi)
Temperature (°F)
Time (hr:mm:ss)
6.3 psi/min
8.3 psi/min
7.5 psi/min
17.4 psi/min
Leakage ≈ 0.8 in.³ over 5 min
Leakage ≈ 0.8 in.³
over 5 min
300
250
200
150
100
50
0
130
120
110
100
90
80
70
16:56:00
17:01:00
17:06:00
17:11:00
17:16:00
17:21:00
17:26:00

Figure C-12

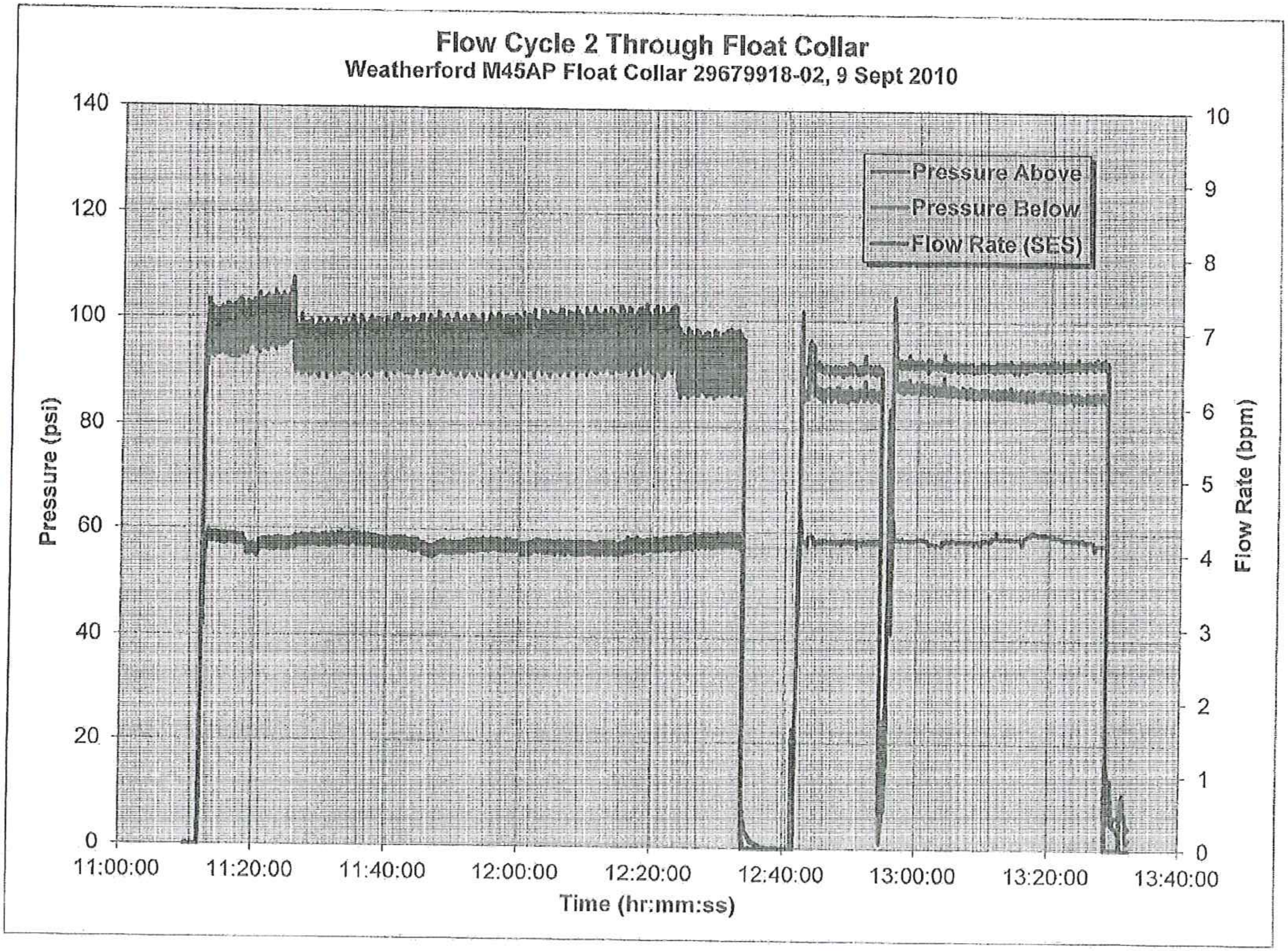


Figure C-13

1601072-02-BackPress2.xlsx

11/2/2010

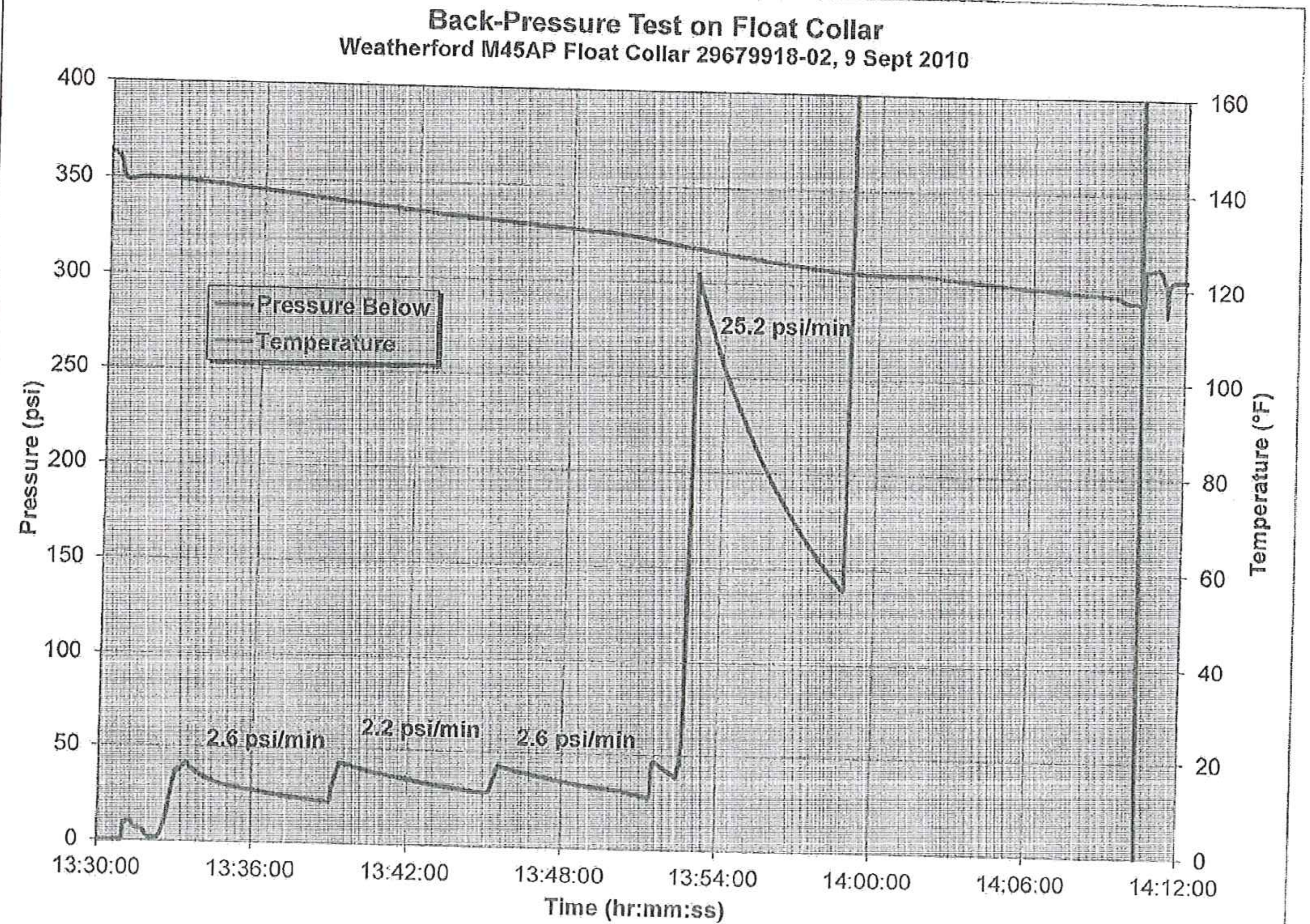


Figure C-14

1601072-02-BackPress2.xlsx

11/2/2010

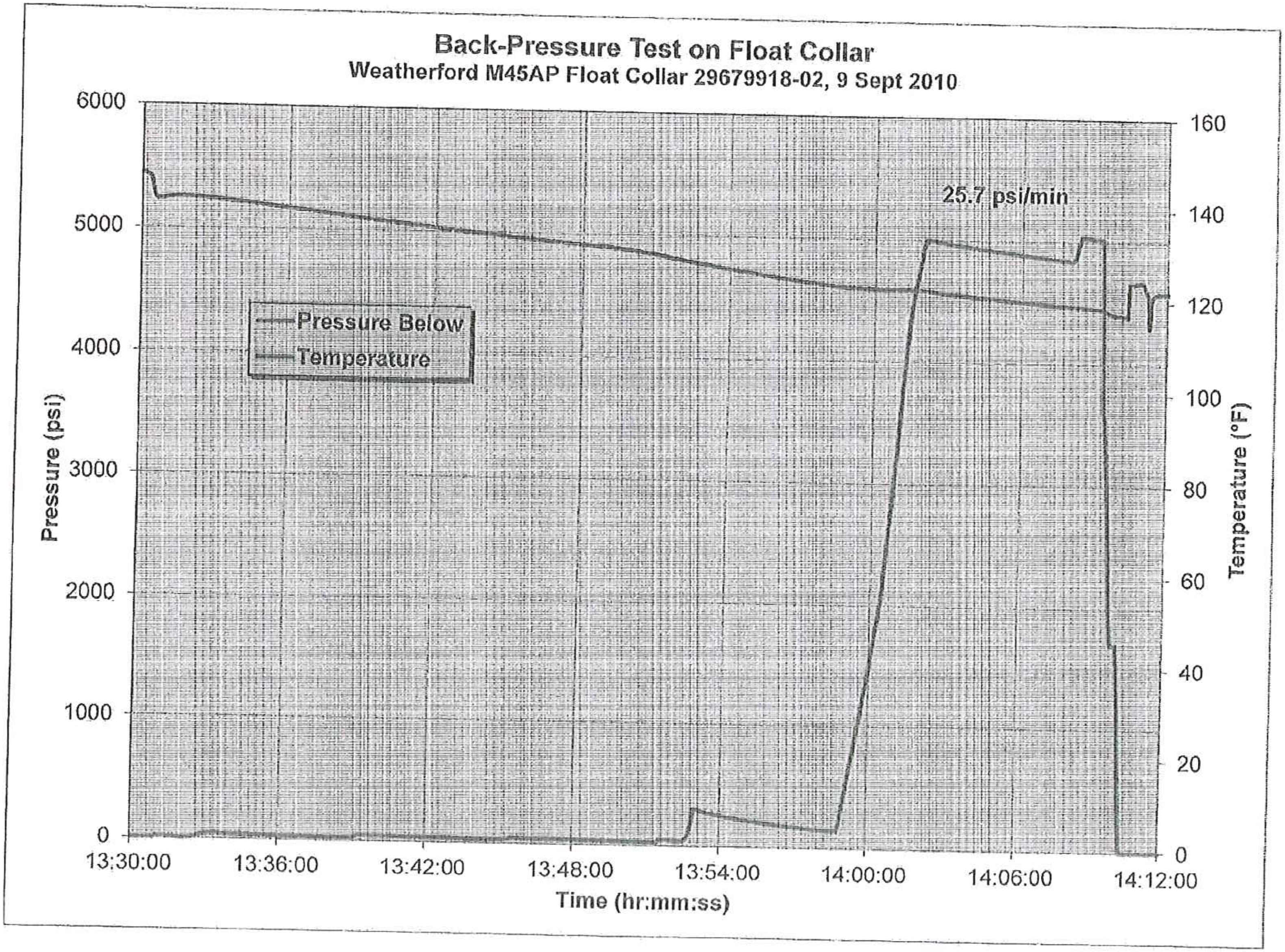


Figure C-15

1601072-02-BackPress2.xlsx

11/2/2010

D

Annex D Flow Conversion Test (SN-03)

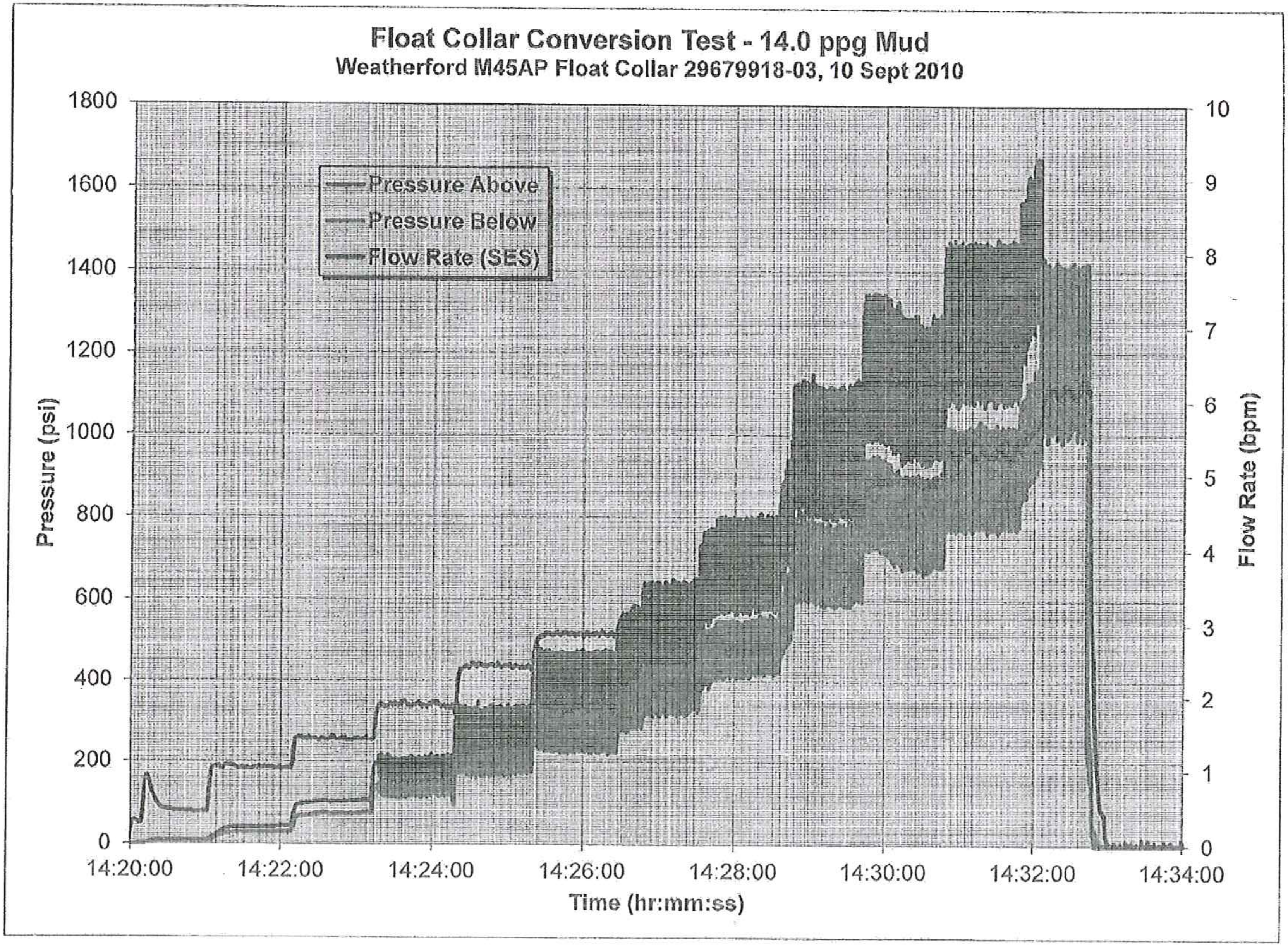


Figure D-1

1601072-03 Conversion.xlsx

10/11/2010

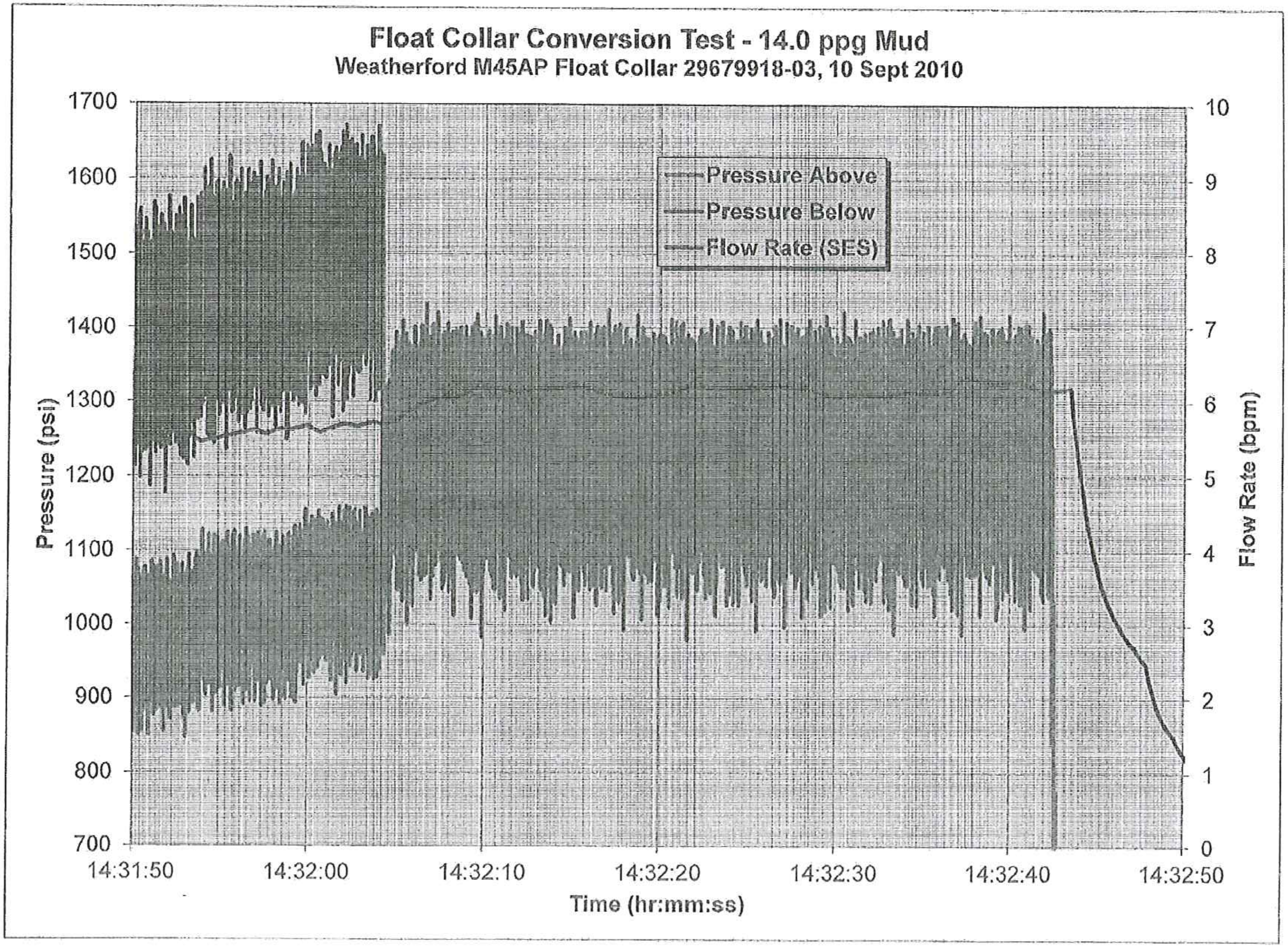


Figure D-2

1601072-03 Conversion.xlsx

10/11/2010

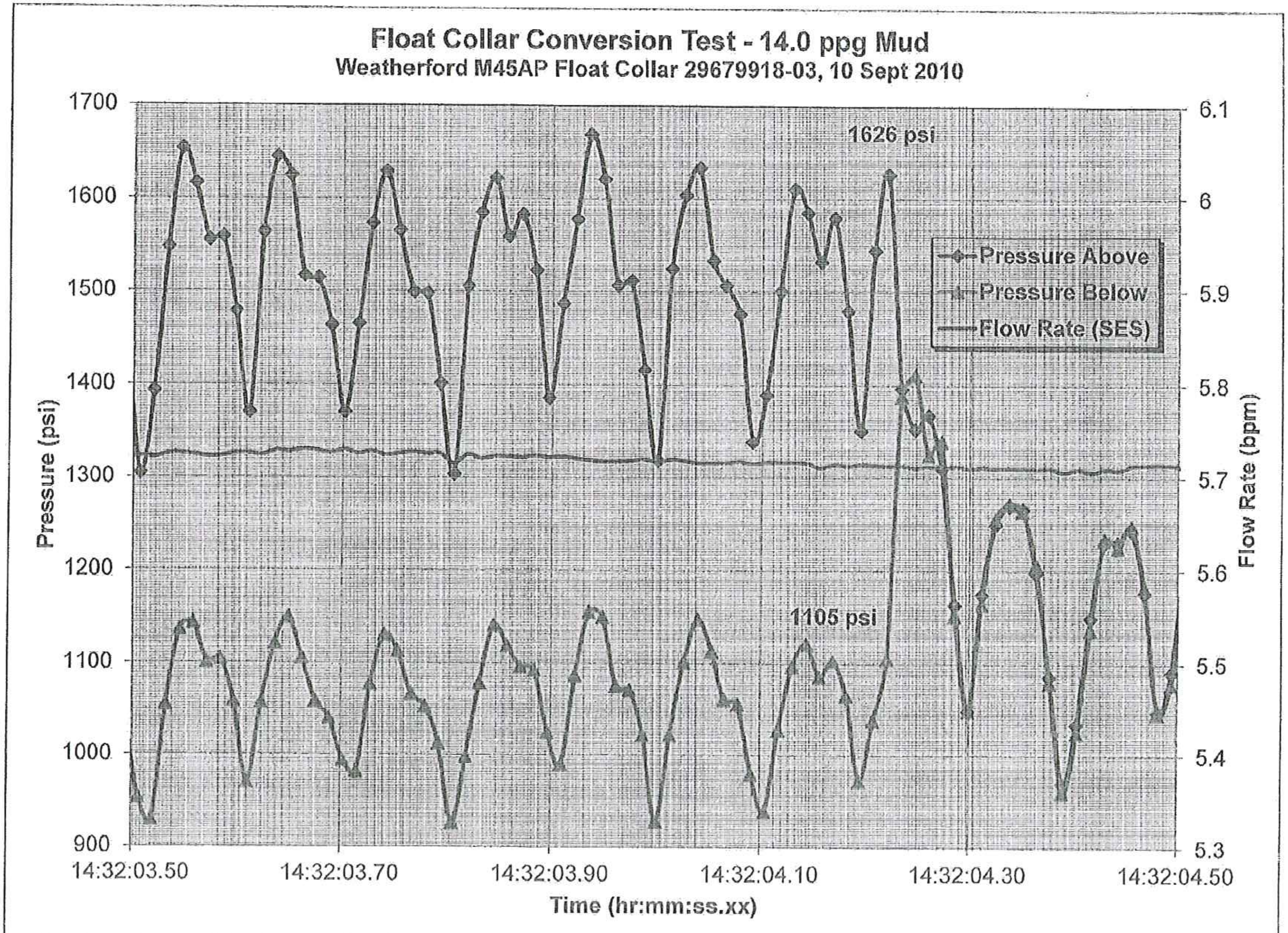


Figure D-3

1601072-03 Conversion.xlsx

11/1/2010

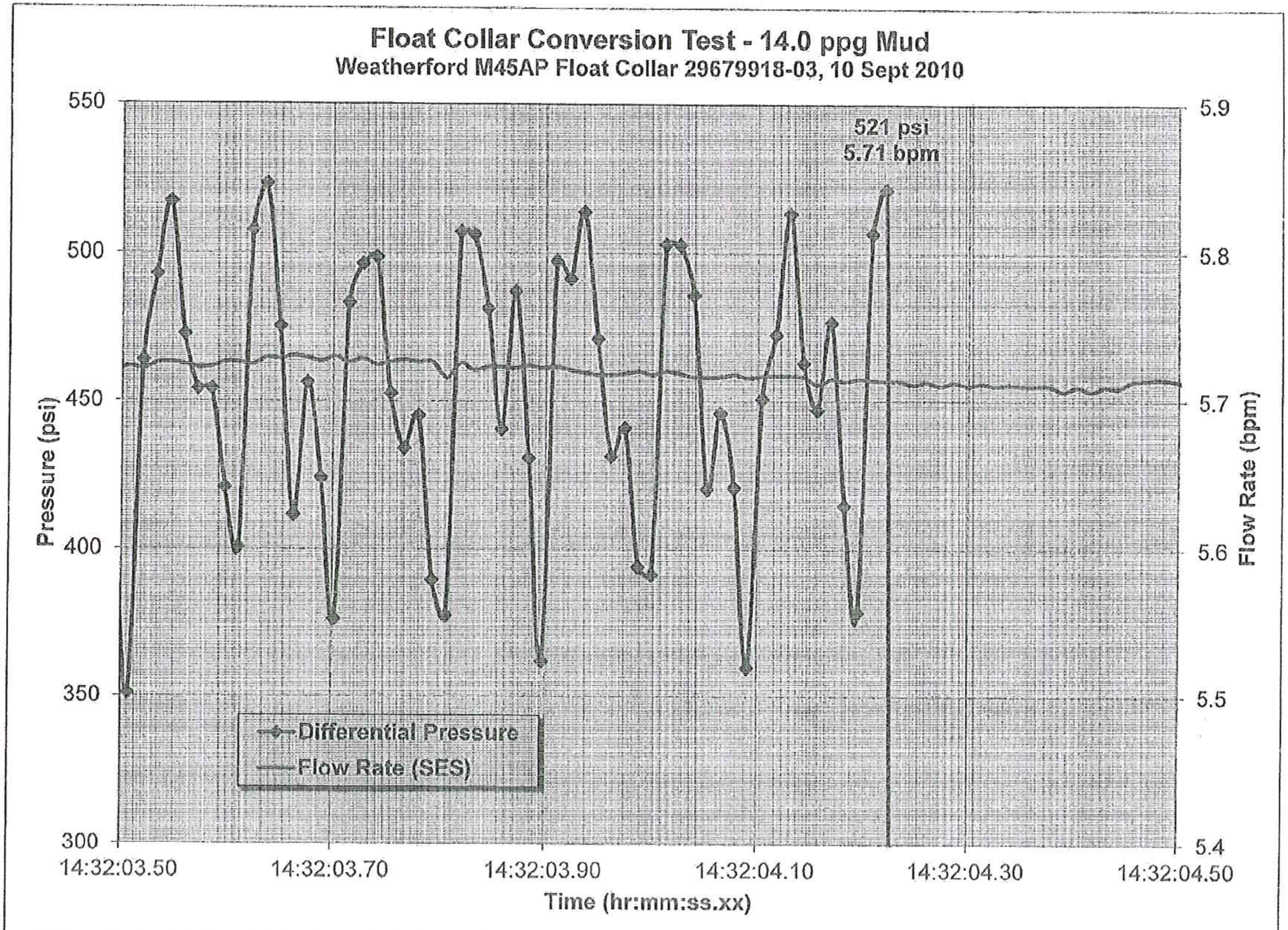

Float Collar Conversion Test - 14.0 ppg Mud
Weatherford M45AP Float Collar 29679918-03, 10 Sept 2010
521 psi
5.71 bpm
Differential Pressure
Flow Rate (SES)
Pressure (psi)
550
500
450
400
350
300
Flow Rate (bpm)
5.9
5.8
5.7
5.6
5.5
5.4
14:32:03.50
14:32:03.70
14:32:03.90
14:32:04.10
14:32:04.30
14:32:04.50
Time (hr:mm:ss.xx)

Figure D-4

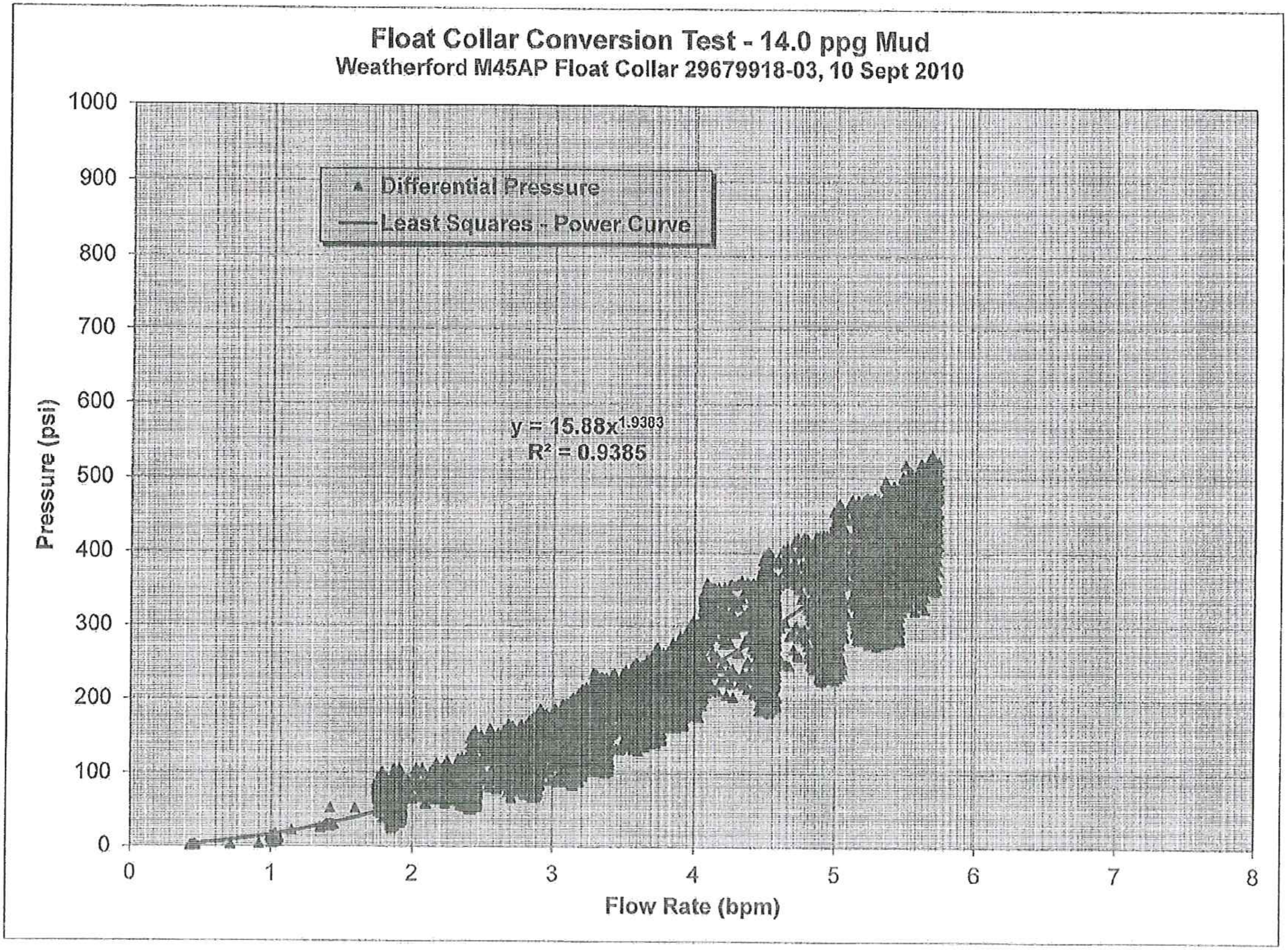


Figure D-5

1601072-03 Conversion.xlsx

11/19/2010

E

Annex E Rehearsal Tests

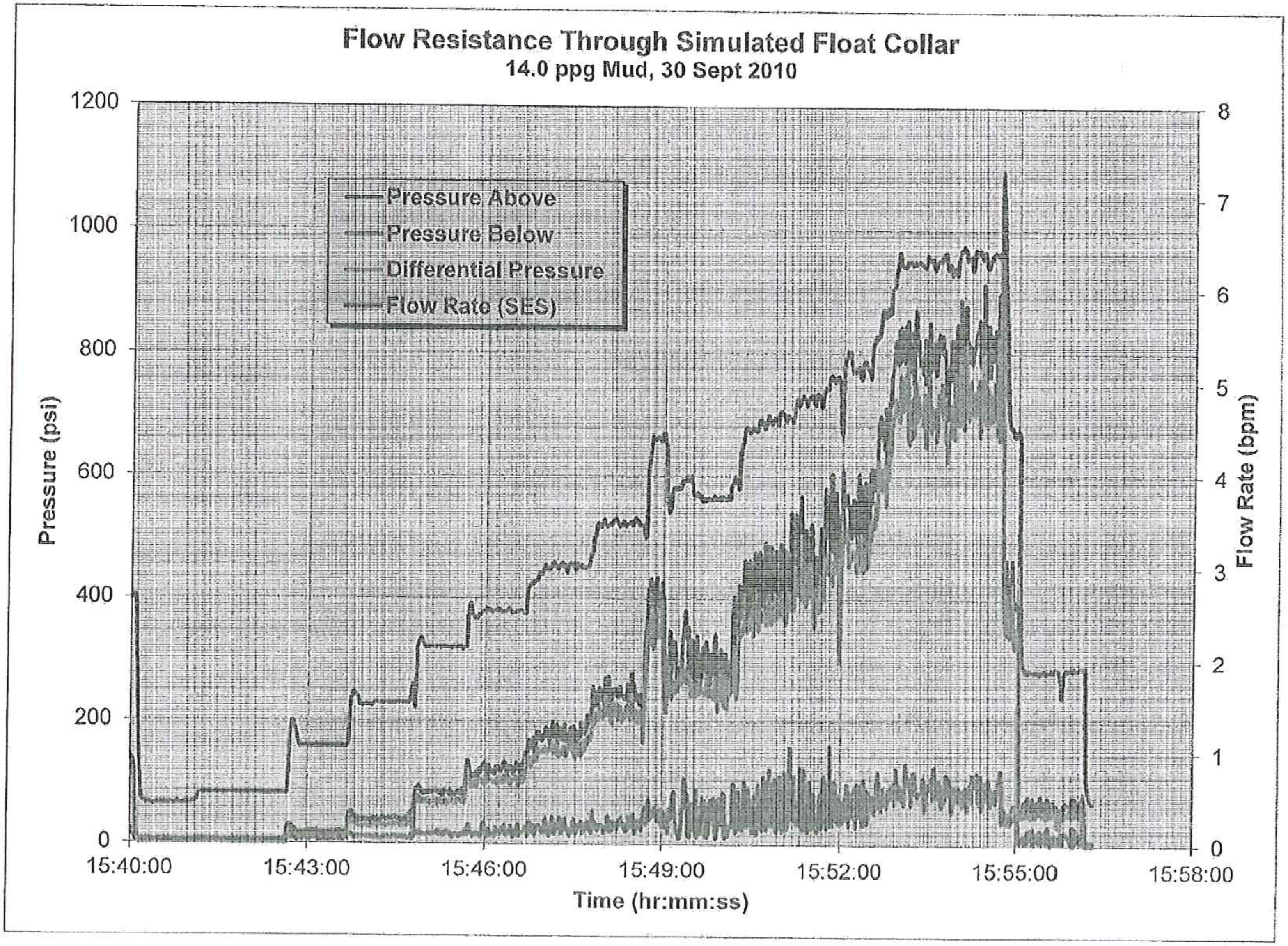


Figure E-1

1601072 Blkge Rehearsal.xlsx

11/5/2010

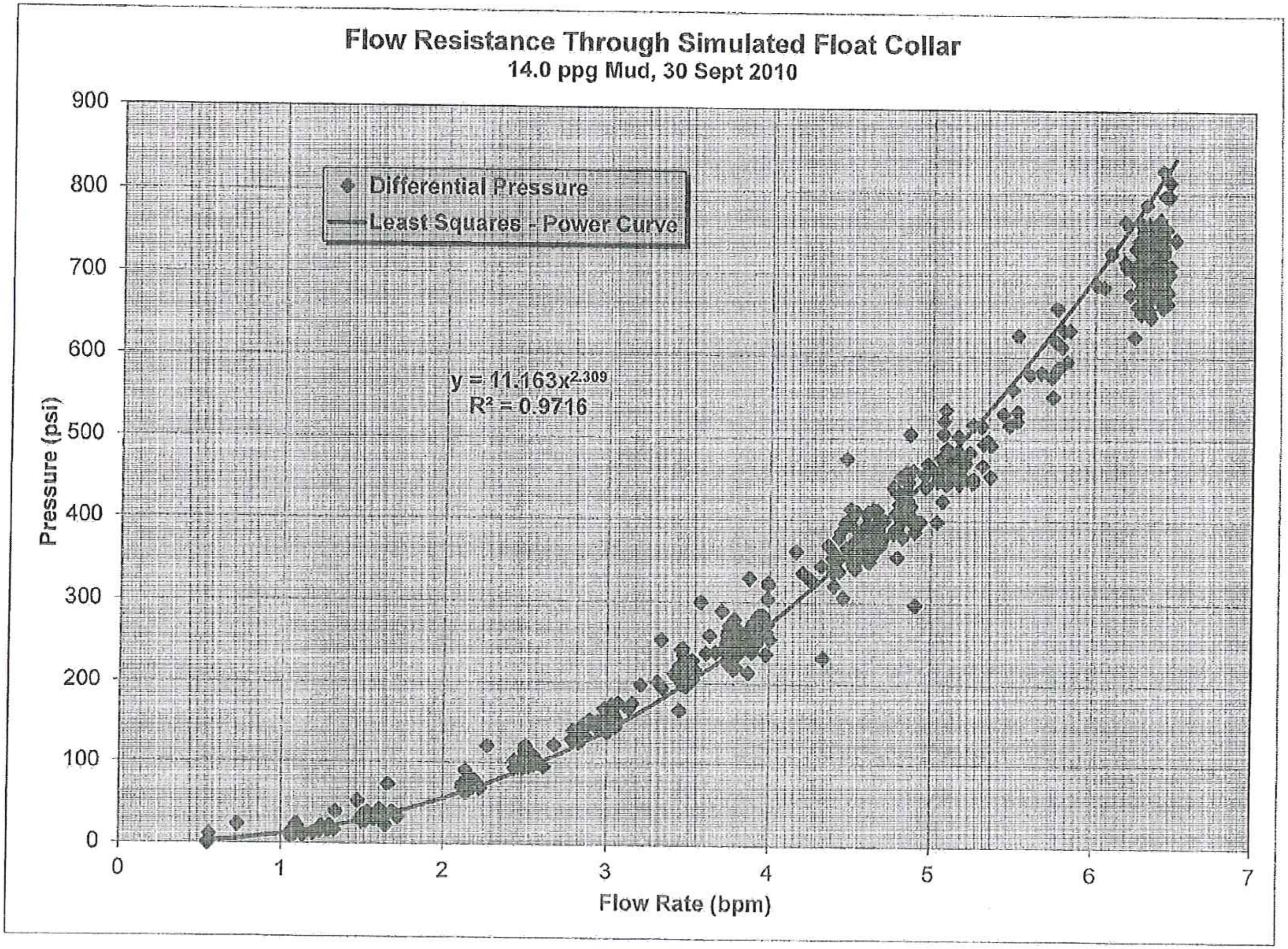


Figure E-2

1601072 Blkge Rehearsal.xlsx

11/19/2010

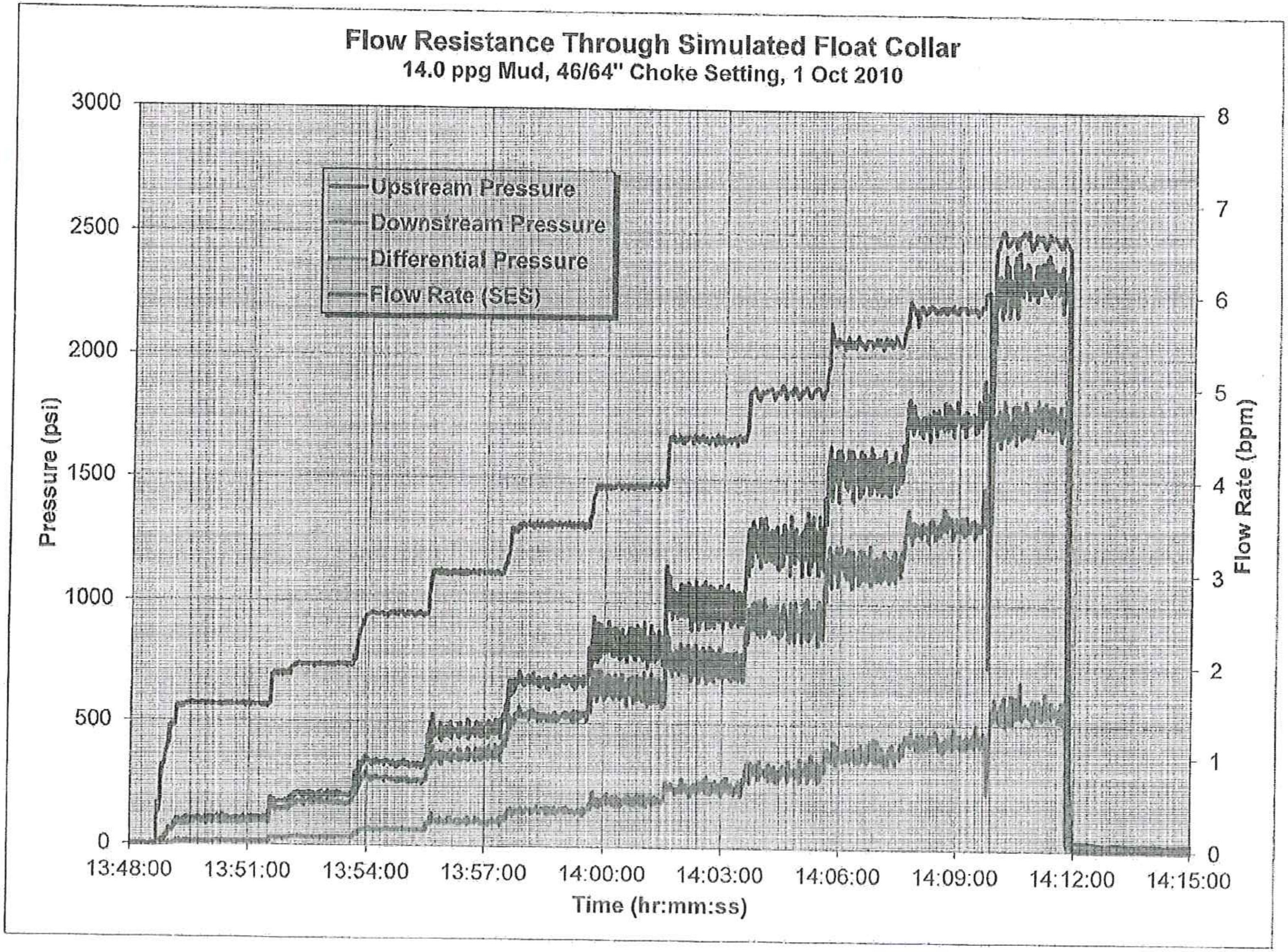


Figure E-3

1601072 Blkge Rehearsal Day 2c.xlsx

11/5/2010

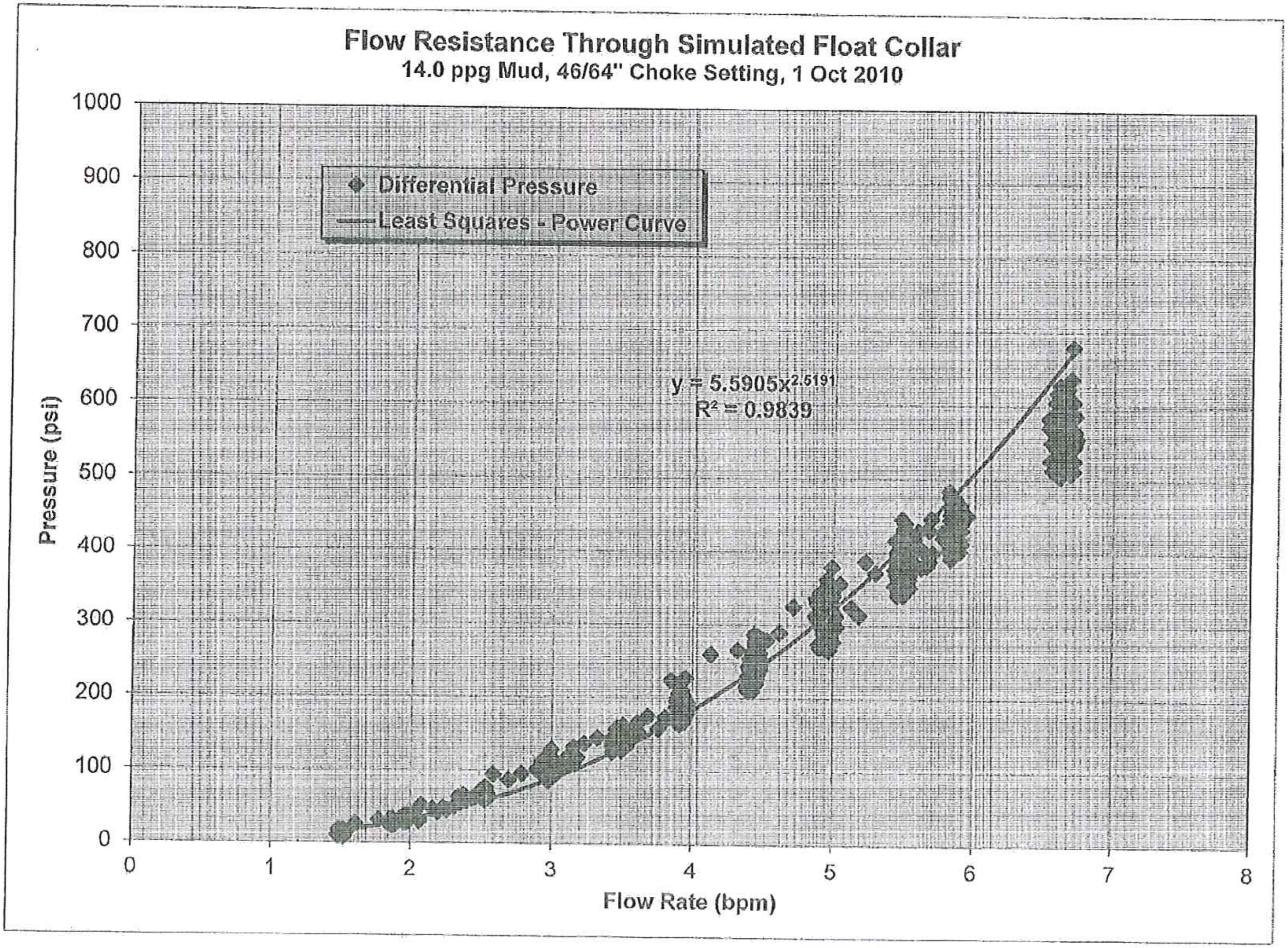


Figure E-4

1601072 Blkge Rehearsal Day 2c.xlsx

11/19/2010

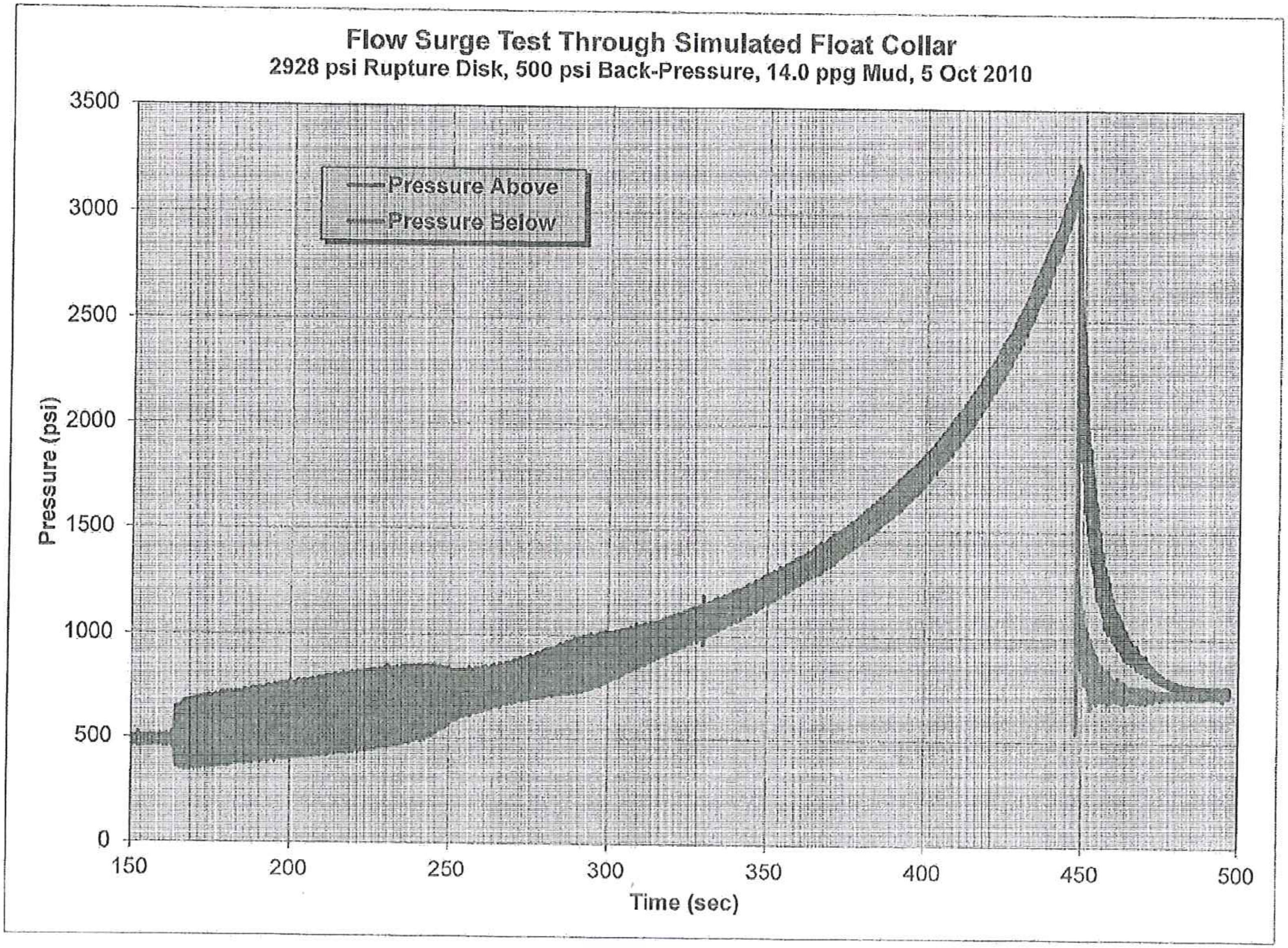


Figure E-5

1601072-1_ToolBlkg.xlsx

11/5/2010

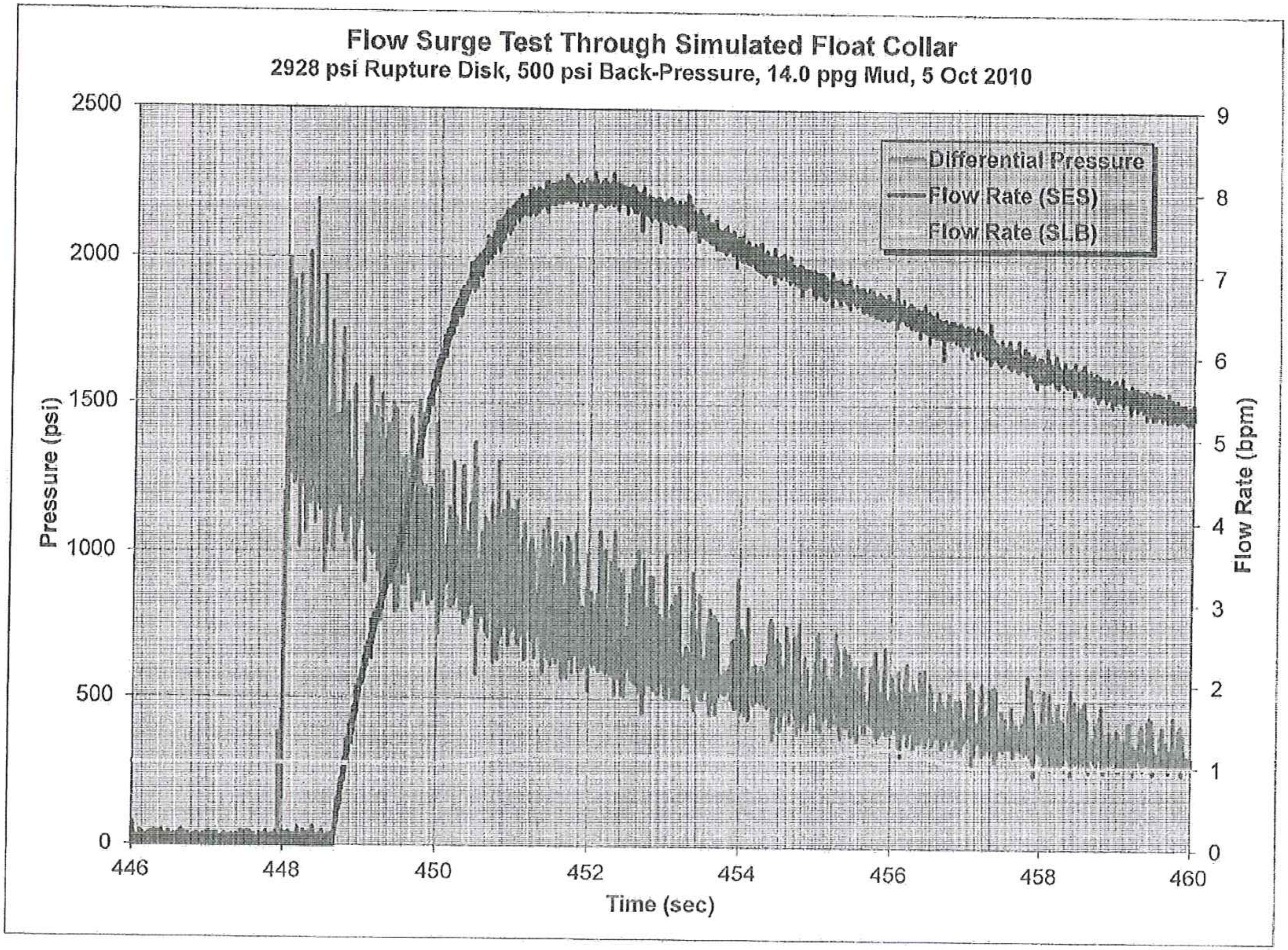


Figure E-6

1601072-1_ToolBlkg.xlsx

11/5/2010

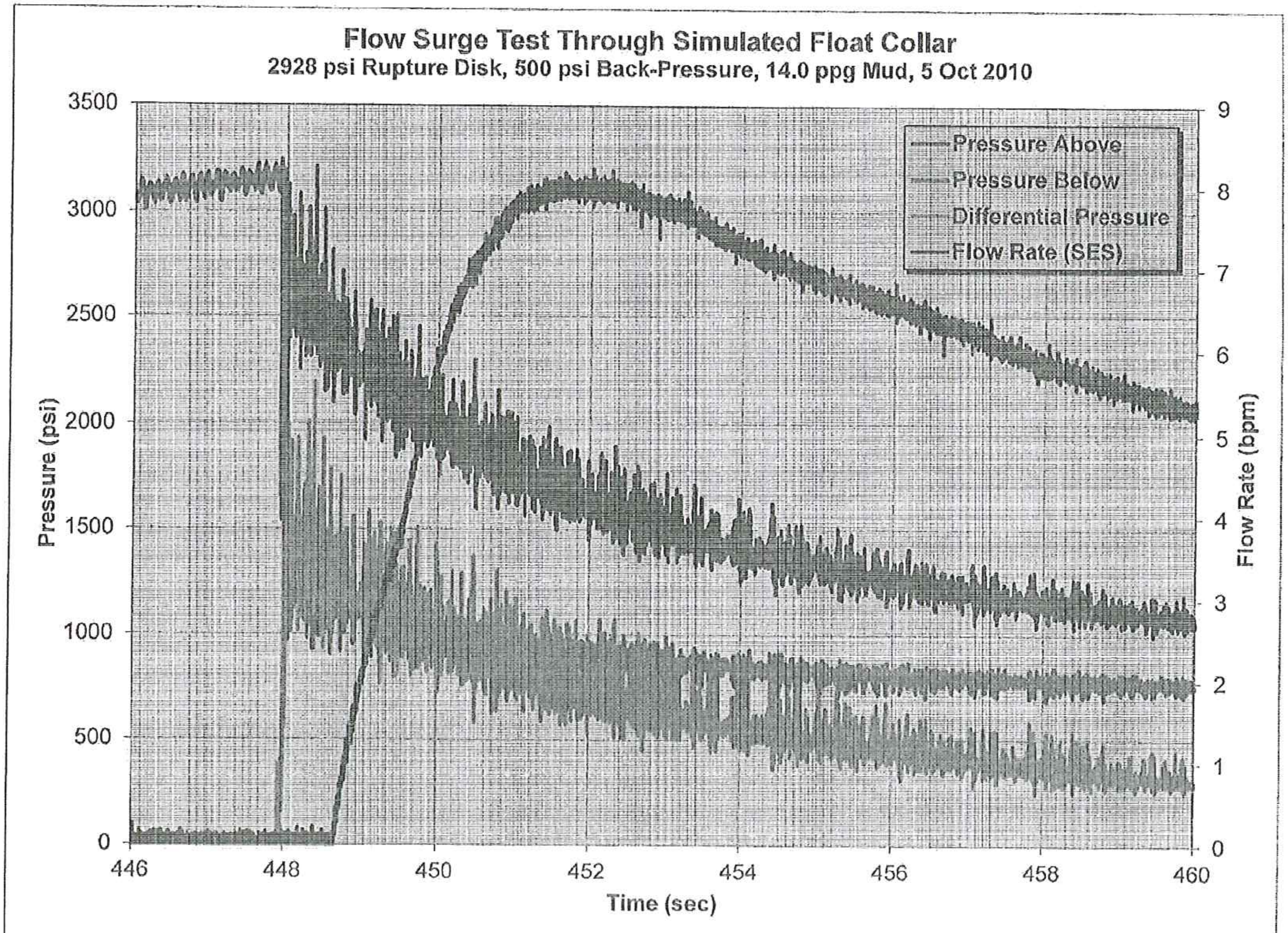


Figure E-7

1601072-1_ToolBlkg.xlsx

11/5/2010

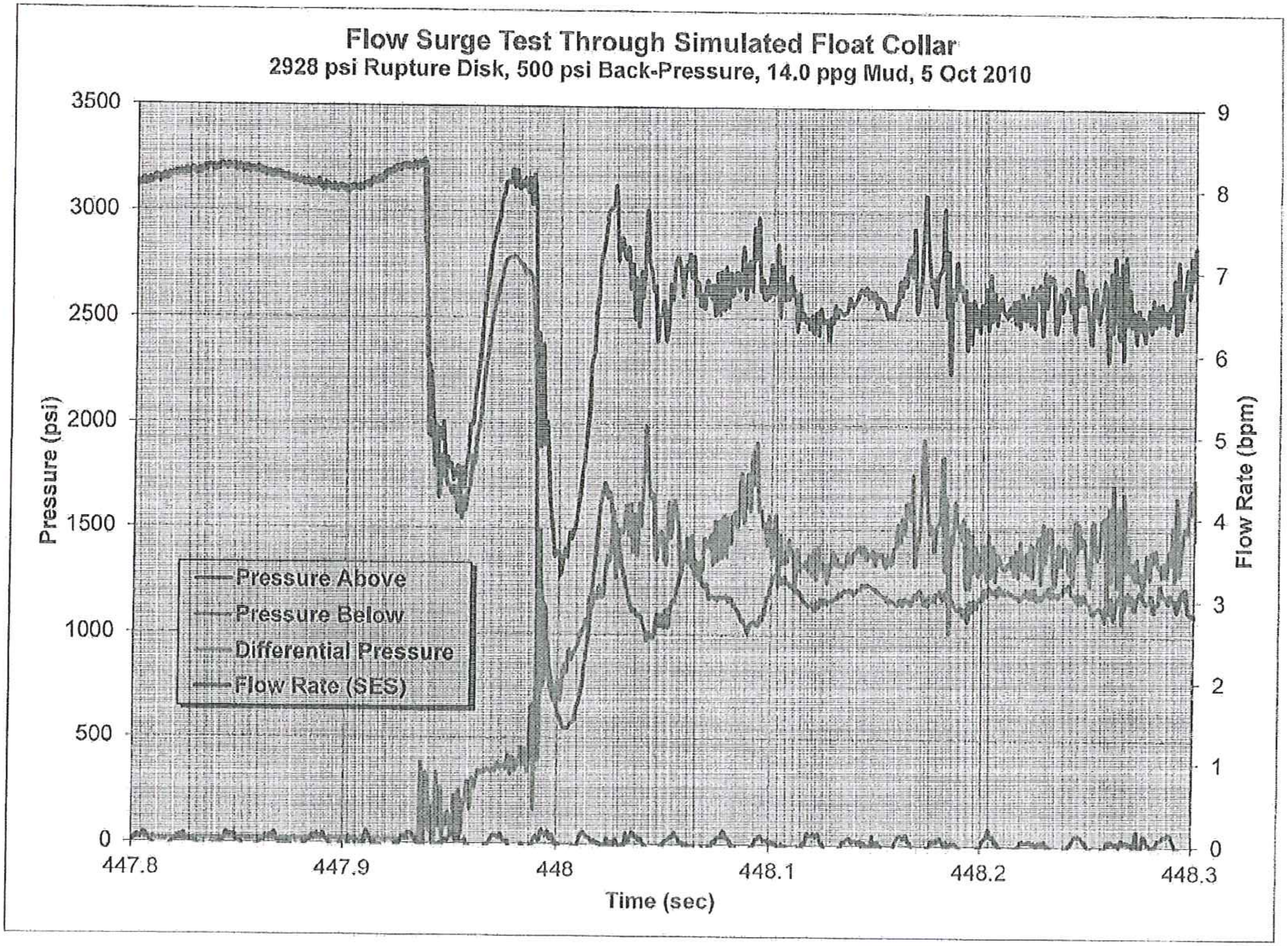


Figure E-8

1601072-1_ToolBlkg.xlsx

11/5/2010

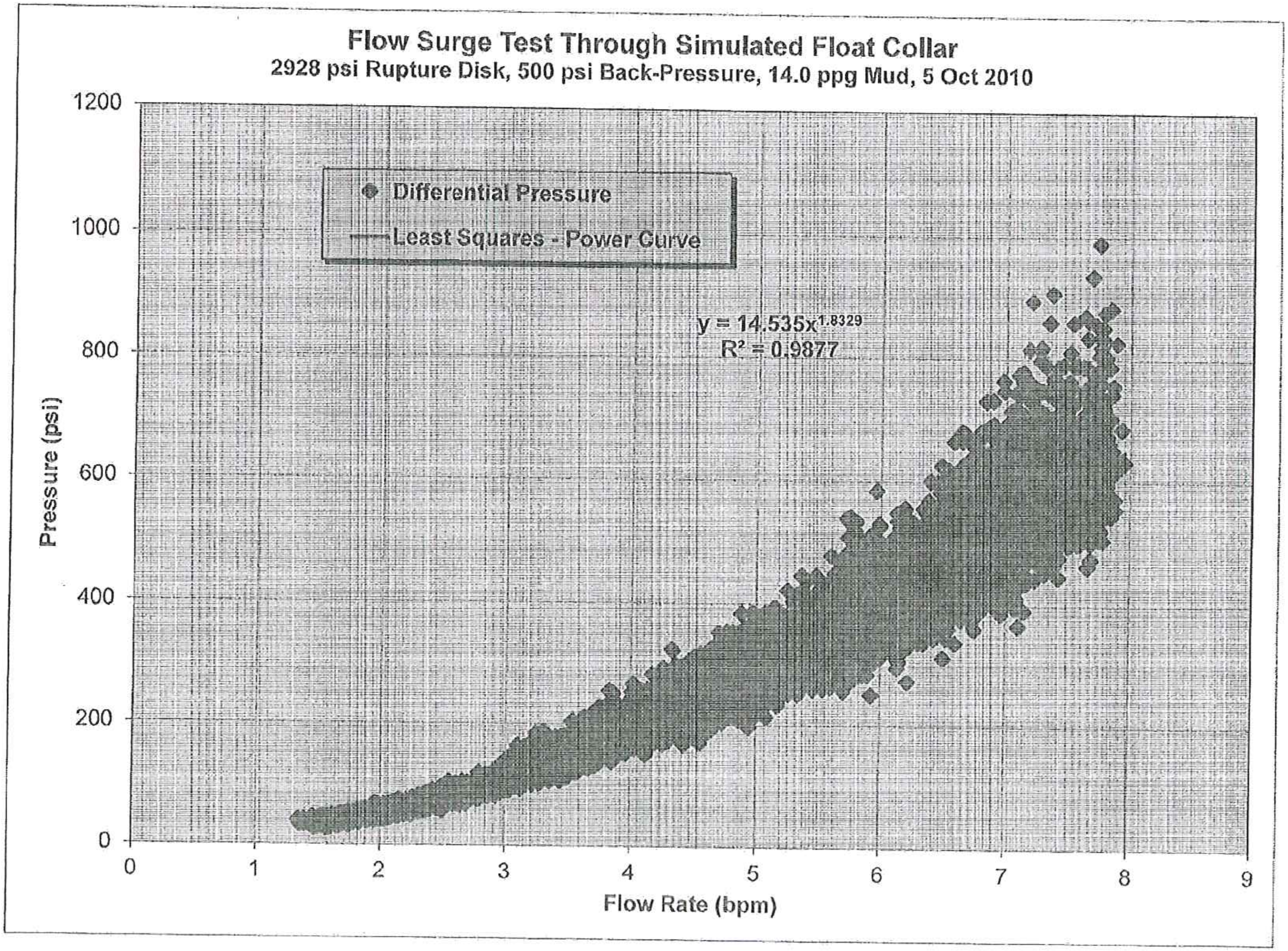
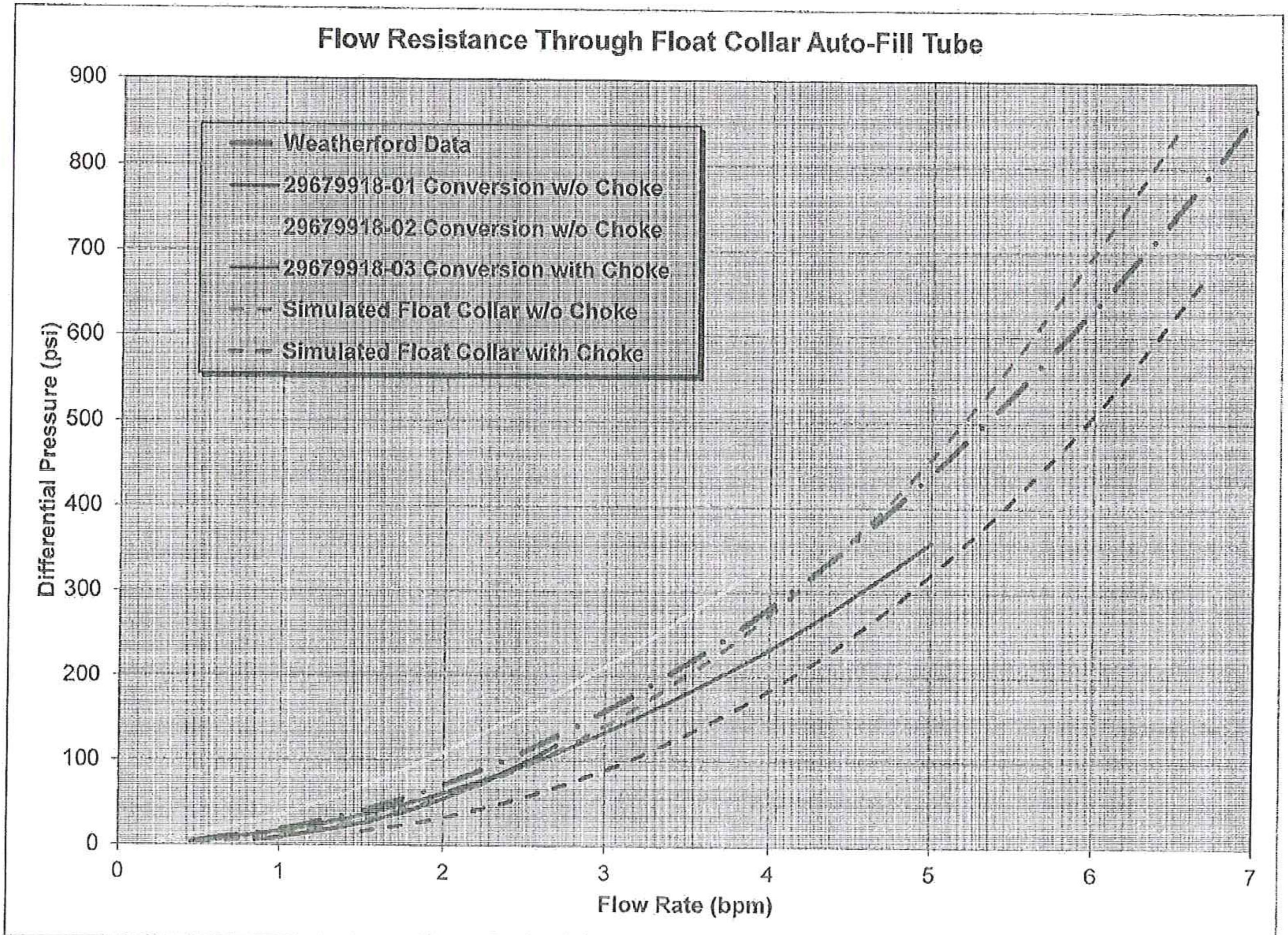


Figure E-9

1601072-1_ToolBlkg.xlsx

11/19/2010


Flow Resistance Through Float Collar Auto-Fill Tube
Weatherford Data
29679918-01 Conversion w/o Choke
29679918-02 Conversion w/o Choke
29679918-03 Conversion with Choke
Simulated Float Collar w/o Choke
Simulated Float Collar with Choke
Differential Pressure (psi)
900
800
700
600
500
400
300
200
100
0
0
1
2
3
4
5
6
7
Flow Rate (bpm)

F

Annex F Flow Surge Conversion Test (SN-05)

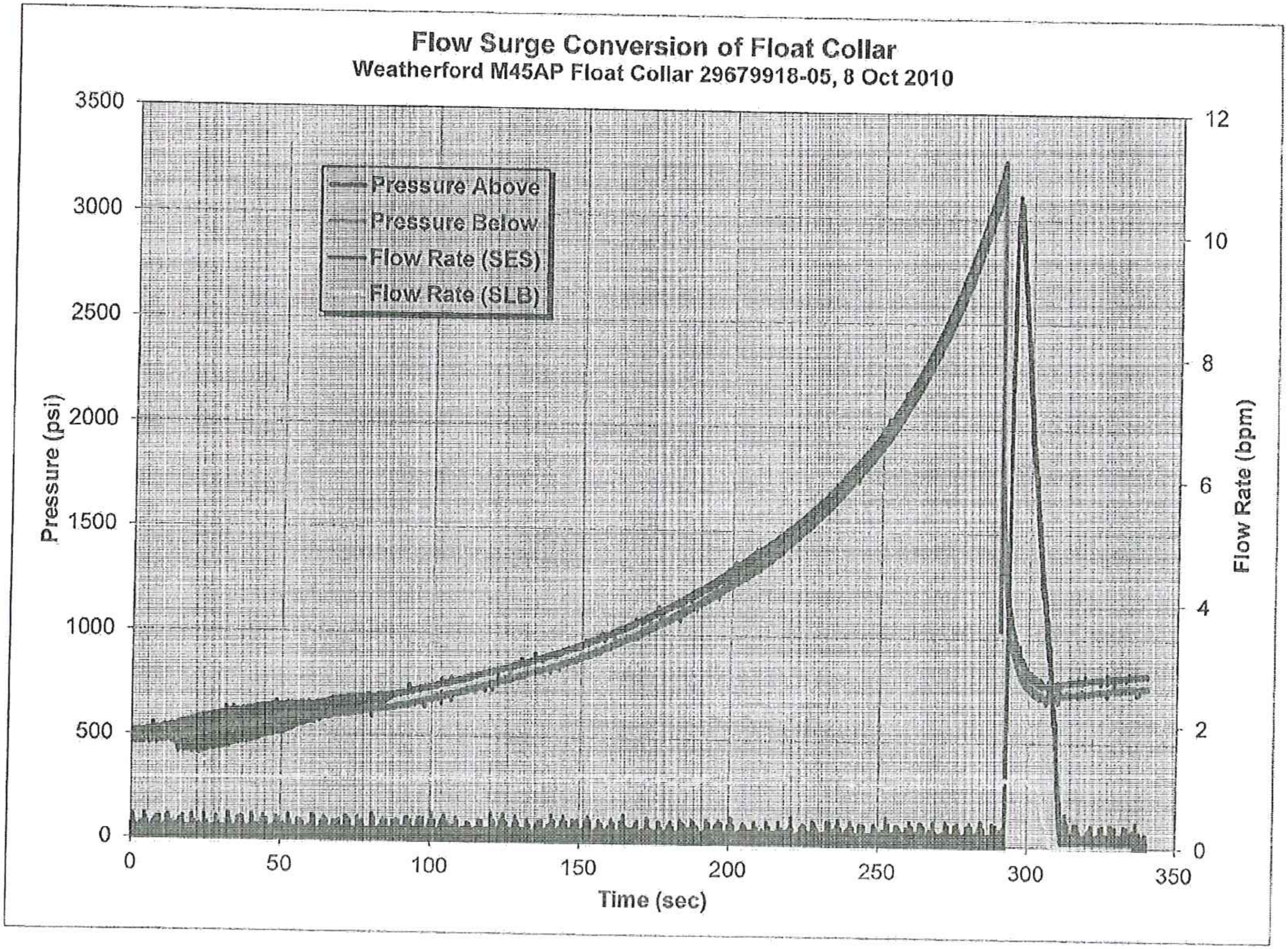

Flow Surge Conversion of Float Collar
Weatherford M45AP Float Collar 29679918-05, 8 Oct 2010
Pressure Above
Pressure Below
Flow Rate (SES)
Flow Rate (SLB)
Pressure (psi)
3500
3000
2500
2000
1500
1000
500
0
Flow Rate (bpm)
12
10
8
6
4
2
0
0
50
100
150
200
250
300
350
Time (sec)

Figure F-1

Flow Surge Conversion of Float Collar
Weatherford M45AP Float Collar 29679918-05, 8 Oct 2010

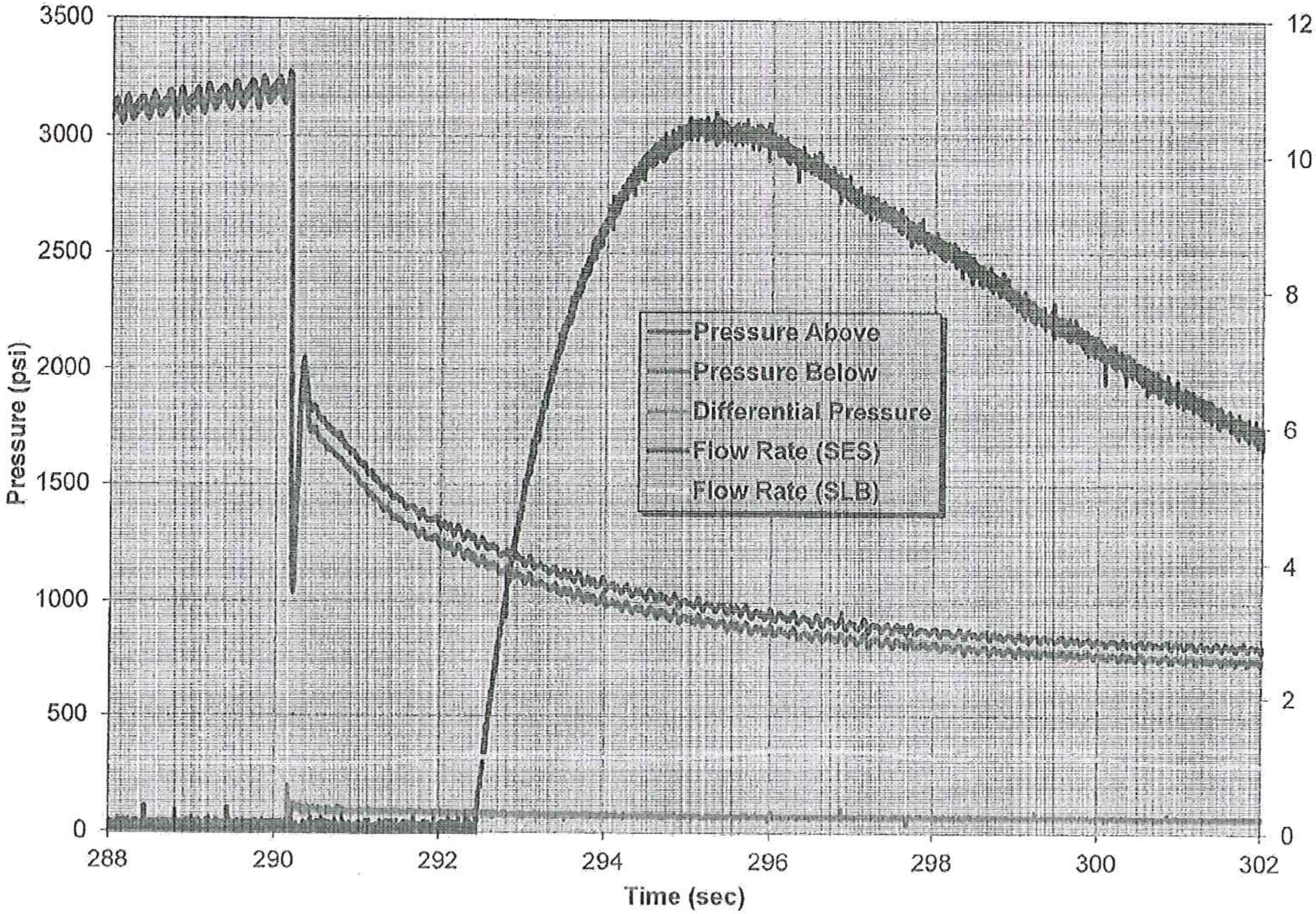


Figure F-2

1601072-05 Blockage_Conv.xlsx

10/27/2010

Flow Surge Conversion of Float Collar
Weatherford M45AP Float Collar 29679918-05, 8 Oct 2010

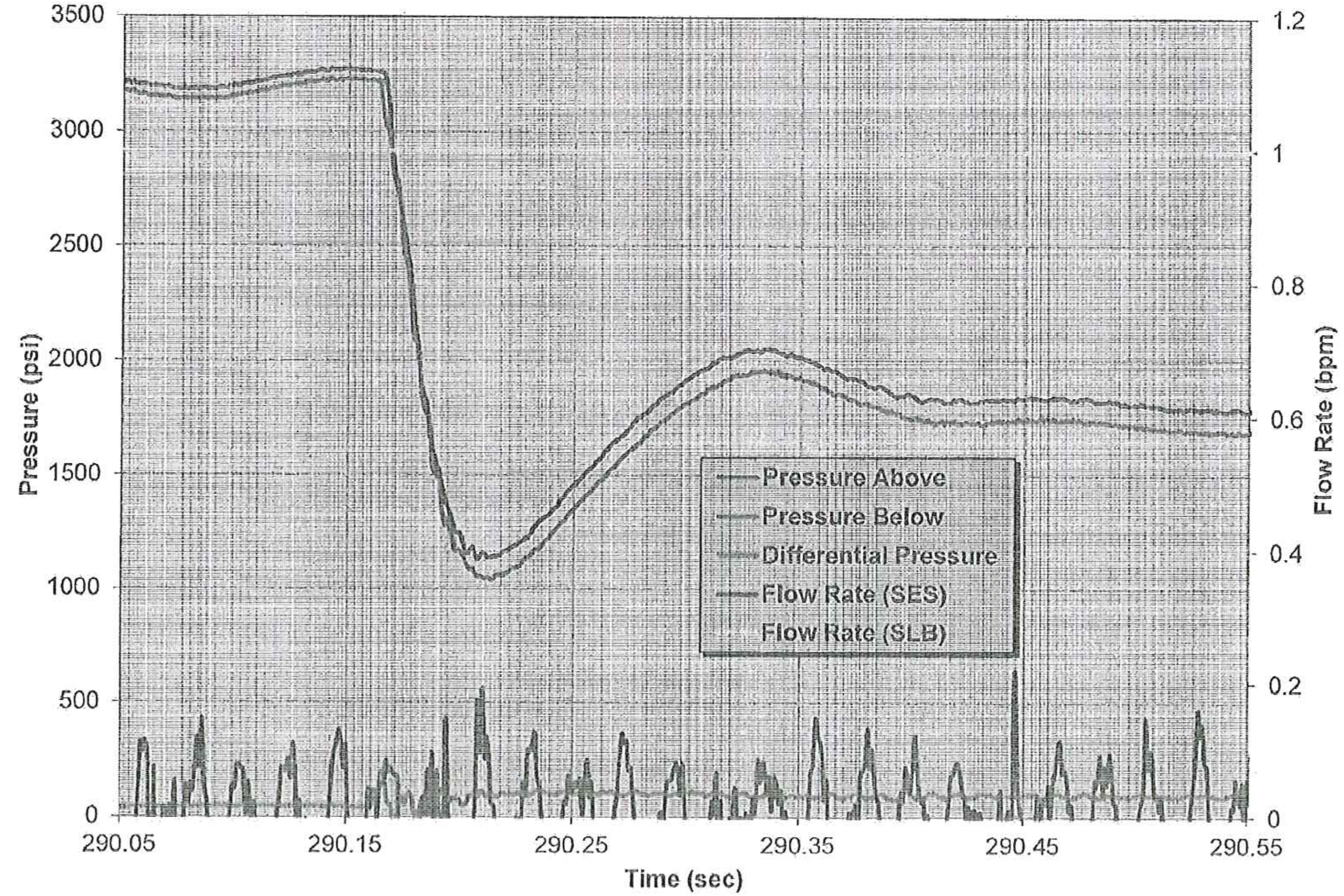


Figure F-3

1601072-05 Blockage_Conv.xlsx

10/27/2010

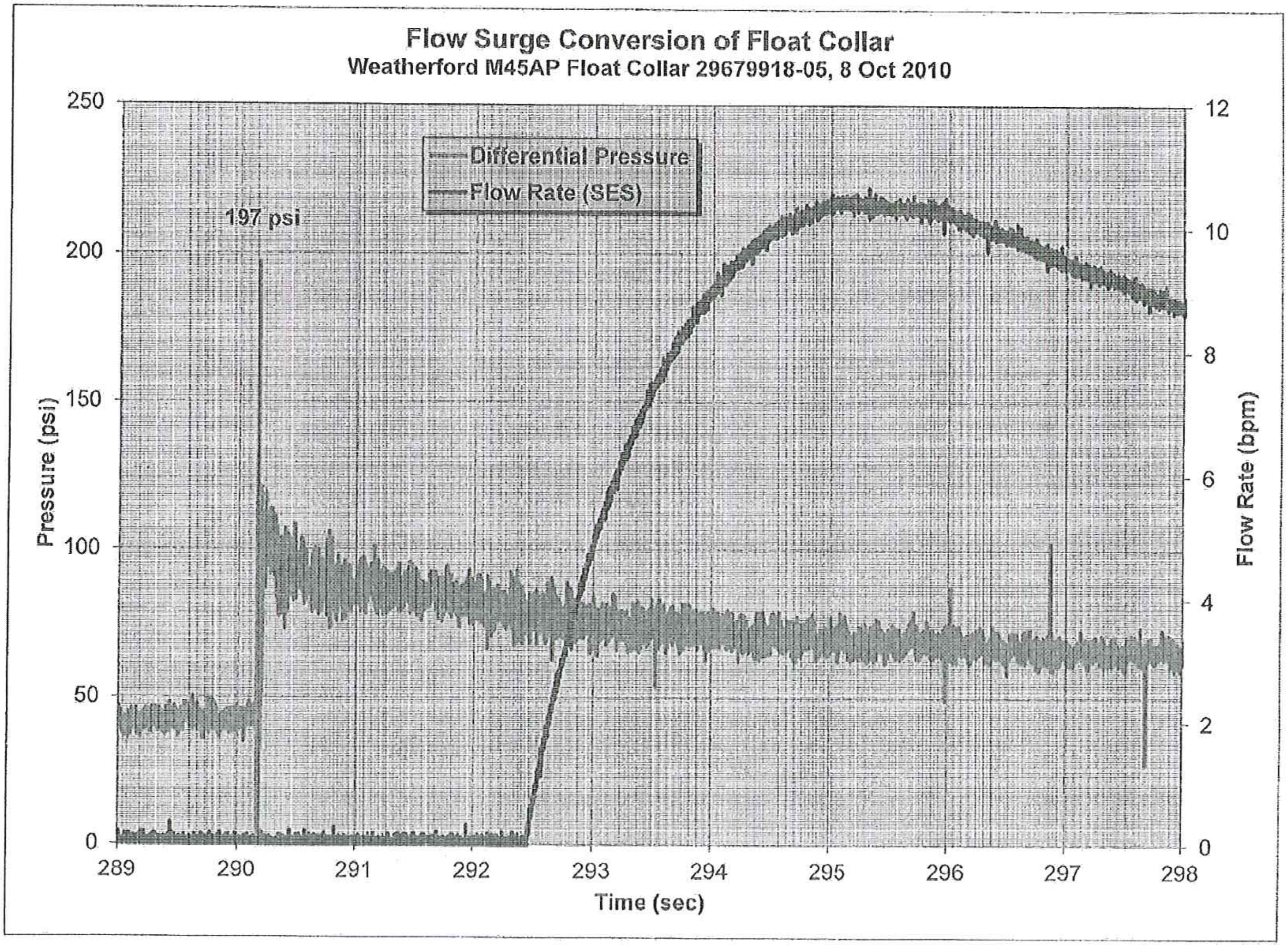


Figure F-4

1601072-05 Blockage_Conv.xlsx

11/17/2010

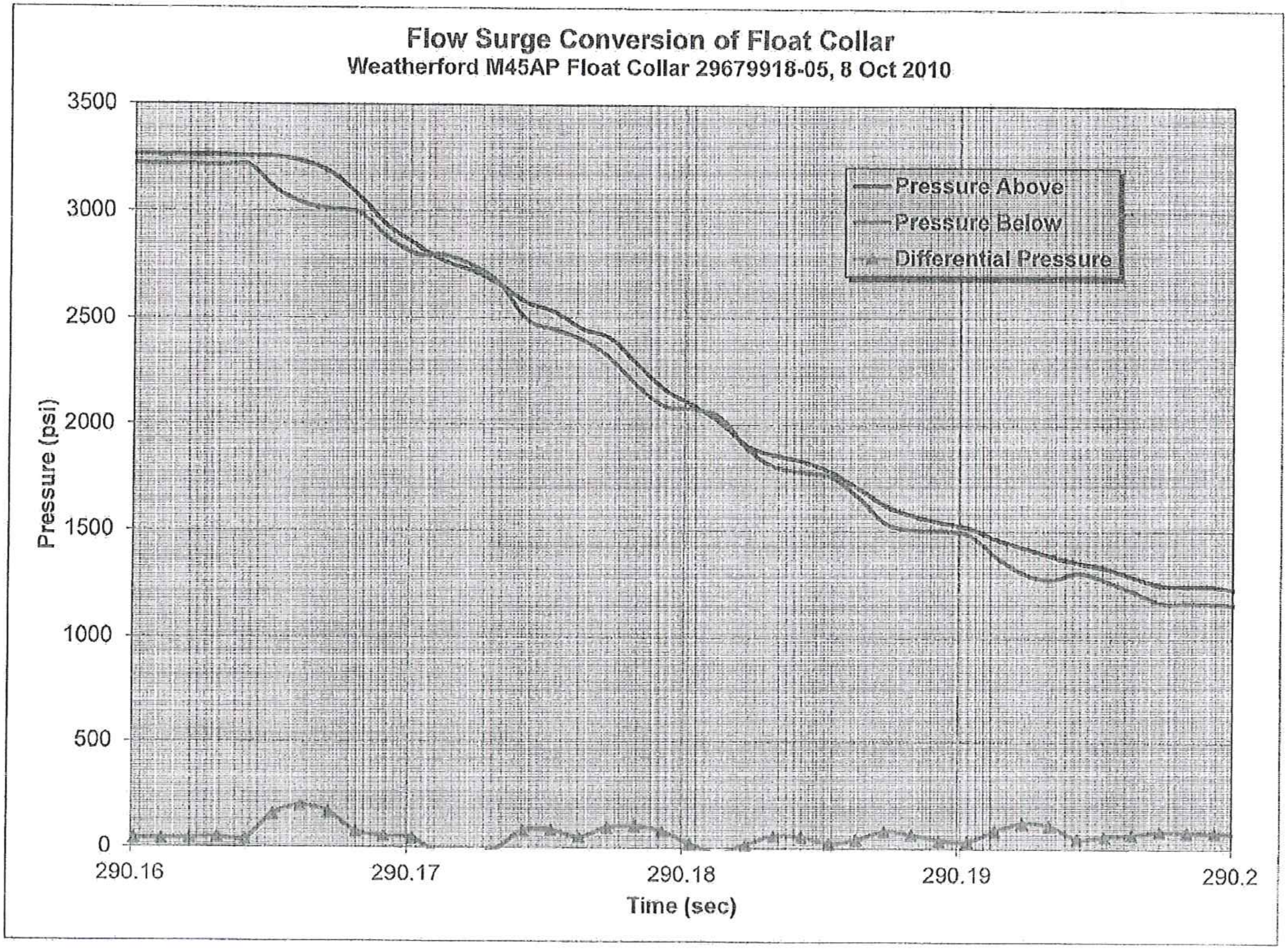


Figure F-5

1601072-05 Blockage_Conv.xlsx

10/27/2010

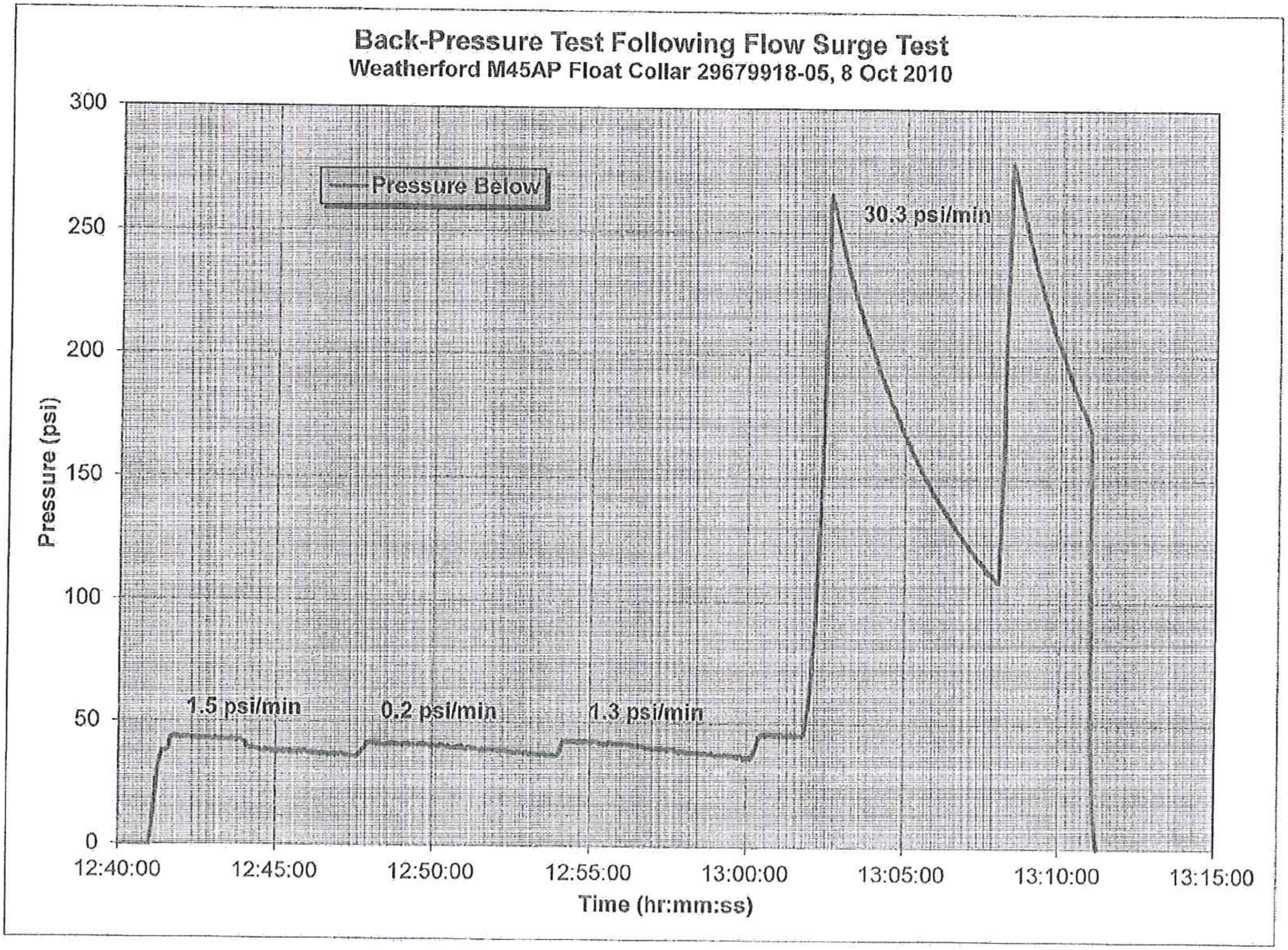


Figure F-6

1601072-05 Blkg_BPress.xlsx

10/27/2010

G

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

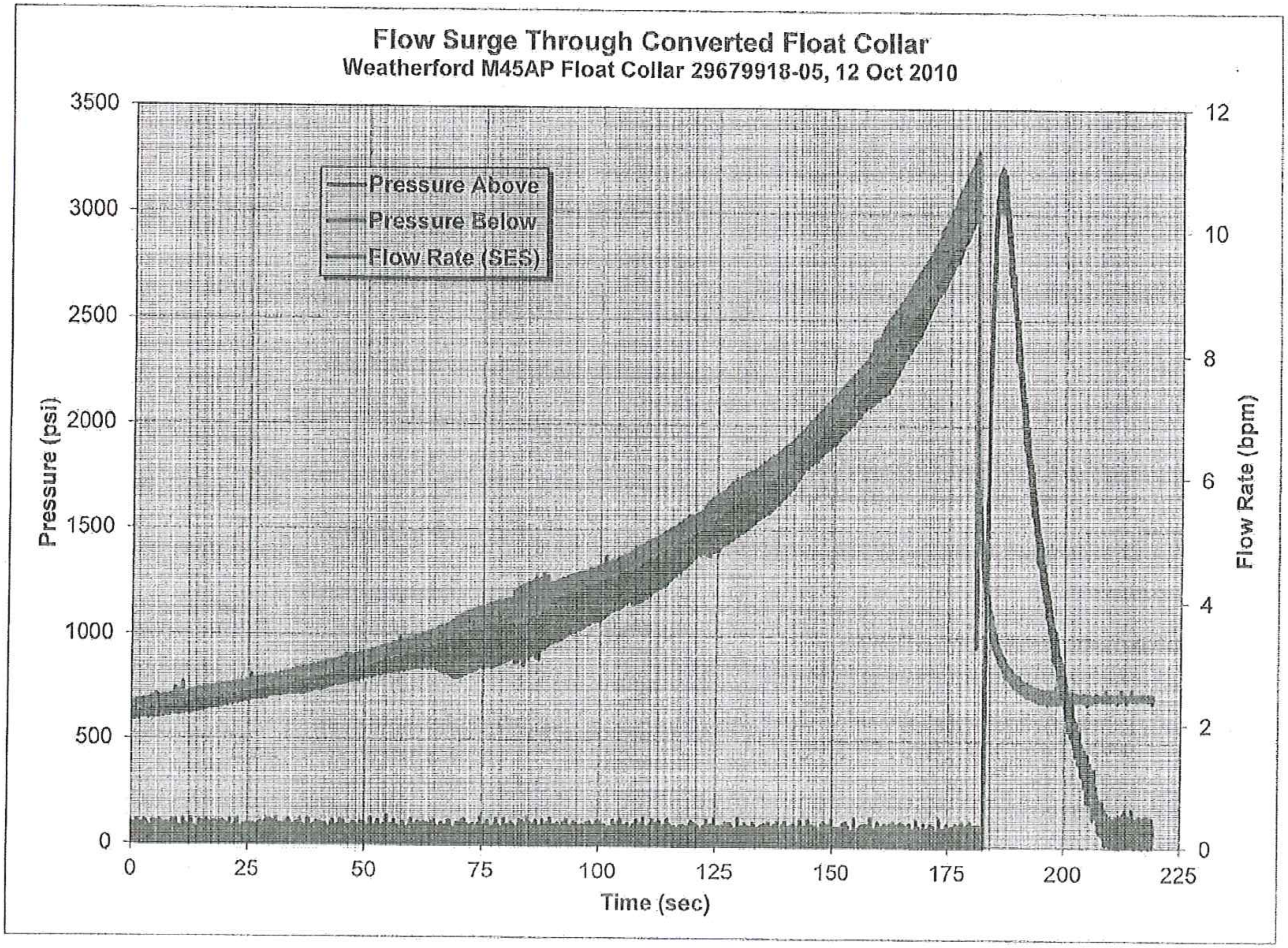


Figure G-1

1601072-05-3 Surge.xlsx

10/27/2010

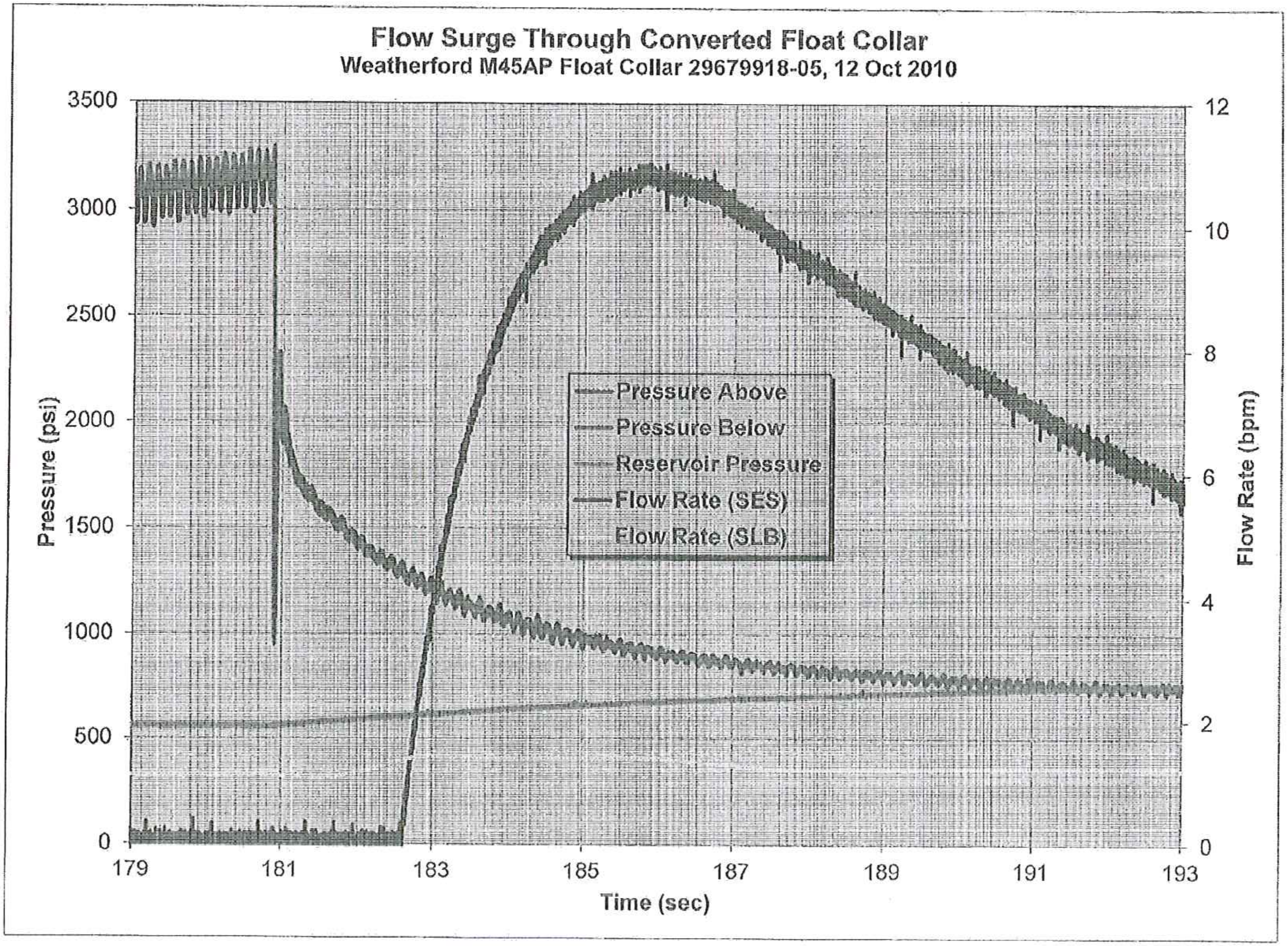


Figure G-2

1601072-05-3 Surge.xlsx

10/27/2010

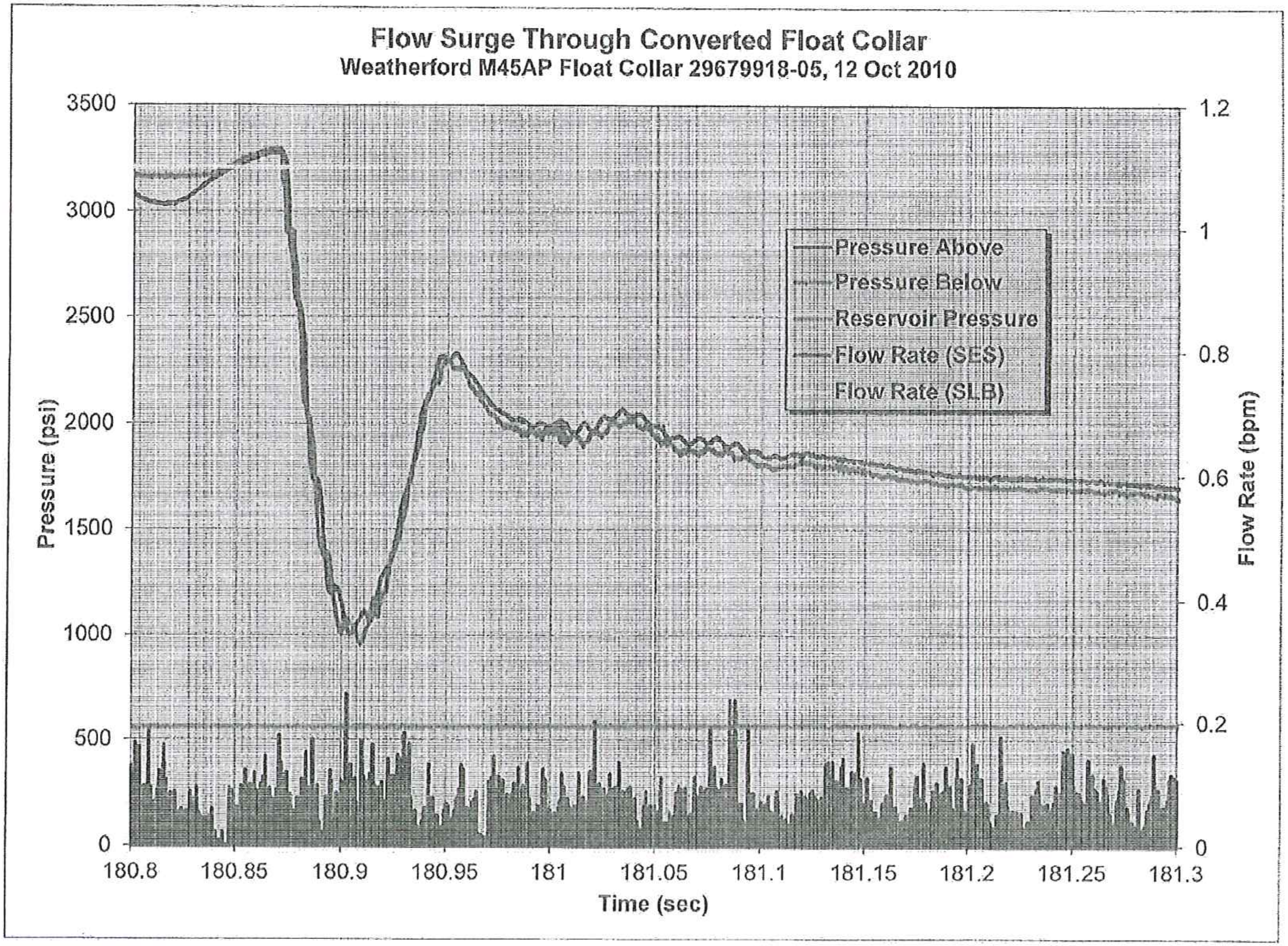


Figure G-3

1601072-05-3 Surge.xlsx

10/27/2010

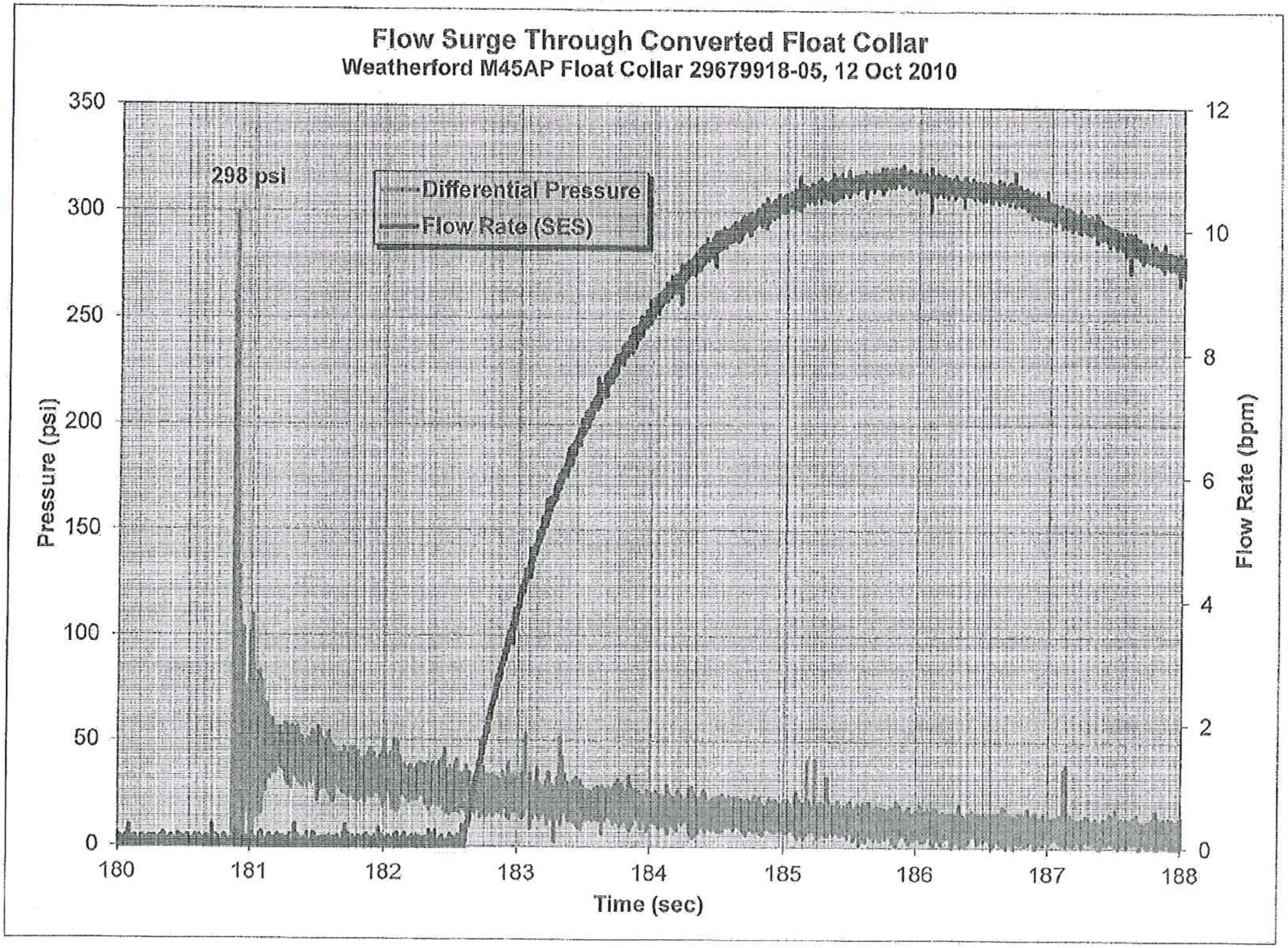


Figure G-4

1601072-05-3 Surge.xlsx

11/17/2010

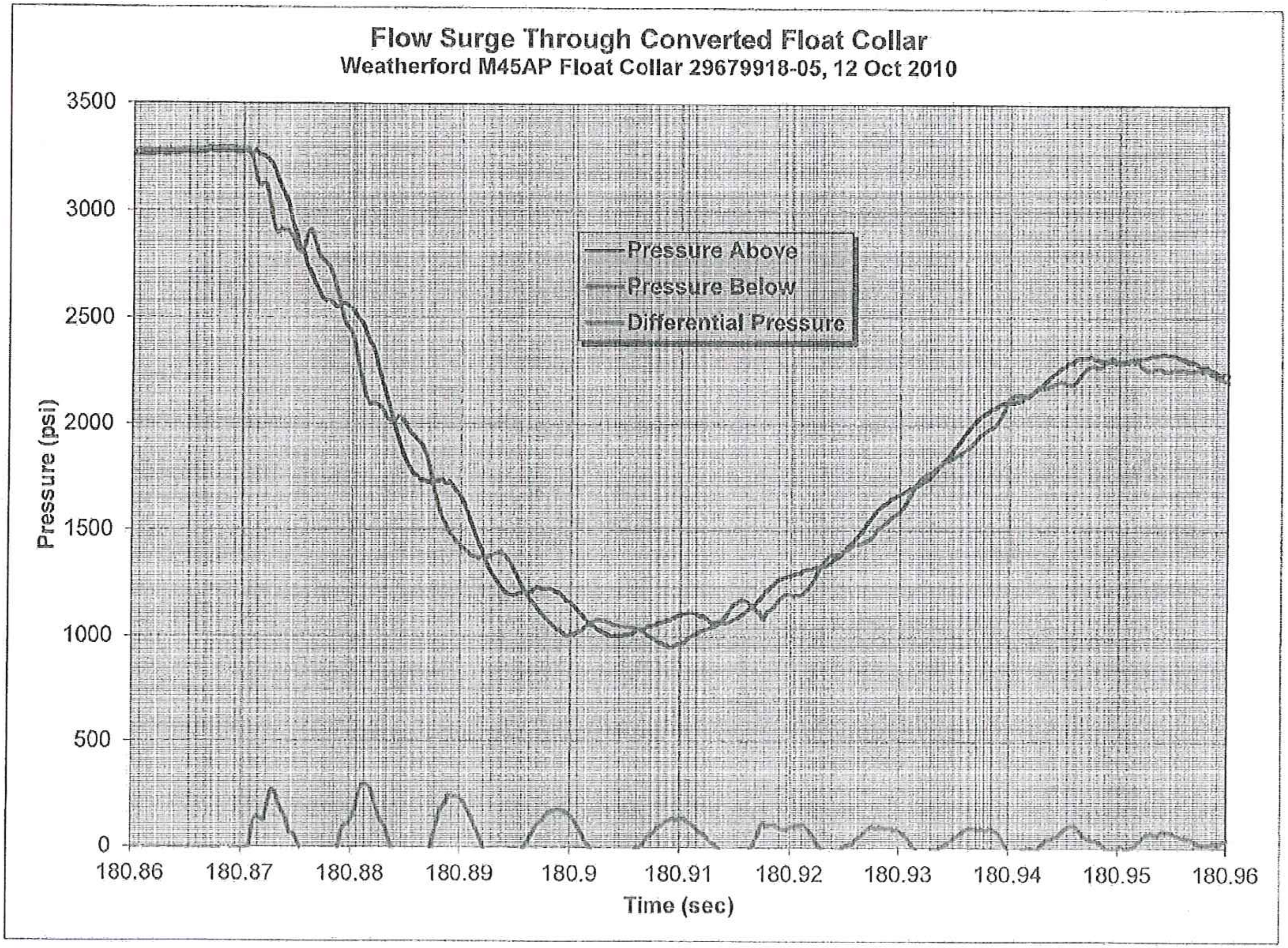


Figure G-5

1601072-05-3 Surge.xlsx

10/27/2010

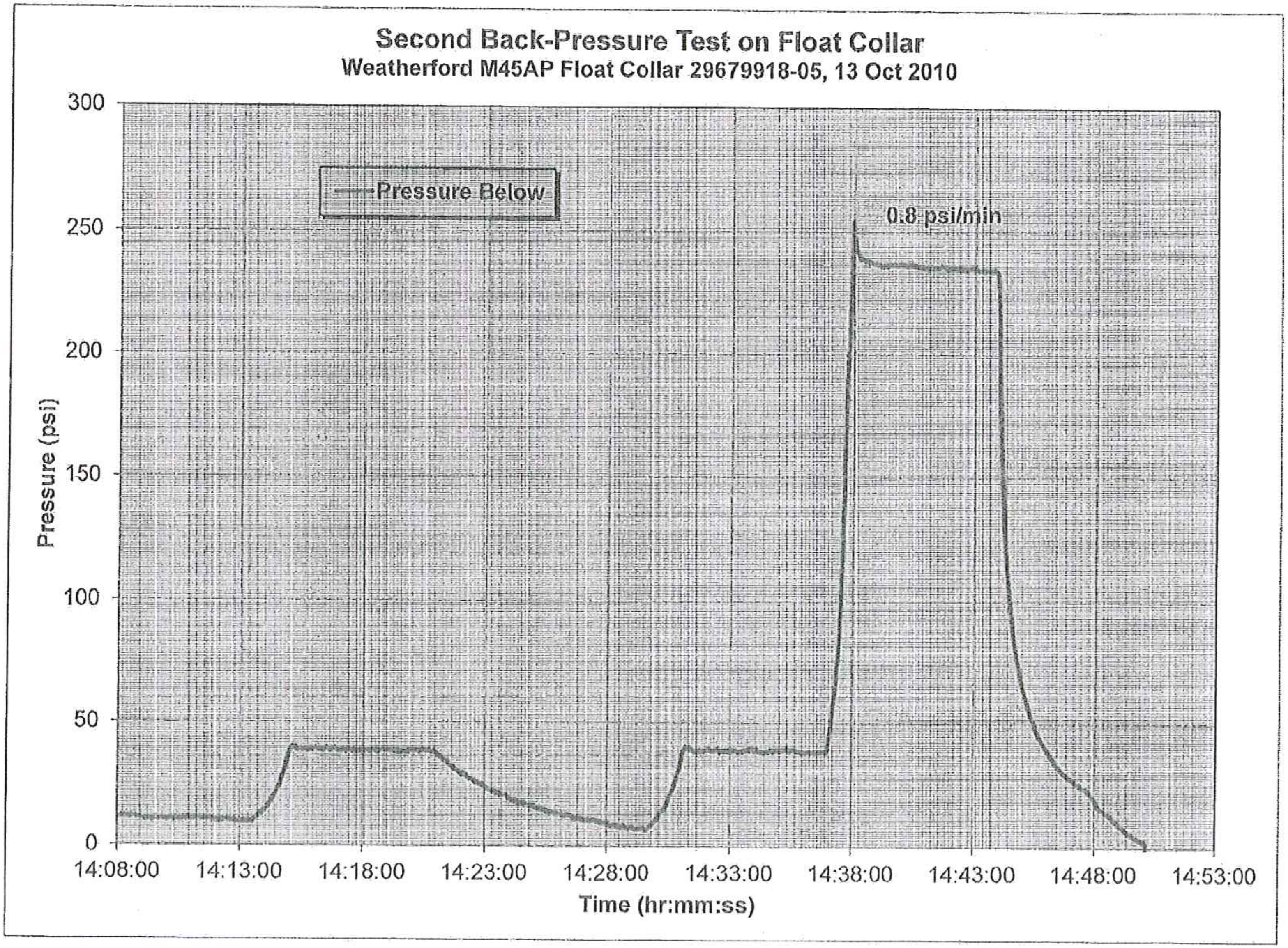


Figure G-6

1601072-05-8 BPressure.xlsx

10/27/2010

H

Annex H Flow Surge Conversion Test (SN-04)

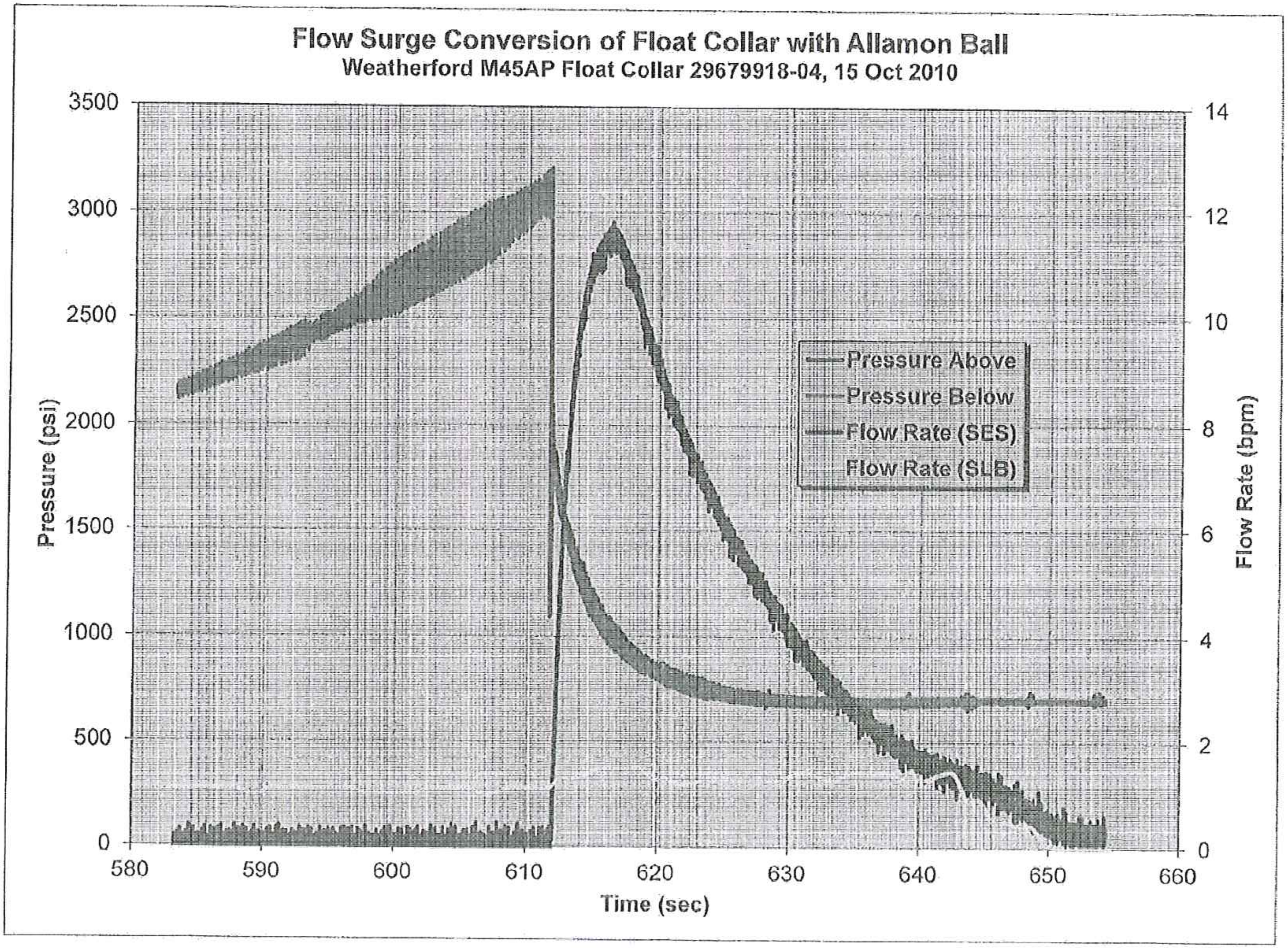


Figure H-1

1601072-04 Conversion.xlsx

11/1/2010

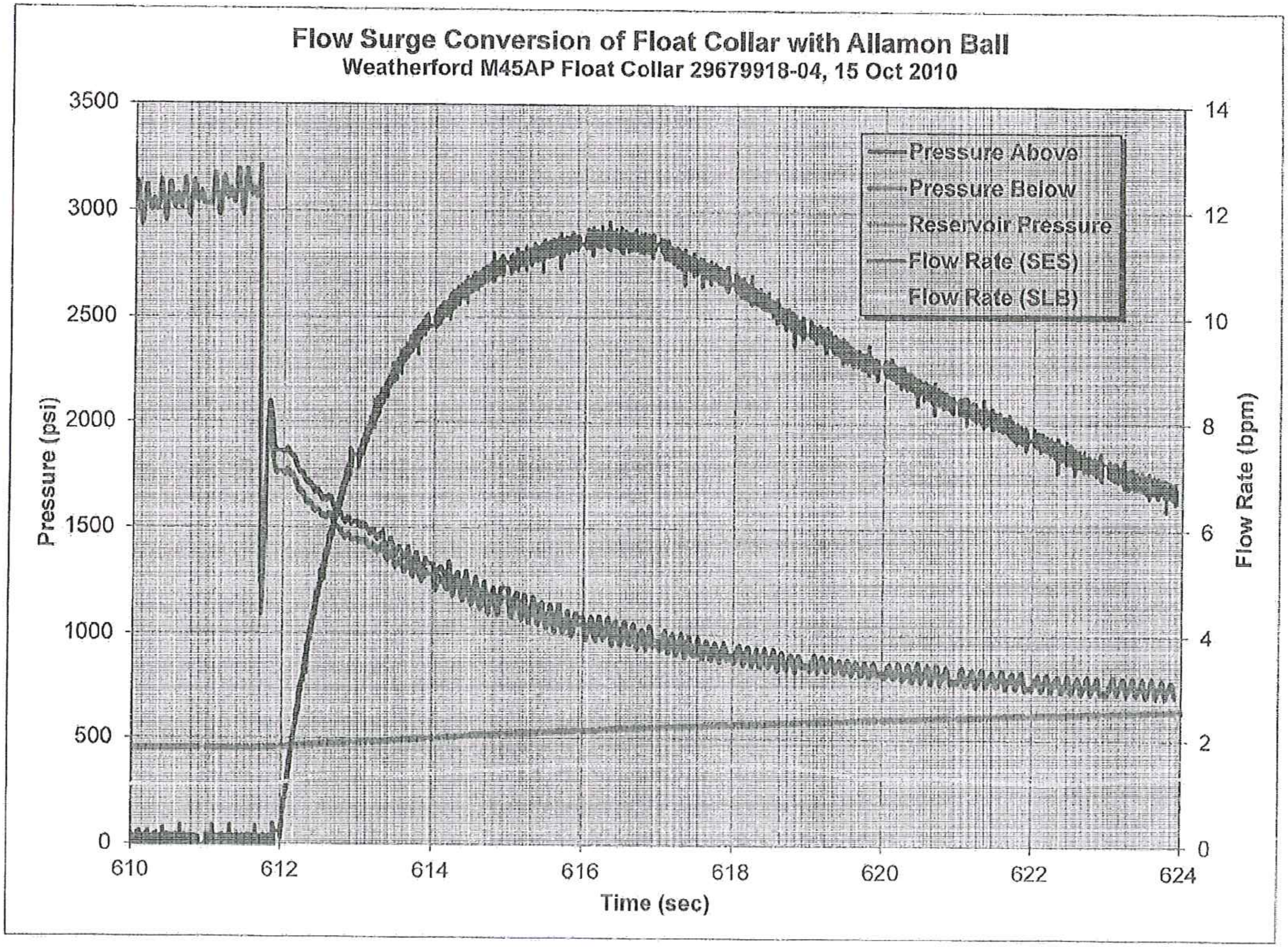


Figure H-2

1601072-04 Conversion.xlsx

11/1/2010

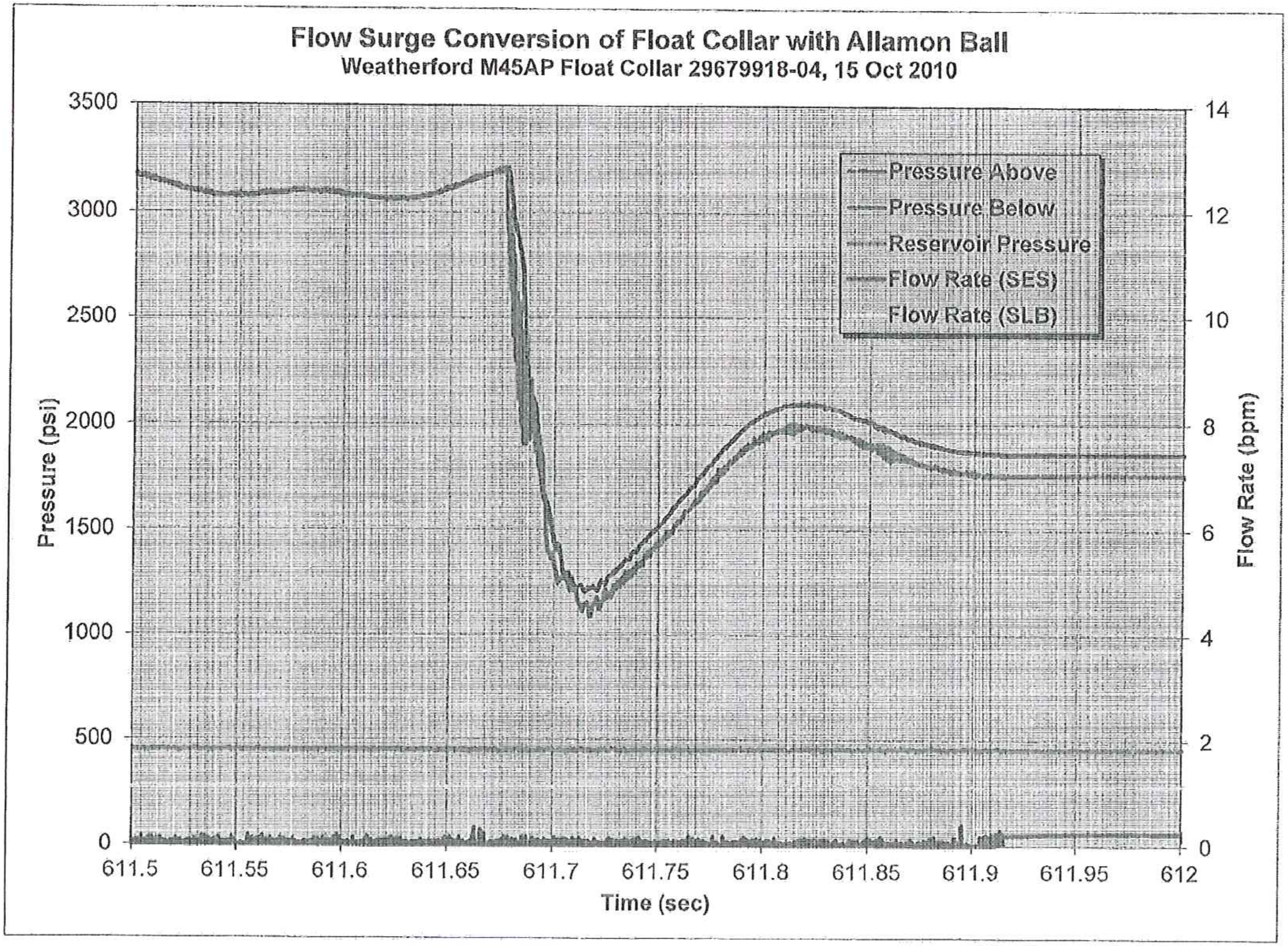


Figure H-3

1601072-04 Conversion.xlsx

11/1/2010

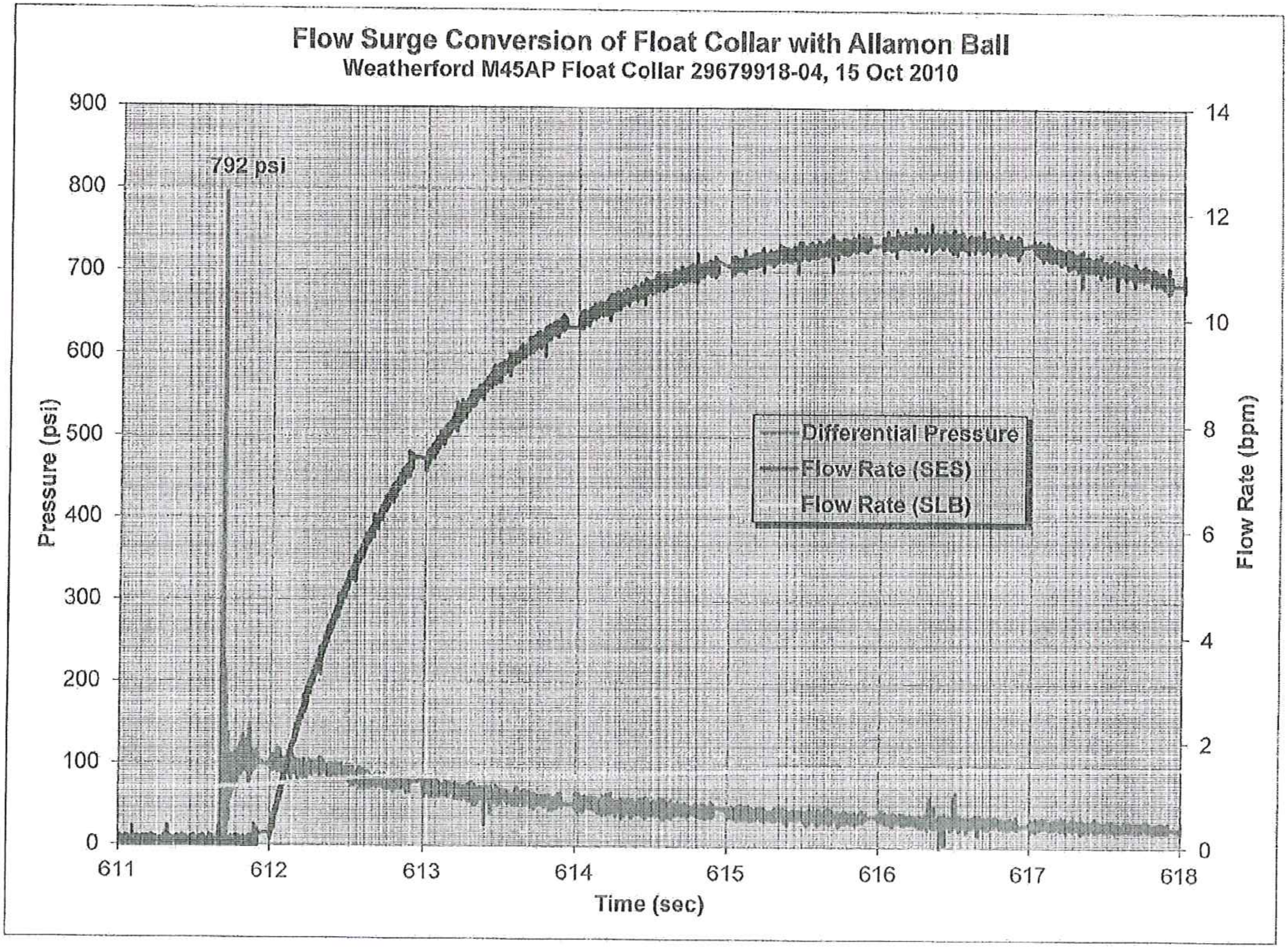


Figure H-4

1601072-04 Conversion.xlsx

11/18/2010

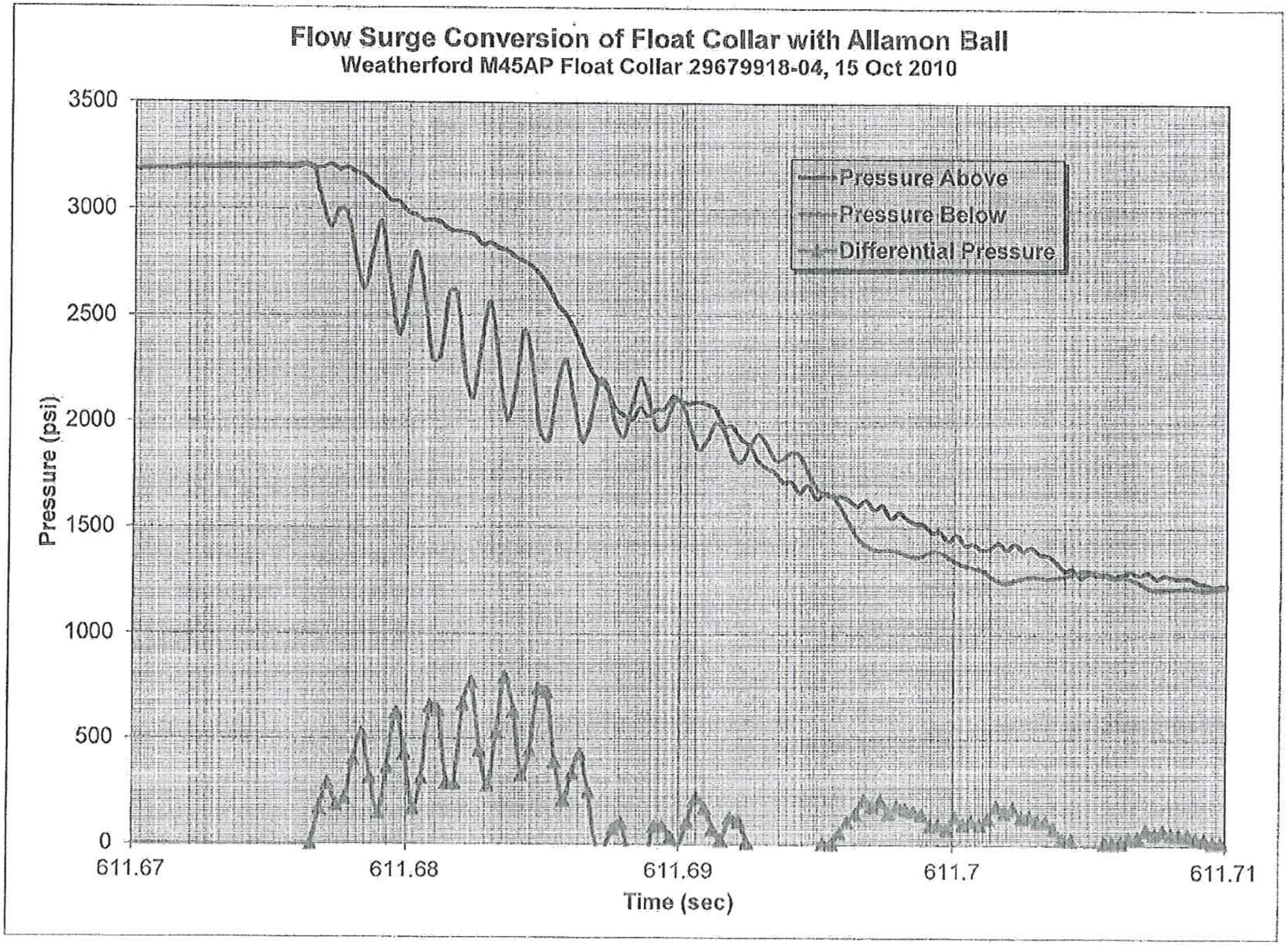


Figure H-5

1601072-04 Conversion.xlsx

10/27/2010

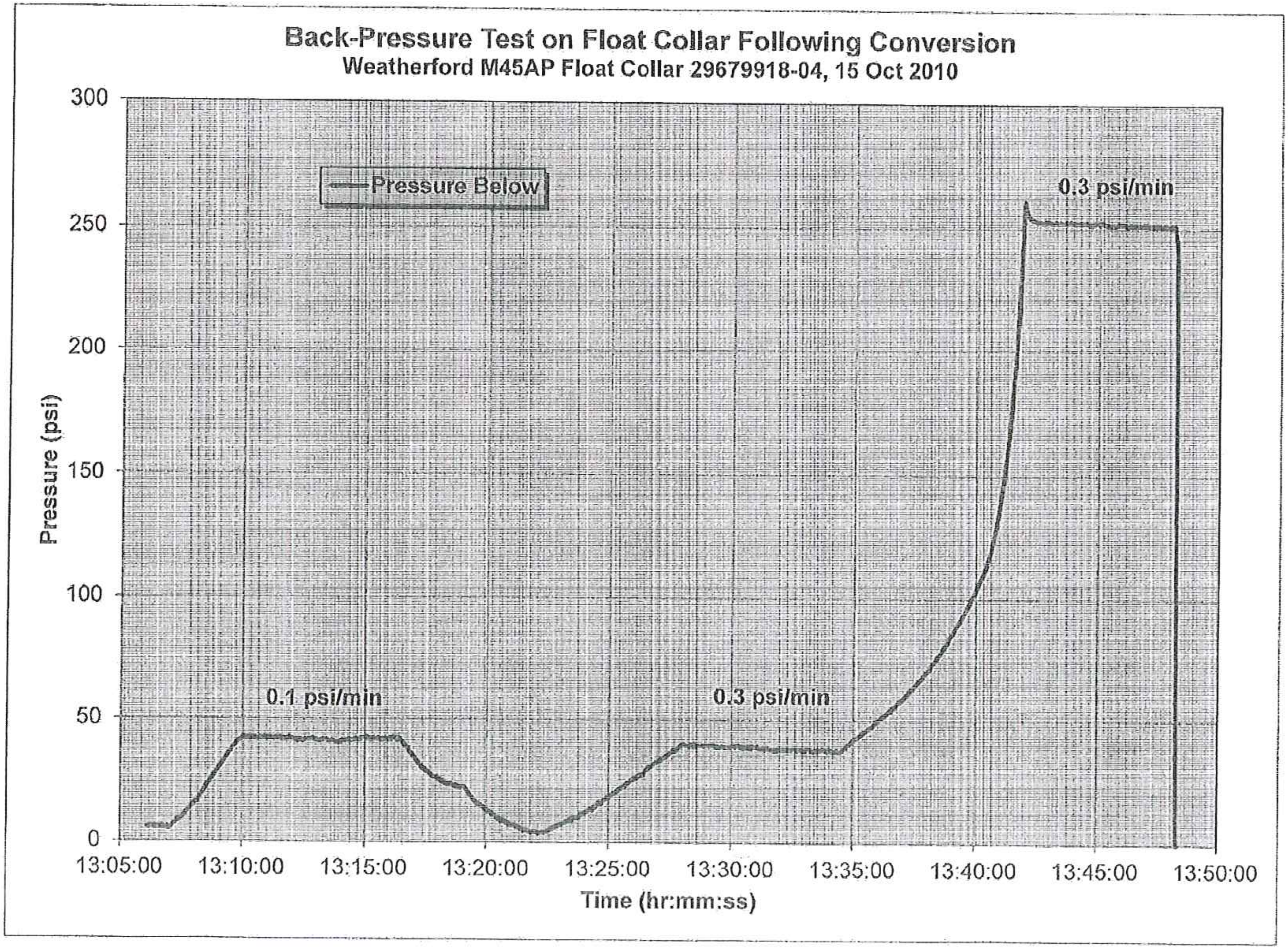


Figure H-6

1601072-04-2 BPress.xlsx

10/27/2010

1

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

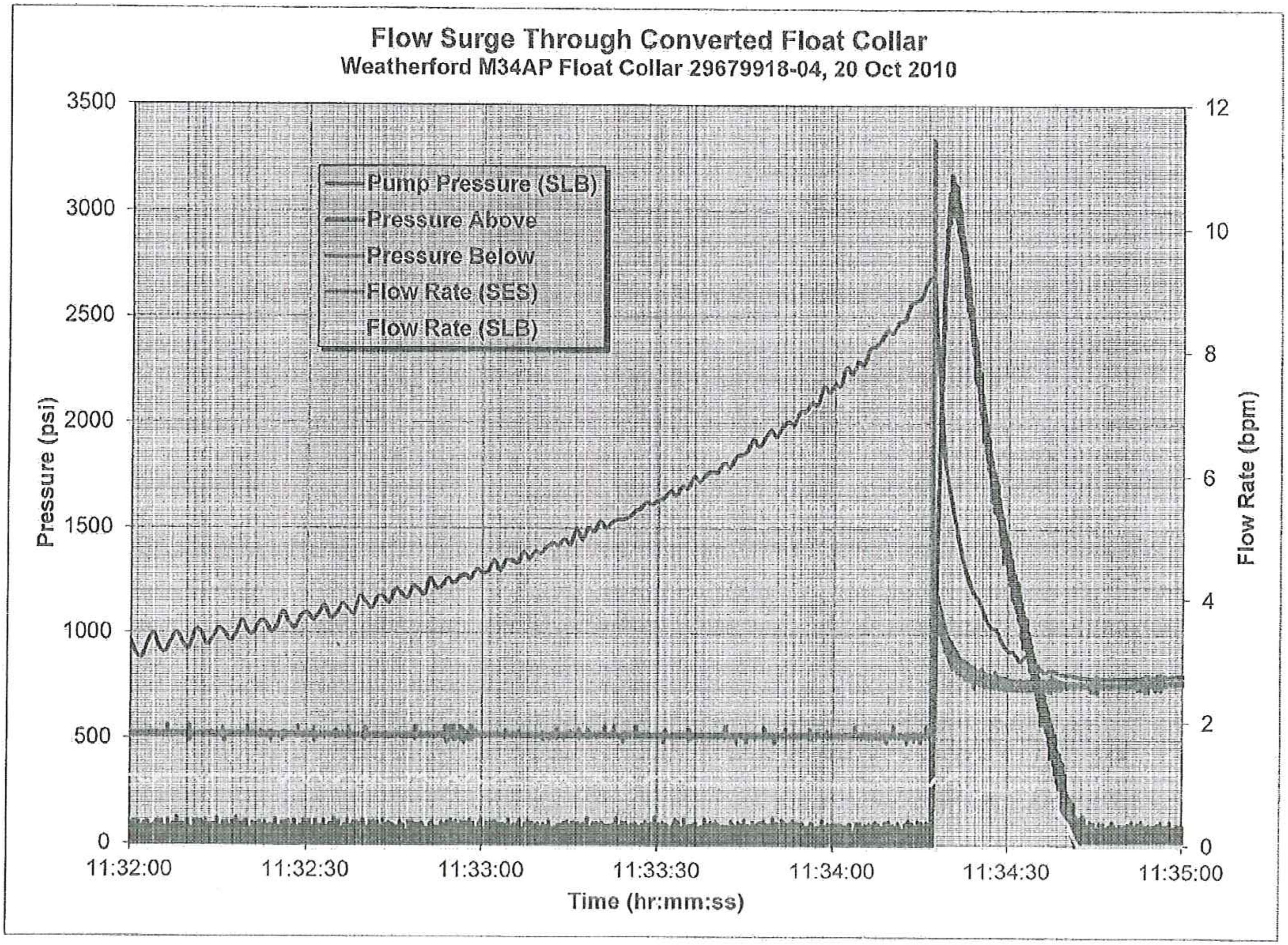


Figure I-1

1601072-04-3 Surge Flow.xlsx

10/27/2010

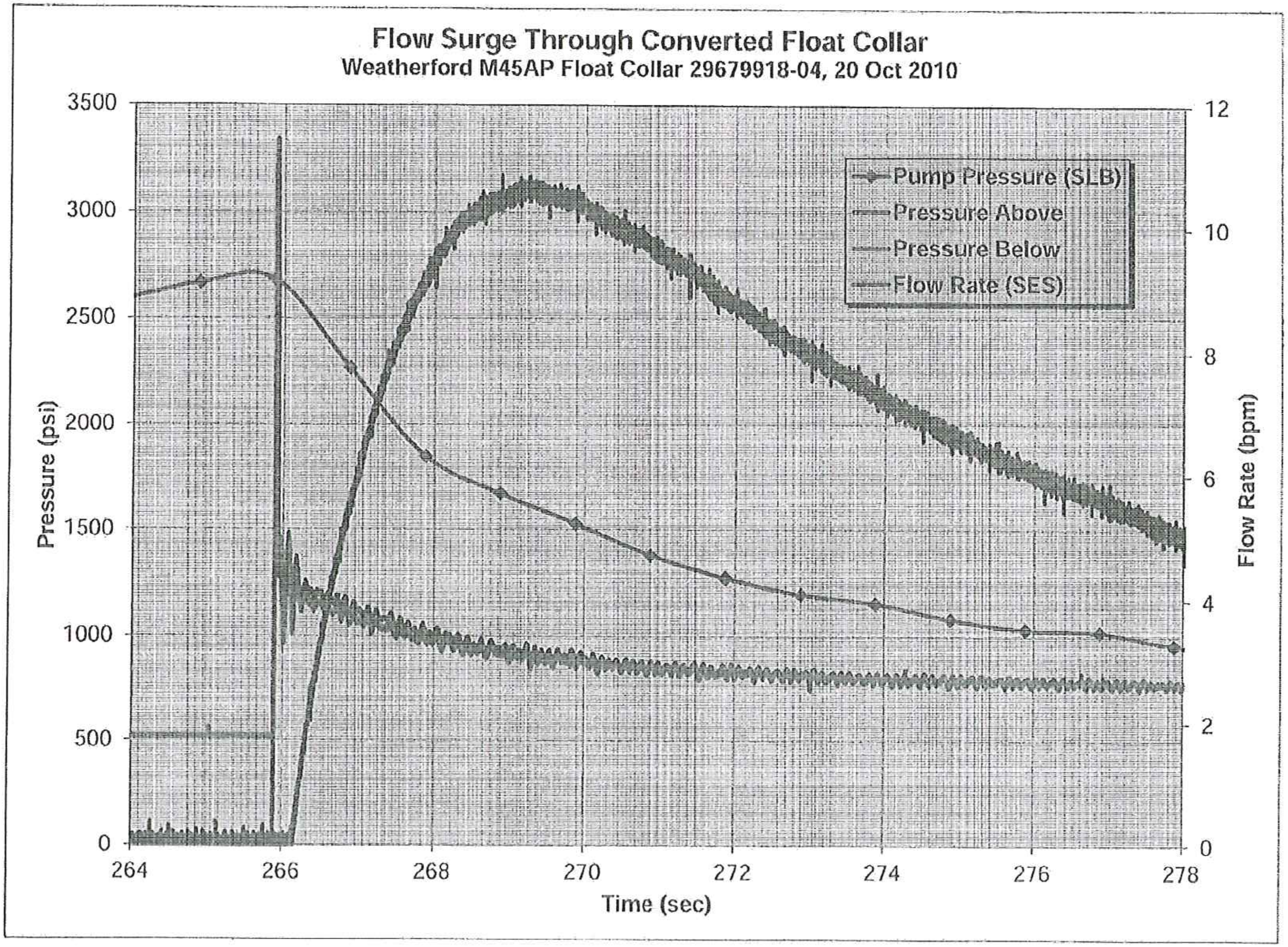


Figure I-2

1601072-04-3 Surge Flow.xlsx

10/27/2010

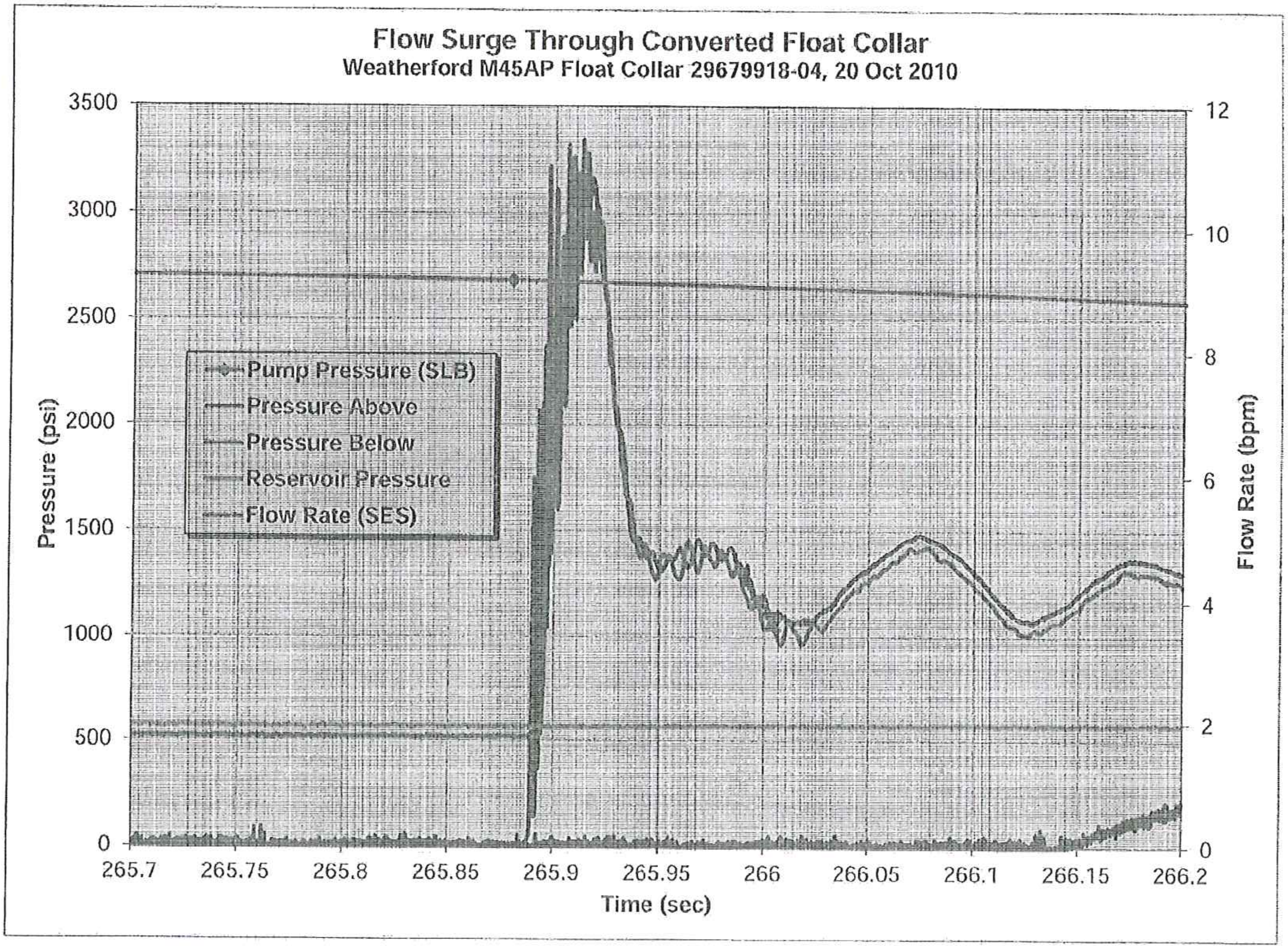


Figure I-3

1601072-04-3 Surge Flow.xlsx

10/27/2010

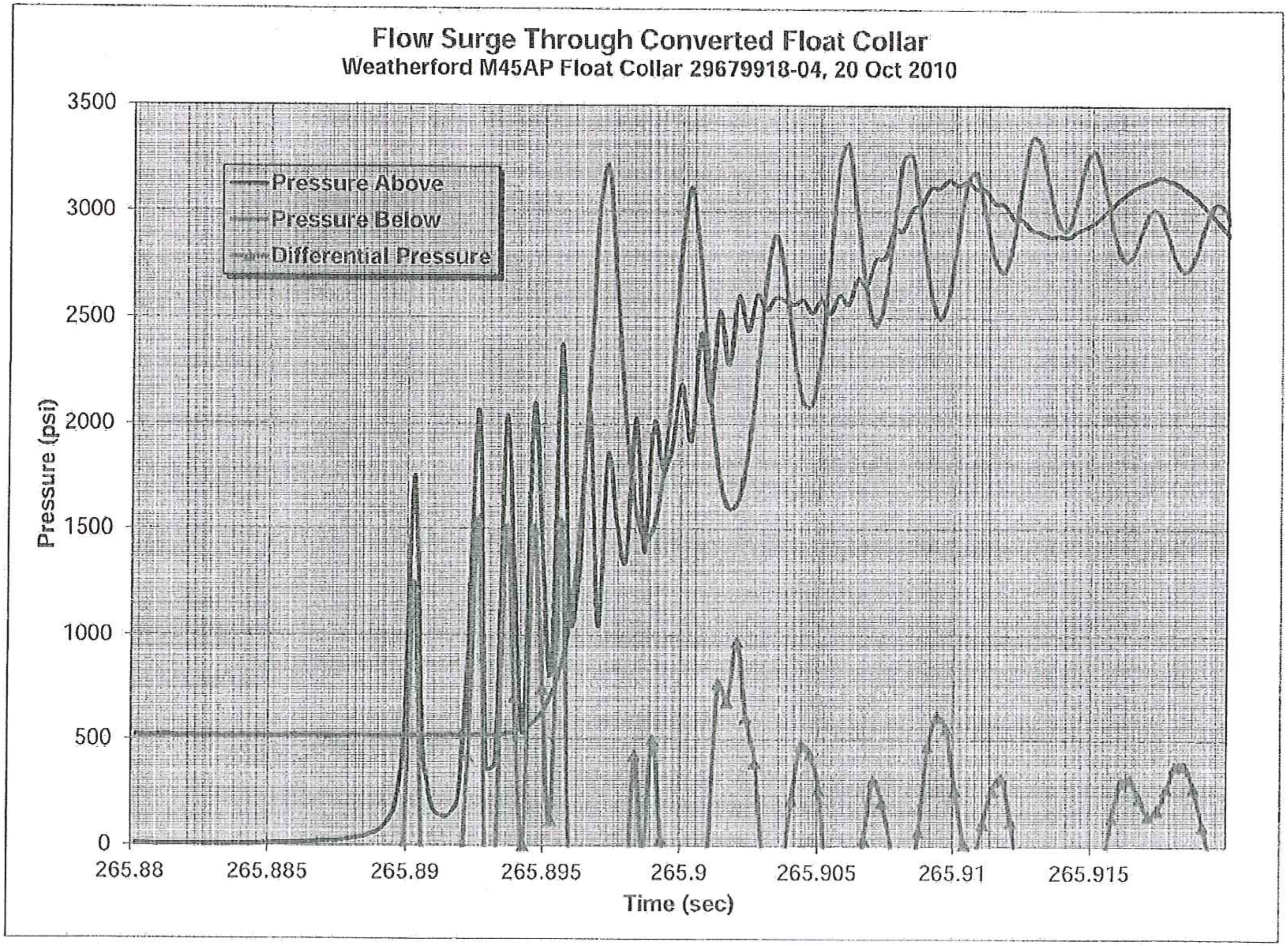


Figure I-5

1601072-04-3 Surge Flow.xlsx

10/27/2010

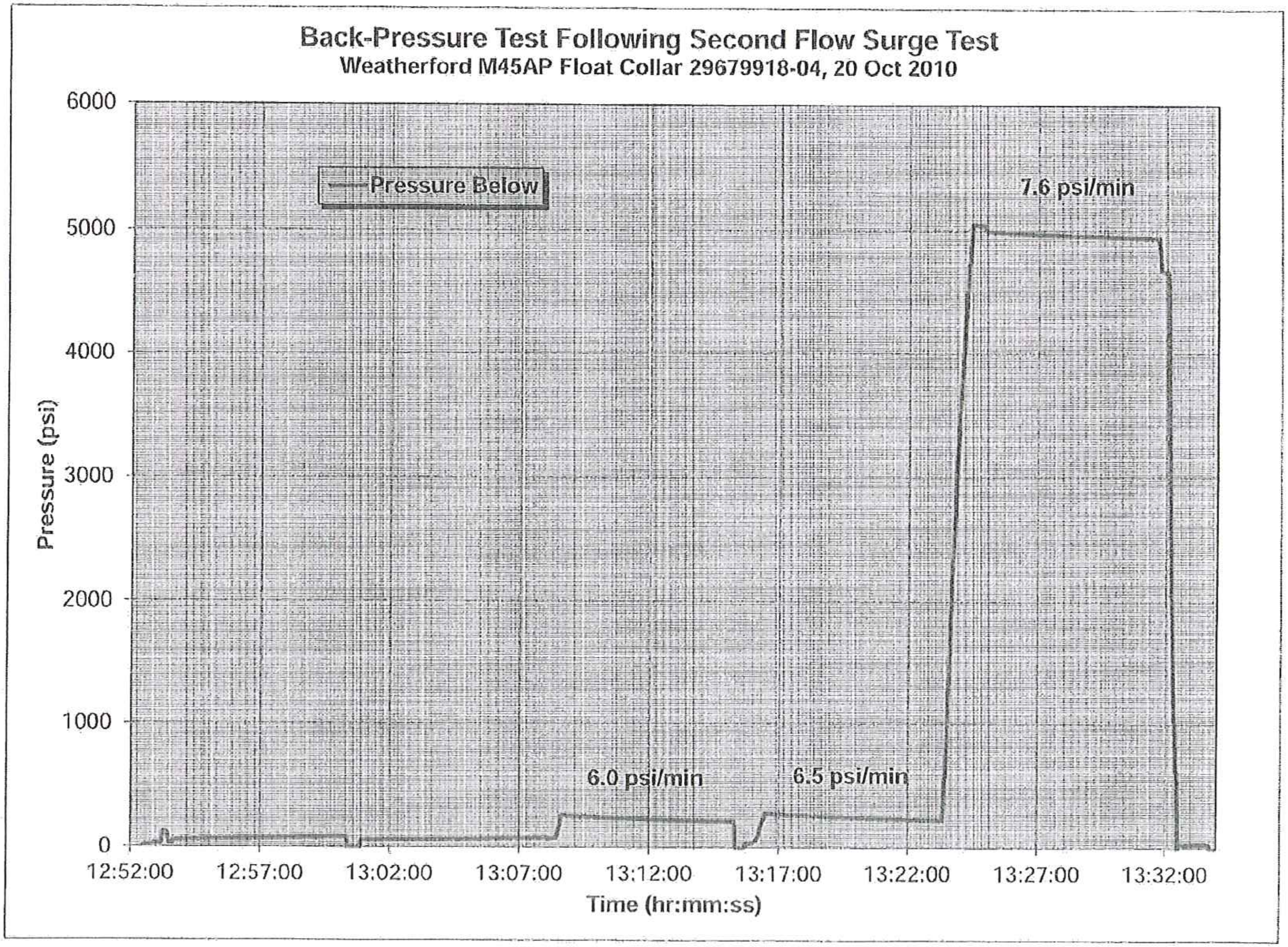


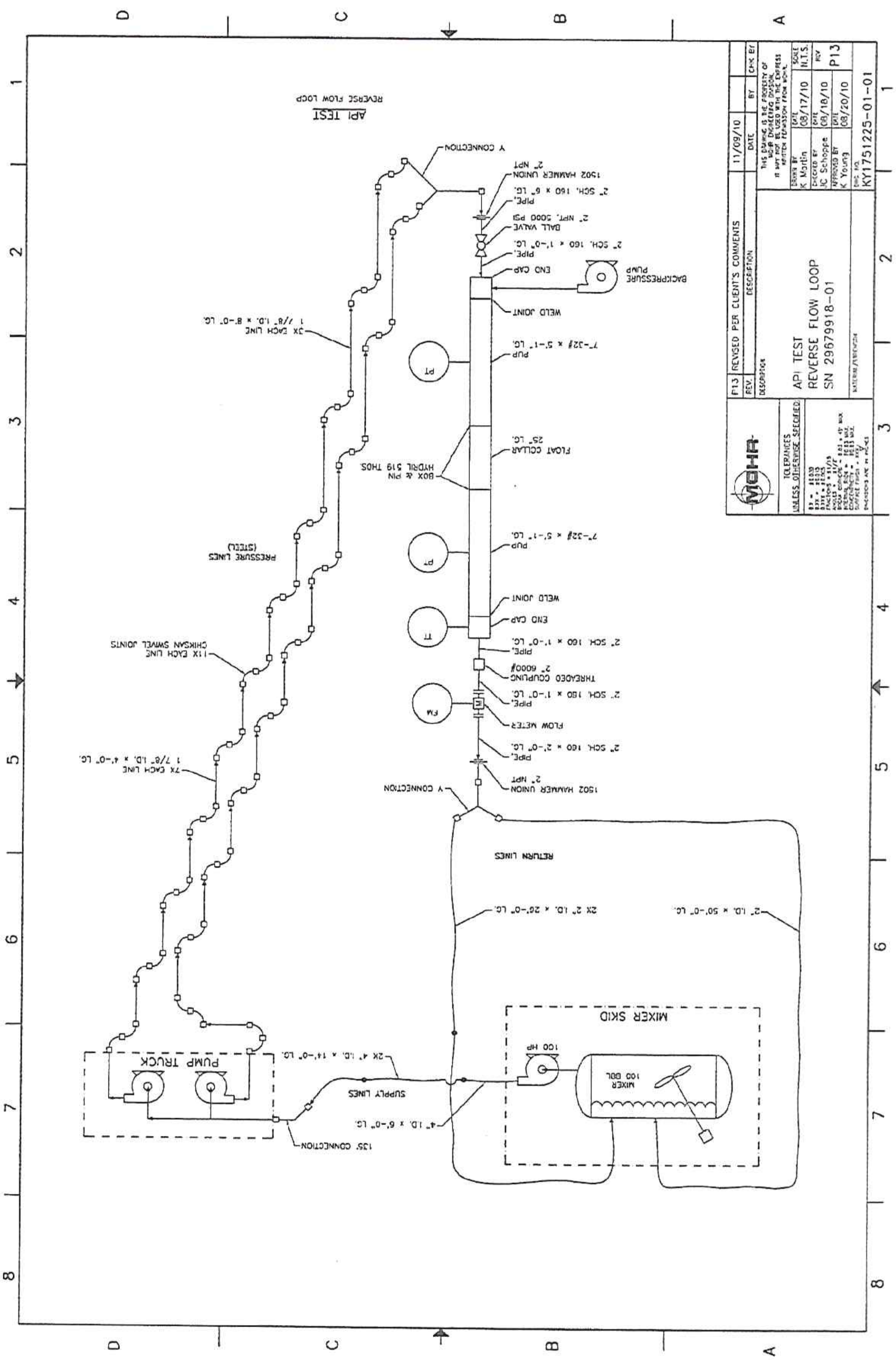
Figure I-6

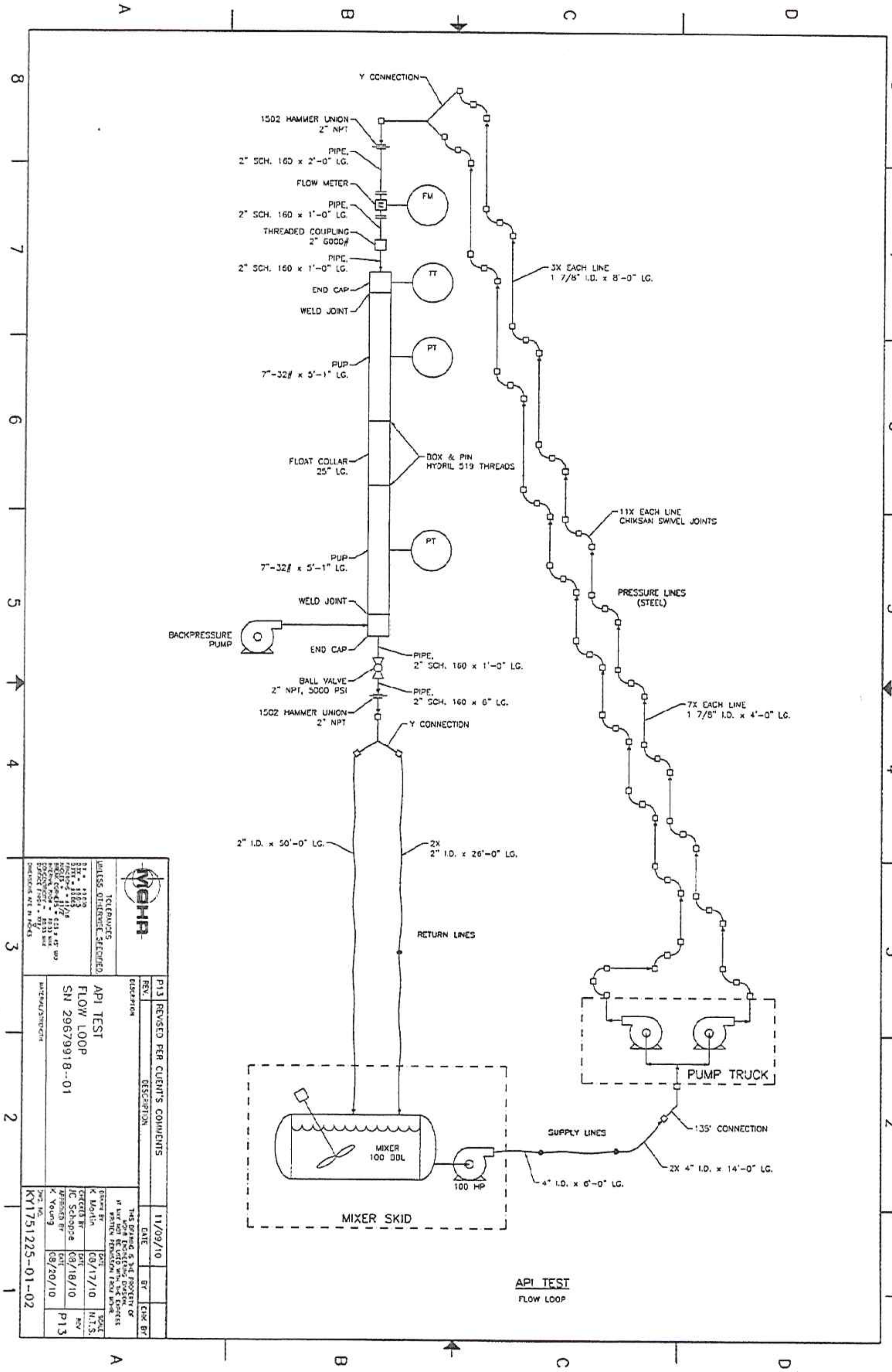
1601072-04-3 bpress.xlsx

10/27/2010

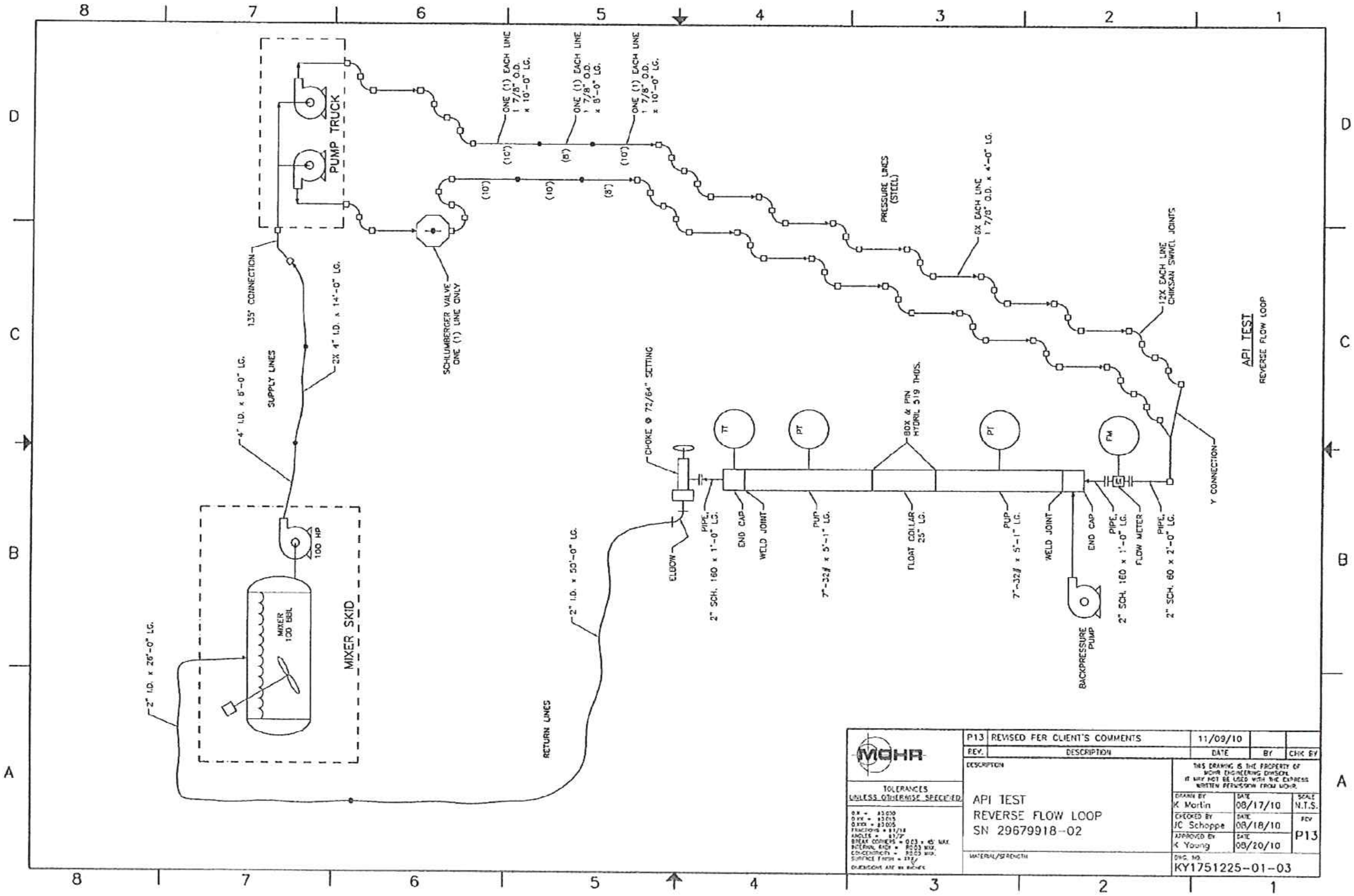
J

Annex J Drawings


API TEST
REVERSE FLOW LOOP
Y CONNECTION
1502 HAMMER UNION 2" NPT
PIPE, 2" SCH. 160 x 6" LG.
BALL VALVE 2" NPT, 5000 PSI
PIPE, 2" SCH. 160 x 1'-0" LG.
END CAP
BACKPRESSURE PUMP
WELD JOINT
PUP 7"-32# x 5'-1" LG.
PT
FLOAT COLLAR 25' LG.
BOX & PIN HYDRIL 519 THDS.
PRESSURE LINES (STEEL)
2X EACH LINE 1 7/8" I.D. x 8'-0" LG.
CHIKSAN SWIVEL JOINTS 11X EACH LINE
7X EACH LINE 1 7/8" I.D. x 4'-0" LG.
TT
THREADED COUPLING 2" 6000#
FM
FLOW METER
PIPE, 2" SCH. 160 x 2'-0" LG.
RETURN LINES
2X 2" I.D. x 26'-0" LG.
2" I.D. x 50'-0" LG.
MIXER SKID
100 HP
100 BBL MIXER
PUMP TRUCK
2X 4" I.D. x 14'-0" LG.
SUPPLY LINES
4" I.D. x 6'-0" LG.
135° CONNECTION
P13 REVISED PER CLIENT'S COMMENTS 11/09/10
REV. DESCRIPTION DATE BY CHK BY
MOHR
TOLERANCES UNLESS OTHERWISE SPECIFIED
API TEST
REVERSE FLOW LOOP
SN 29679918-01
DRAWN BY K Martin 08/17/10
CHECKED BY JC Schoppe 08/18/10
APPROVED BY K Young 08/20/10
SCALE N.T.S.
REV P13
KY1751225-01-01

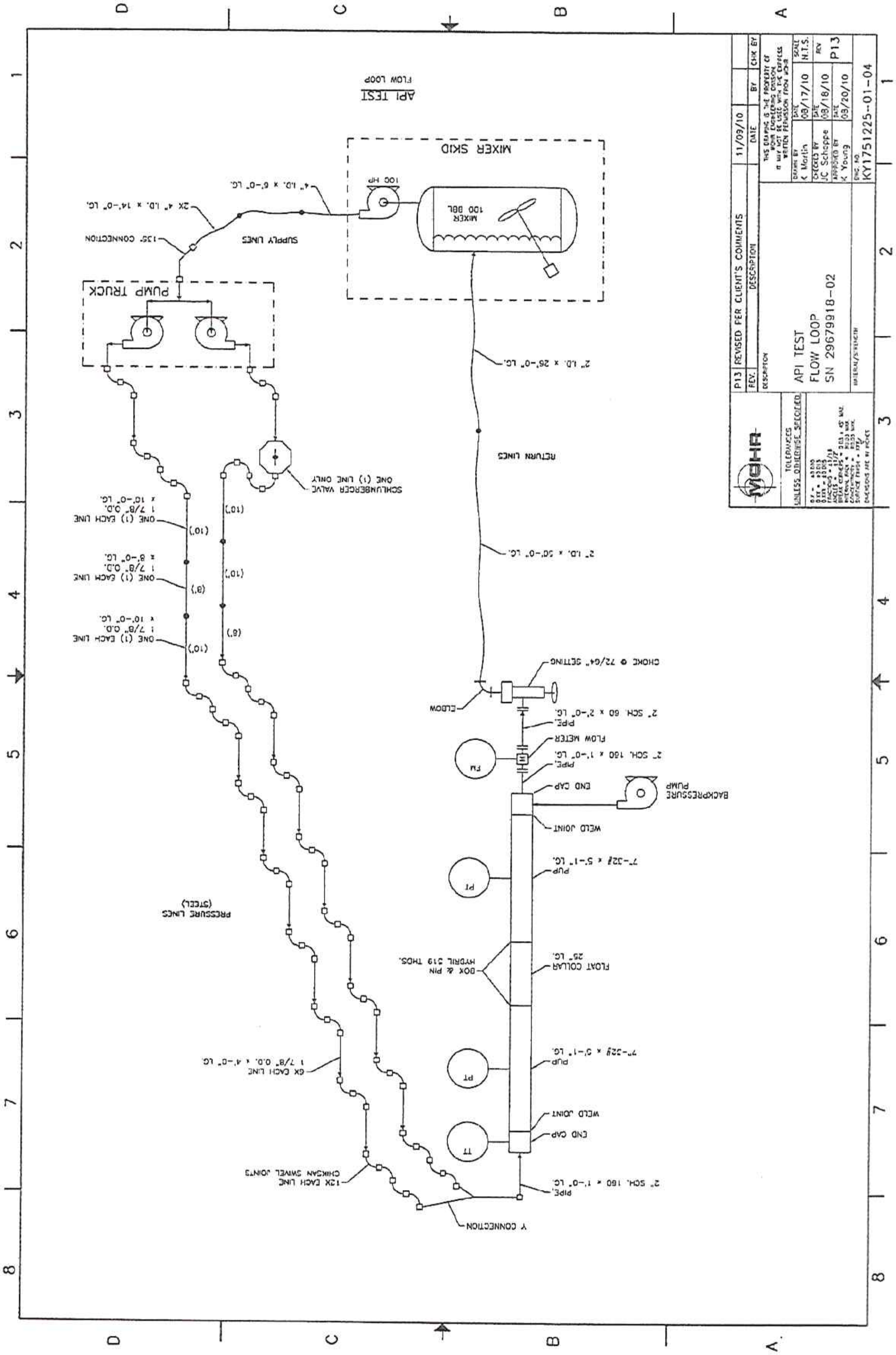


API TEST
FLOW LOOP
MIXER SKID
MIXER
100 BBL
100 HP
4" I.D. x 6'-0" LG.
SUPPLY LINES
2X 4" I.D. x 14'-0" LG.
135' CONNECTION
PUMP TRUCK
RETURN LINES
2" I.D. x 50'-0" LG.
2X
2" I.D. x 26'-0" LG.
Y CONNECTION
1502 HAMMER UNION
2" NPT
PIPE,
2" SCH. 160 x 6" LG.
BALL VALVE
2" NPT, 5000 PSI
PIPE,
2" SCH. 160 x 1'-0" LG.
END CAP
BACKPRESSURE
PUMP
WELD JOINT
PUP
7"-32# x 5'-1" LG.
PT
FLOAT COLLAR
25" LG.
BOX & PIN
HYDRIL 519 THREADS
PUP
7"-32# x 5'-1" LG.
PT
WELD JOINT
END CAP
TT
PIPE,
2" SCH. 160 x 1'-0" LG.
THREADED COUPLING
2" 6000#
PIPE,
2" SCH. 160 x 1'-0" LG.
FM
FLOW METER
PIPE,
2" SCH. 160 x 2'-0" LG.
1502 HAMMER UNION
2" NPT
Y CONNECTION
PRESSURE LINES
(STEEL)
7X EACH LINE
1 7/8" I.D. x 4'-0" LG.
11X EACH LINE
CHIKSAN SWIVEL JOINTS
3X EACH LINE
1 7/8" I.D. x 8'-0" LG.
P13
REVISED PER CLIENT'S COMMENTS
11/09/10
REV.
DESCRIPTION
DATE
BY
CHK BY
MOHR
TOLERANCES
UNLESS OTHERWISE SPECIFIED
API TEST
FLOW LOOP
SN 29679918-01
K Martin
08/17/10
SCALE
N.T.S.
JC Schoppe
08/18/10
REV
K Young
08/20/10
P13
KY1751225-01-02

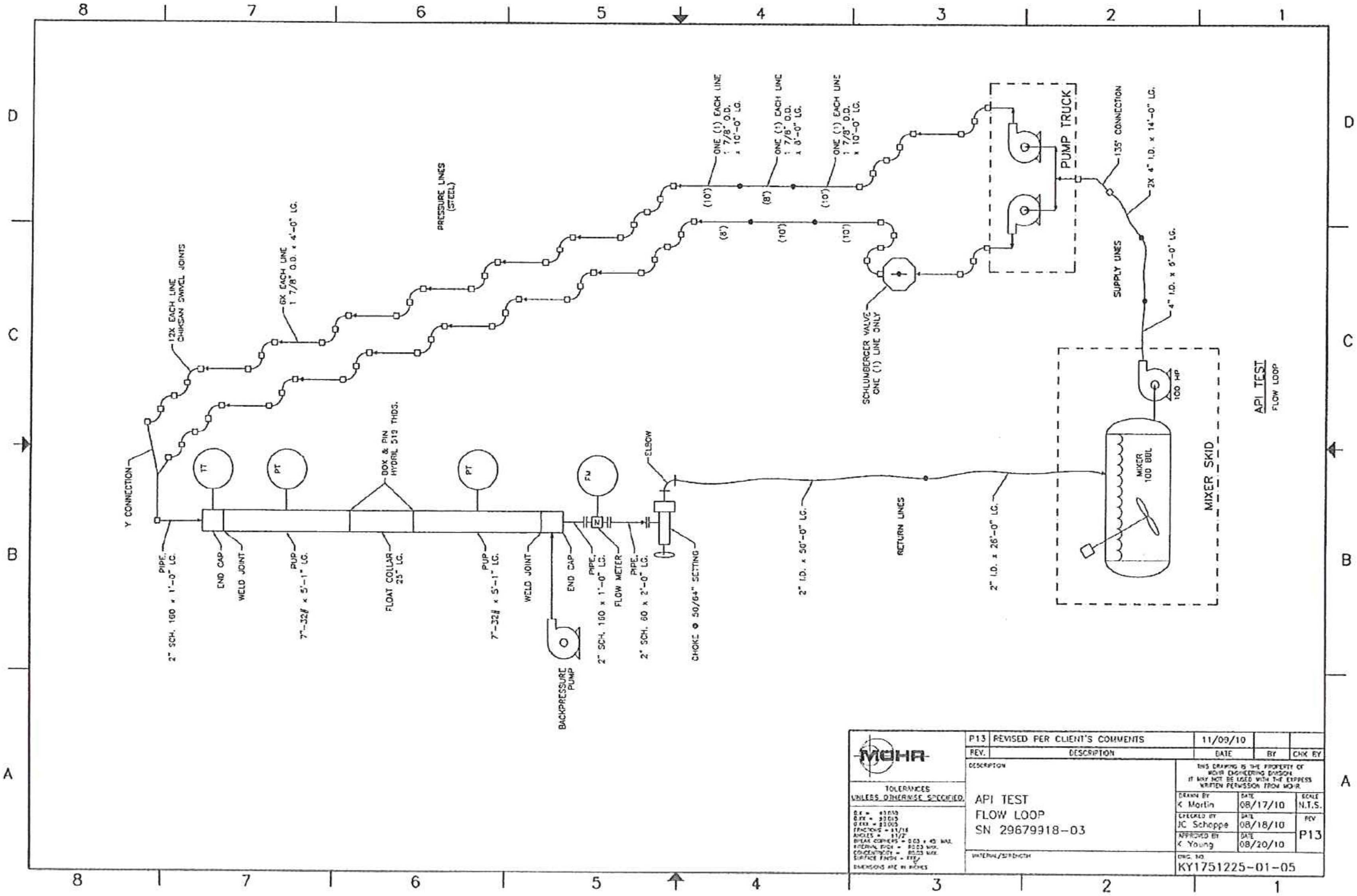


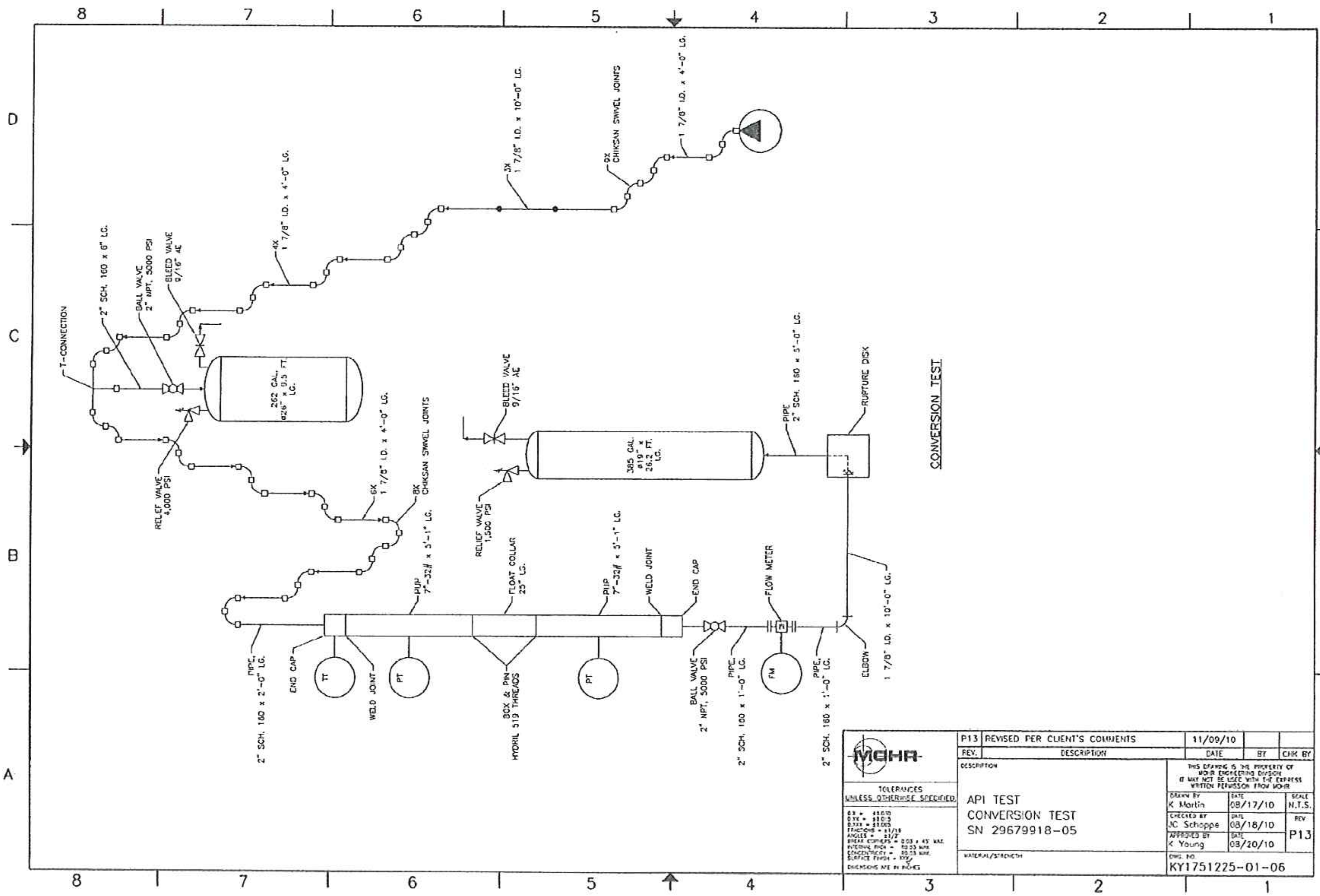
CONFIDENTIAL

BP-HZN-BLY00128634



CONFIDENTIAL BP-HZN-BLY00128635


API TEST
FLOW LOOP
MIXER SKID
MIXER
100 BBL
100 HP
4" I.D. x 5'-0" LG.
2X 4" I.D. x 14'-0" LG.
135° CONNECTION
SUPPLY LINES
PUMP TRUCK
ONE (1) EACH LINE
1 7/8" O.D.
x 10'-0" LG.
ONE (1) EACH LINE
1 7/8" O.D.
x 8'-0" LG.
ONE (1) EACH LINE
1 7/8" O.D.
x 10'-0" LG.
(10')
(8')
(10')
SCHLUMBERGER VALVE
ONE (1) LINE ONLY
PRESSURE LINES
(STEEL)
6X EACH LINE
1 7/8" O.D. x 4'-0" LG.
12X EACH LINE
CHIKSAN SWIVEL JOINTS
Y CONNECTION
RETURN LINES
2" I.D. x 26'-0" LG.
2" I.D. x 50'-0" LG.
ELBOW
CHOKE @ 50/64" SETTING
PIPE,
2" SCH. 60 x 2'-0" LG.
FLOW METER
PIPE,
2" SCH. 160 x 1'-0" LG.
FM
END CAP
BACKPRESSURE
PUMP
WELD JOINT
PT
PUP
7"-32# x 5'-1" LG.
FLOAT COLLAR
25" LG.
BOX & PIN
HYDRIL 513 THDS.
PT
PUP
7"-32# x 5'-1" LG.
WELD JOINT
TT
END CAP
PIPE,
2" SCH. 160 x 1'-0" LG.
MOHR
TOLERANCES
UNLESS OTHERWISE SPECIFIED
P13 REVISED PER CLIENT'S COMMENTS 11/09/10
REV. DESCRIPTION DATE BY CHK BY
DESCRIPTION
API TEST
FLOW LOOP
SN 29679918-03
MATERIAL/STRENGTH
THIS DRAWING IS THE PROPERTY OF MOHR ENGINEERING DIVISION. IT MAY NOT BE USED WITH THE EXPRESS WRITTEN PERMISSION FROM MOHR.
DRAWN BY K Martin DATE 08/17/10 SCALE N.T.S.
CHECKED BY JC Schoppe DATE 08/18/10 REV P13
APPROVED BY K Young DATE 08/20/10
DWG. NO. KY1751225-01-05


CONVERSION TEST
1 7/8" I.D. x 4'-0" LG.
9X CHIKSAN SWIVEL JOINTS
3X 1 7/8" I.D. x 10'-0" LG.
4X 1 7/8" I.D. x 4'-0" LG.
T-CONNECTION
2" SCH. 160 x 6" LG.
BALL VALVE 2" NPT, 5000 PSI
BLEED VALVE 9/16" AE
262 GAL. ø26" x 9.5 FT. LG.
RELIEF VALVE 4,000 PSI
6X 1 7/8" I.D. x 4'-0" LG.
8X CHIKSAN SWIVEL JOINTS
BLEED VALVE 9/16" AE
RELIEF VALVE 1,500 PSI
385 GAL. ø19" x 26.2 FT. LG.
PIPE 2" SCH. 160 x 5'-0" LG.
RUPTURE DISK
PUP 7"-32# x 5'-1" LG.
FLOAT COLLAR 25" LG.
PUP 7"-32# x 5'-1" LG.
WELD JOINT
END CAP
FLOW METER
PIPE, 2" SCH. 160 x 2'-0" LG.
END CAP
TT
WELD JOINT
PT
BOX & PIN HYDRIL 519 THREADS
PT
BALL VALVE 2" NPT, 5000 PSI
PIPE, 2" SCH. 160 x 1'-0" LG.
FM
PIPE, 2" SCH. 160 x 1'-0" LG.
ELBOW
1 7/8" I.D. x 10'-0" LG.
MOHR
TOLERANCES UNLESS OTHERWISE SPECIFIED
P13 REVISED PER CLIENT'S COMMENTS 11/09/10
REV. DESCRIPTION DATE BY CHK BY
DESCRIPTION
API TEST
CONVERSION TEST
SN 29679918-05
MATERIAL/STRENGTH
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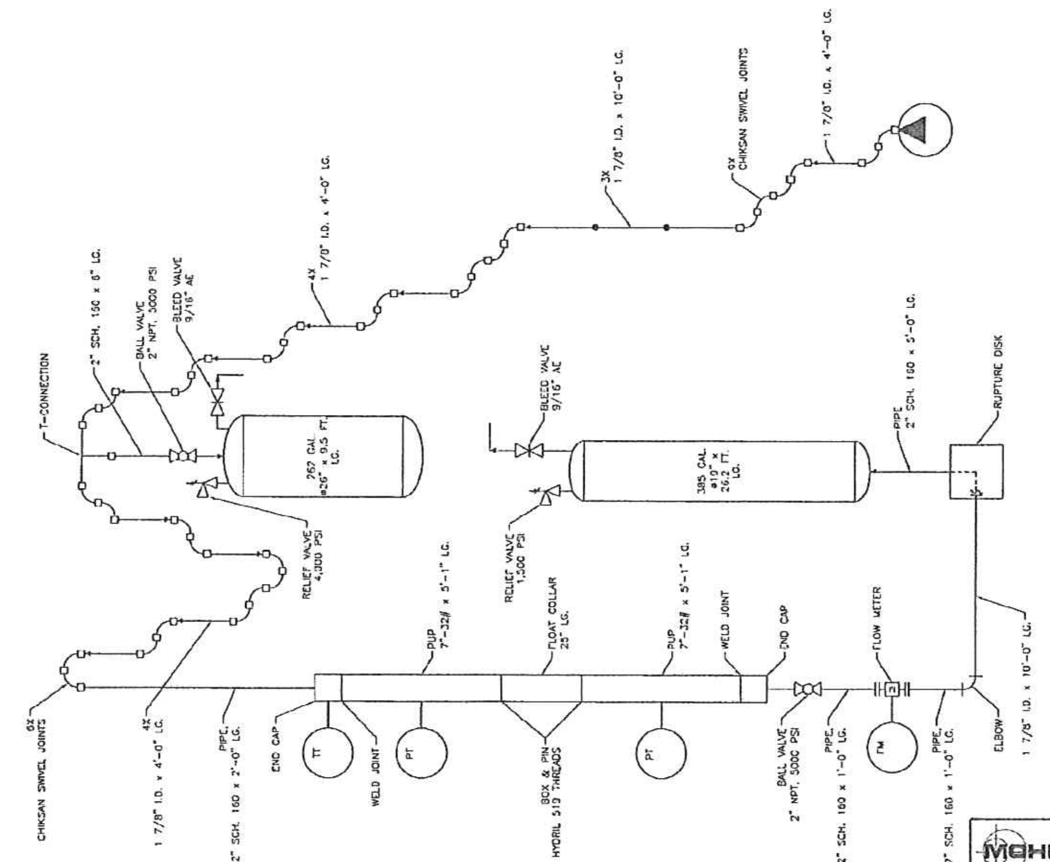
DRAWN BY K Martin DATE 08/17/10 SCALE N.T.S.
CHECKED BY JC Schoppe DATE 08/18/10 REV P13
APPROVED BY K Young DATE 08/20/10
DWG. NO. KY1751225-01-06

BLOCKAGE TEST



P13	REVISED PER CLIENT'S COMMENTS	11/09/10		
REV.	DESCRIPTION	DATE	BY	CHK BY

MOHR

TOLERANCES UNLESS OTHERWISE SPECIFIED

DESCRIPTION: API TEST BLOCKAGE TEST SN 29679918-05

MATERIAL/STRENGTH

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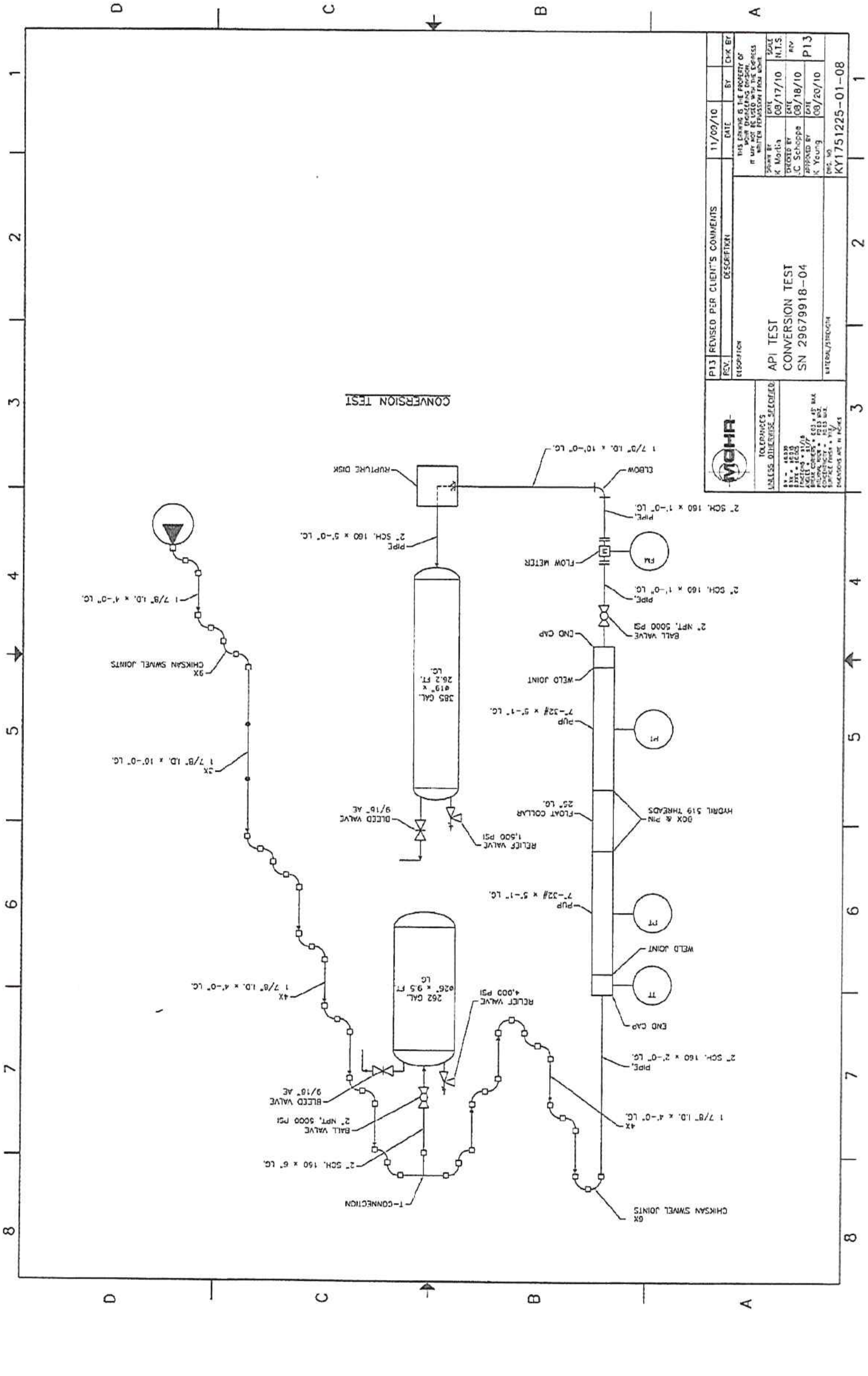
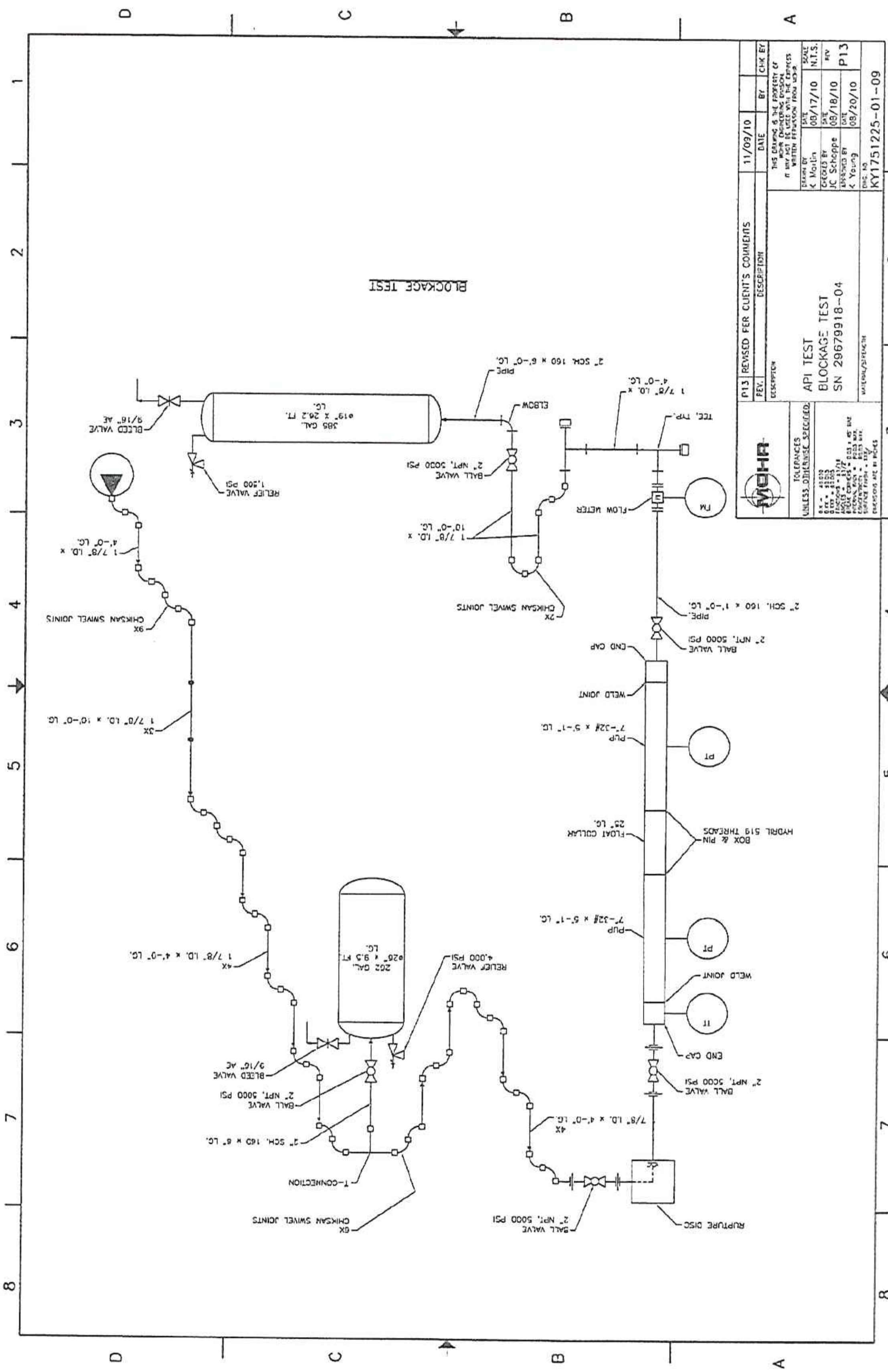
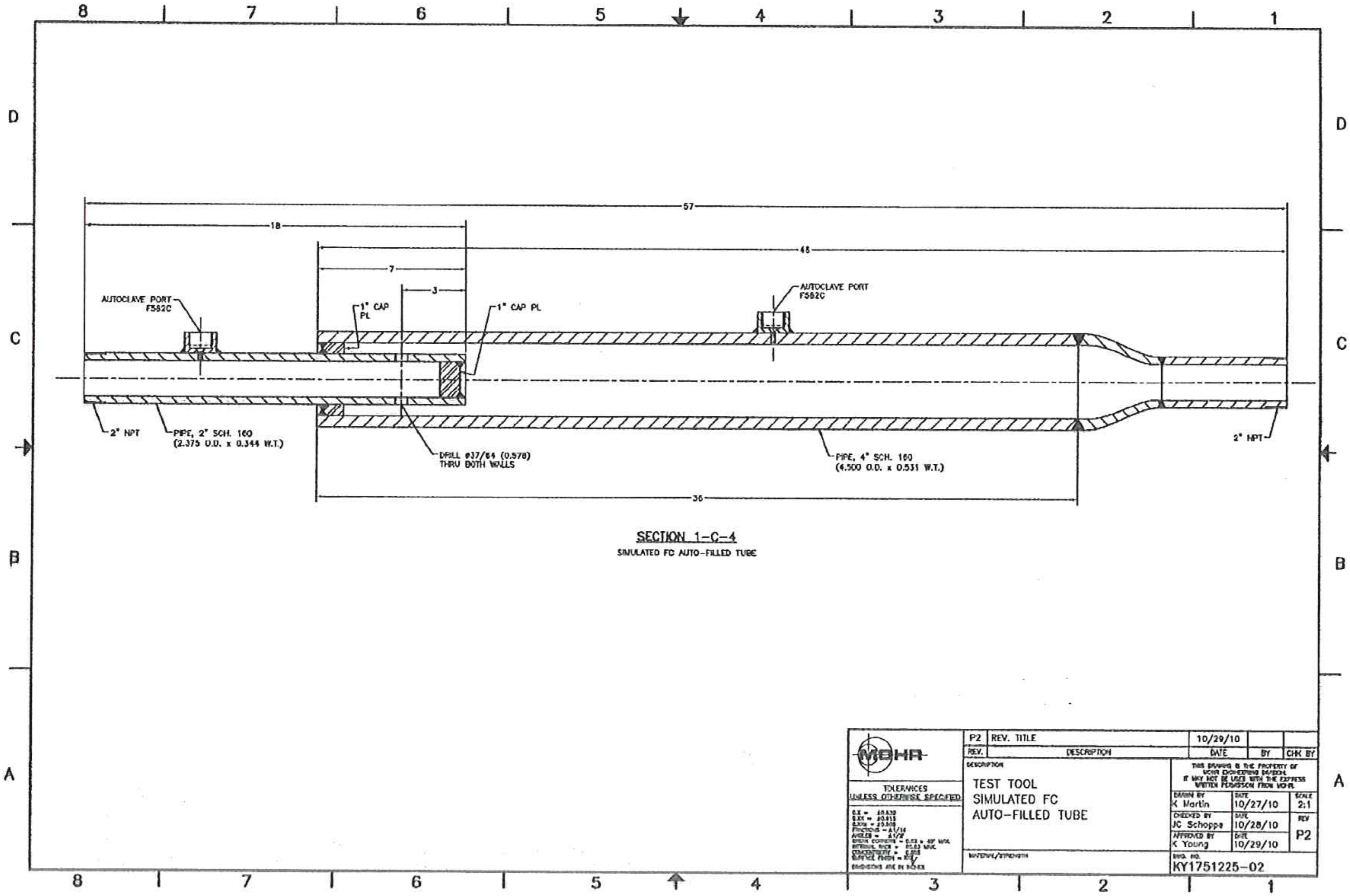
DRAWN BY K Martin	DATE 08/17/10	SCALE N.T.S.
CHECKED BY JC Schoppe	DATE 08/18/10	REV P13
APPROVED BY K Young	DATE 08/20/10	

DWG. NO. KY1751225-01-07



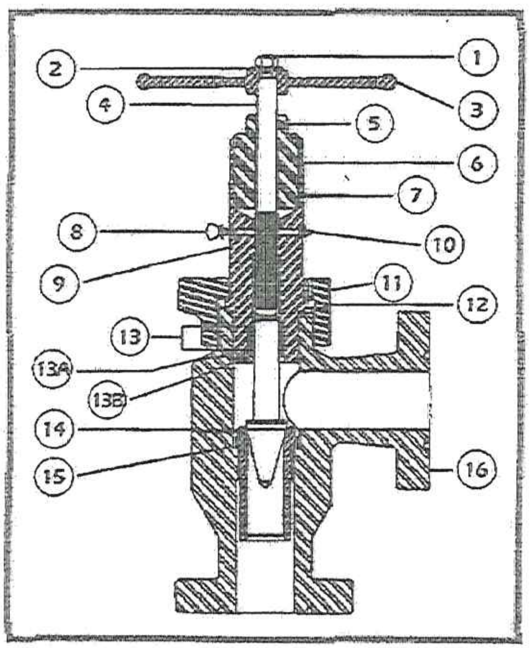
CONVERSION TEST
RUPTURE DISK
ELBOW
1 7/8" I.D. x 10'-0" LG.
PIPE, 2" SCH. 160 x 1'-0" LG.
FLOW METER
FM
PIPE, 2" SCH. 160 x 5'-0" LG.
BALL VALVE 2" NPT, 5000 PSI
END CAP
WELD JOINT
PUP 7"-32# x 5'-1" LG.
PT
FLOAT COLLAR 25" LG.
BOX & PIN HYDRIL 519 THREADS
TT
385 GAL. Ø19" x 26.2 FT. LG.
RELIEF VALVE 1,500 PSI
BLEED VALVE 9/16" AE
262 GAL. Ø26" x 9.5 FT. LG
RELIEF VALVE 4,000 PSI
PIPE, 2" SCH. 160 x 2'-0" LG.
4X 1 7/8" I.D. x 4'-0" LG.
9X CHIKSAN SWIVEL JOINTS
2X 1 7/8" I.D. x 10'-0" LG.
1 7/8" I.D. x 4'-0" LG.
2" SCH. 160 x 6" LG.
T-CONNECTION
6X CHIKSAN SWIVEL JOINTS
P13 REVISED PER CLIENT'S COMMENTS 11/09/10
MOHR
API TEST
CONVERSION TEST
SN 29679918-04
K. Mortis 08/17/10
J.C. Schoppe 08/18/10
K. Young 08/20/10
N.T.S.
P13
KY1751225-01-08


BLOCKAGE TEST
385 GAL. ø19" x 26.2 FT. LG.
262 GAL. ø26" x 9.5 FT. LG.
BLEED VALVE 9/16" AE
RELIEF VALVE 1,500 PSI
RELIEF VALVE 4,000 PSI
2" SCH. 160 x 6'-0" LG. PIPE
ELBOW
TEE, TYP.
1 7/8" I.D. x 4'-0" LG.
1 7/8" I.D. x 10'-0" LG.
BALL VALVE 2" NPT, 5000 PSI
FLOW METER
FM
2X CHIKSAN SWIVEL JOINTS
6X CHIKSAN SWIVEL JOINTS
3X 1 7/8" I.D. x 10'-0" LG.
4X 1 7/8" I.D. x 4'-0" LG.
2" SCH. 160 x 1'-0" LG. PIPE
END CAP
WELD JOINT
PUP 7"-32# x 5'-1" LG.
PT
FLOAT COLLAR 25" LG.
BOX & PIN HYDRIL 513 THREADS
TT
2" SCH. 160 x 6" LG.
T-CONNECTION
4X 7/8" I.D. x 4'-0" LG.
RUPTURE DISC
P13 REVISED PER CLIENT'S COMMENTS 11/09/10
REV. DESCRIPTION DATE BY CHK BY
API TEST
BLOCKAGE TEST
SN 29679918-04
MOHR
TOLERANCES UNLESS OTHERWISE SPECIFIED
K Morlin 08/17/10
JC Schoppe 08/18/10
K Young 08/20/10
SCALE N.T.S.
REV P13
KY1751225-01-09



57
18
48
7
3
36
AUTOCLAVE PORT F582C
1" CAP PL
1" CAP PL
AUTOCLAVE PORT F582C
2" NPT
PIPE, 2" SCH. 160 (2.375 O.D. x 0.344 W.T.)
DRILL ø37/64 (0.578) THRU BOTH WALLS
PIPE, 4" SCH. 160 (4.500 O.D. x 0.531 W.T.)
2" NPT
SECTION 1-C-4
SIMULATED FC AUTO-FILLED TUBE
MOHR
TOLERANCES UNLESS OTHERWISE SPECIFIED
P2
REV. TITLE
10/29/10
REV.
DESCRIPTION
DATE
BY
CHK BY
DESCRIPTION
TEST TOOL
SIMULATED FC
AUTO-FILLED TUBE
MATERIAL/STRENGTH
THIS DRAWING IS THE PROPERTY OF MOHR ENGINEERING DIVISION. IT MAY NOT BE USED WITH THE EXPRESS WRITTEN PERMISSION FROM MOHR.
DRAWN BY
K Martin
DATE
10/27/10
SCALE
2:1
CHECKED BY
JC Schoppa
DATE
10/28/10
REV
P2
APPROVED BY
K Young
DATE
10/29/10
DWG. NO.
KY1751225-02

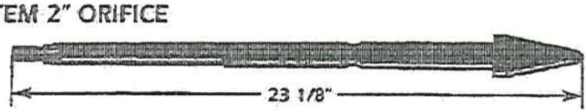
—TYPE H-H2 ADJUSTABLE CHOKES—
MAX 2" ORIFICE

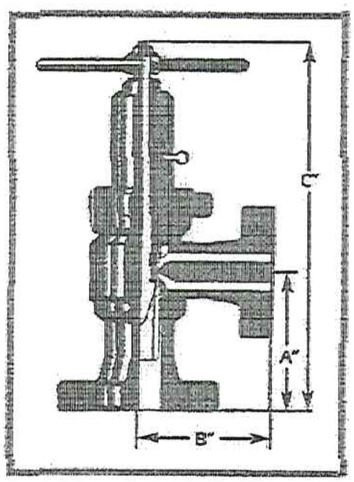


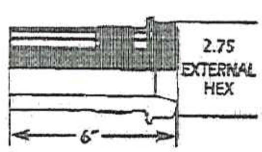
TYPE H-H2 ADJUSTABLE CHOKES MAX 2" ORIFICE

FLANGE SIZE	CWP	A"	B"	C"
3"	3,000 API	11.38	8.88	30.00
3"	5,000 API	11.38	8.88	30.00
3 1/16"	10,000 API	11.75	10.38	30.25
4 1/16"	10,000 API	11.50	9.94	30.12
3"	600 ANSI RTJ	11.38	8.88	30.00

STEM 2" ORIFICE







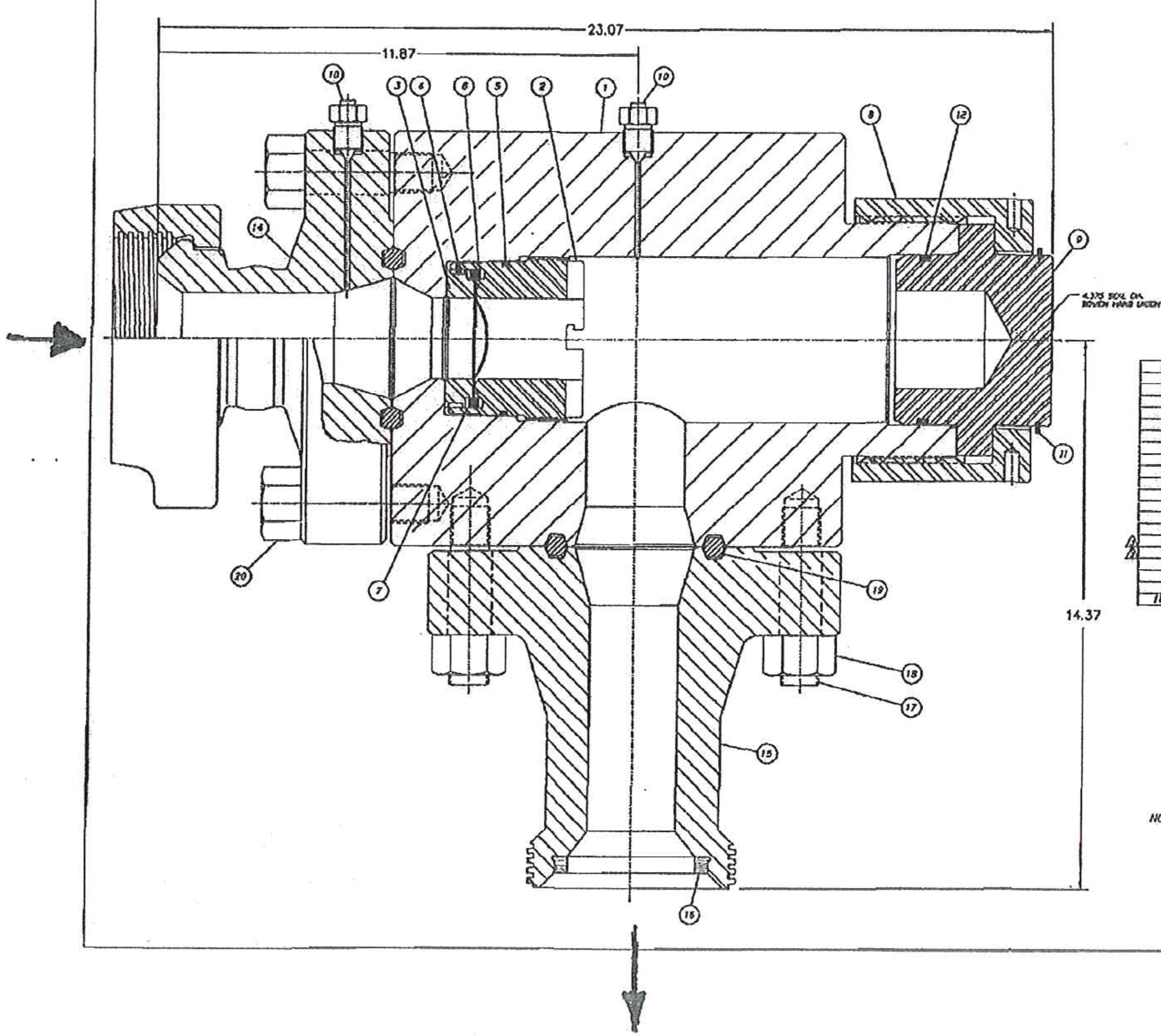
SEAT 2" ORIFICE

PARTS H-H2 ADJUSTABLE CHOKES MAX 2" ORIFICE

ITEM	DESCRIPTION	QTY.	PART NUMBER
1	Hex Nut	1	1024
2	Flat Washer	1	1023
3	Handwheel	1	1521
4	Stem HS 2"	1	1530
	Stem SS 2"	1	1590
	Stem SSTC 2"	1	1427
5	Set Screw	1	1535
6	Indicator 2"	1	1483
7	Bonnet	1	1510
8	Thumbscrew	1	1529
9	Nylon Ball	1	1004
10	Grease Fitting	1	1013
11	Hammer Nut 5M	1	1511
	Hammer Nut 10M	1	1512
12	O-Ring	1	1528
13	Packing	1	1505
13A	Junk Ring	1	1614
13B	Retaining Ring	1	1484
14	Seat HS 2"	1	1513
	Seat SS 2"	1	1514
	Seat SSTC 2"	1	1429
15	Seat Gasket	1	1464
16	Body, Flanged 3" 5M	1	1516
	Body, Flanged 3" 10M	1	1517
*17	Seat Wrench	1	1474

*Sold Separately – Not Pictured

PART NO.	REVISIONS		
	NO	DATE	BY
M1561	0	05/21/01	LA
	1	11/21/02	GS
	2	07/17/03	GS
	3	10/21/08	RJ



ITEM	QTY	PART NO.	DESCRIPTION
20	8	BY-1376	BOLT, HEX 1" X 3 1/2" LONG
19	2	BX-154-16	GASKET, BX-154
18	8	B-10	NUT, HEX 1"-8UN
17	8	BR-1946	STUD, 1"-8UN X 4 3/4" LG
16	1	WC-1415A	SEAL RING, 3" FIG.1502
15	1	M1561-15	FLANGE, X-OVER 3 1/16"-10M X 3" FIG.1502 FEMALE
14	1	M1561-14	FLANGE, X-OVER 3 1/16"-10M X 3" FIG.1502 MALE
13	1	M0864-13	RUPTURE DISK PLUG WRENCH (NOT SHOWN)
12	1	PT-3400	SEALING RING
11	1	BY-0234	RETAINING RING
10	1	AC-3750	BLEEDER PLUG
9	1	M0864-9	BLANKING CAP
8	1	M0864-8	BLANKING CAP RETAINING NUT
7	1	PT-1440	SEALING RING
6	A / R	BY-0565	RUPTURE DISK (SEE NOTE 1)
5	1	PT-2309	SEALING RING
4	2	BY-8177	SET SCREW
3	1	M0864-3	RUPTURE DISK HOLDER
2	1	M0864-2	RUPTURE DISK RETAINING PLUG
1	1	M1448-1	BODY

NOTES:
1. RUPTURE DISCS ARE TO BE ORDERED AS SEPARATE ITEM AND SHIPPED LOOSE.

WOOLSTON OILFIELD MACHINE INC.

SCALE NONE
DATE 05/21/01
APPROVED BY [signature]
DRAWN BY LA
CHK. BY RJ

3 1/16"-10M PUMP SAVER
W/3" FIG.1502 UNIONS

M1561 3

K

Annex K Mud Reports

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

ANALYTICAL SERVICES LABORATORY

Project Number : AS155-0726-2010 **Analyst :** Marc Churan **Date :** 7/27/2010

Sample Identification: Play Sand from Stress Engineering Services, Mohr Engineering, Hempstead Yard

Equipment Test: Lab Master # : 20102236

Request : Sieve Analysis

Testing Procedure : Sieve Analysis of submitted sand sample

Test Data:

Sieve Analysis:

	Play Sand Stress Engineering Services
+10 mesh	0.36 wt%
-10 mesh and +20 mesh	1.68 wt%
-20 mesh and +40 mesh	17.6 wt%
-40 mesh and +60 mesh	54.7 wt%
-60 mesh and +80 mesh	17.2 wt%
-80 mesh and +100 mesh	4.76 wt%
-100 mesh and +200 mesh	3.59 wt%
-200 mesh and +325 mesh	0.16 wt%
-325 mesh	0.01 wt%

Copies to: Jack Littlefield
Cole Vanya
Jay Forrester

Signed: *Marc Churan*

MI SWACO

WATER-BASED MUD REPORT No. 1

Date	7/20/2010	Depth/TVD	ft / ft
Spud Date	7/20/2010	Mud Type	Spud Mud
Water Depth		Activity	

Operator : Stress Engineering
Report For : Kenneth Young
Well Name :
Contractor :
Report For :

Field/Area :
Description : Test
Location : Waller County
M-I Well No. :

DRILLING ASSEMBLY		CASING	MUD VOLUME (bbl)
Bit Size 0. in		Surface	Hole
Nozzles 1/32"			
Drill Pipe Size 0. in	Length ft	Intermediate	Active Pits 0
Drill Pipe Size 0. in	Length ft	Intermediate	Total Circulating Vol
Drill Collar Size 0. in	Length ft	Production or Liner	In Storage 0

CIRCULATION DATA		
Pump Make		
Pump Size	0. X 0.in	0. X 0.in
Pump Cap	gal/stk	gal/stk
Pump stk/min		
Flow Rate		gal/min
Bottoms Up		
Total Circ Time		
Circulating Pressure		

MUD PROPERTIES

Sample From		PIT@16:00	
Flow Line Temp	°F	-	
Depth/TVD	ft	-/-	
Mud Weight	lb/gal	12.45@85°F	
Funnel Viscosity	s/qt	-	
Rheology Temp	°F	120	
R600/R300		51/32	
R200/R100		-/-	
R6/R3		-/-	
PV	cP	19	
YP	lb/100ft²	13	
10s/10m/30m Gel	lb/100ft²	17/-/-	
API Fluid Loss	cc/30 min	16.4	
HTHP FL Temp	cc/30 min	-@-°F	
Cake API/HTHP	1/32"	4/-	
Solids	%Vol	17	
Oil/Water	%Vol	0/83	
Sand	%Vol	4.5	
MBT	lb/bbl	20	
pH		8.4	
Alkal Mud (Pm)		.1	
Pf/Mf		.05/.2	
Chlorides	mg/l	200	
Hardness Ca	mg/l	80	

PRODUCTS USED LAST 24 HRS

Products	Size	Amt
ENGINEERING SERVICE	1 EA	1
M-I BAR	100 LB BG	115
M-I GEL	100 LB BG	10
PLAY SAND	50 LB BG	35

SOLIDS EQUIP	Size	Hr

MUD PROPERTY SPECIFICATIONS

Weight
Viscosity
Filtrate

REMARKS AND TREATMENT

REMARKS

TIME DISTR	Last 24 Hrs
Rig Up/Service	24
Drilling	
Tripping	
Non-Productive Time	

MUD VOL ACCTG	(bbl)
Oil Added	0
Water Added	0
Mud Received	0
Shakers	0
Evaporation	0
Centrifuge	0
Formation	0
Left in Hole	0
Other	0
Dumped	0

SOLIDS ANALYSIS (%/lb/bbl)	
NaCl	0./0.1
KCl	0./0.
Low Gravity	3.1/28.2
Bentonite	2.1/19.
Drill Solids	1./9.2
Weight Material	13.9/204.4
Chemical Conc	- / 0.
Inert/React	0.4077
Average SG	3.91
Carb/HCarb (m mole/L)	1./19.9

MUD RHEOLOGY & HYDRAULICS	
n/k Values	
Tau0 (lb/100ft²)	
Bit Loss (psi / %)	
Bit HHP (hhp / HSI)	
Bit Jet Vel (ft/s)	
Ann Vel DP (ft/min)	
Ann Vel DC (ft/min)	
Crit Vel DP (ft/min)	
Crit Vel DC (ft/min)	

M-I ENGR / PHONE		RIG PHONE	WAREHOUSE PHONE	DAILY COST	CUMULATIVE COST
Cole Vanya	979-220-7701			USD 1,200.00	USD 1,200.00

MI SWACO

WATER-BASED MUD REPORT No. 2

Date	7/21/2010	Depth/TVD	ft / ft
Spud Date	7/20/2010	Mud Type	Spud Mud
Water Depth		Activity	

Operator : Stress Engineering
Report For : Kenneth Young
Well Name :
Contractor :
Report For :

Field/Area :
Description : Test
Location : Waller County
M-I Well No. :

DRILLING ASSEMBLY		CASING	MUD VOLUME (bbl)
Bit Size 0. in		Surface	Hole
Nozzles 1/32"			
Drill Pipe Size 0. in	Length ft	Intermediate	Active Pits 0
Drill Pipe Size 0. in	Length ft	Intermediate	Total Circulating Vol
Drill Collar Size 0. in	Length ft	Production or Liner	In Storage 0

CIRCULATION DATA

Pump Make		
Pump Size	0. X 0.in	0. X 0.in
Pump Cap	gal/stk	gal/stk
Pump stk/min		
Flow Rate		gal/min
Bottoms Up		
Total Circ Time		
Circulating Pressure		

MUD PROPERTIES

Sample From		PIT@07:30
Flow Line Temp	°F	118
Depth/TVD	ft	-/-
Mud Weight	lb/gal	12.45@118°F
Funnel Viscosity	s/qt	-
Rheology Temp	°F	120
R600/R300		58/35
R200/R100		-/-
R6/R3		-/-
PV	cP	23
YP	lb/100ft²	12
10s/10m/30m Gel	lb/100ft²	19/-/-
API Fluid Loss	cc/30 min	16.4
HTHP FL Temp	cc/30 min	-@-°F
Cake API/HTHP	1/32"	6/-
Solids	%Vol	17
Oil/Water	%Vol	0/83
Sand	%Vol	4.5
MBT	lb/bbl	20
pH		8.4
Alkal Mud (Pm)		.1
Pf/Mf		.05/.2
Chlorides	mg/l	200
Hardness Ca	mg/l	80

PRODUCTS USED LAST 24 HRS

Products	Size	Amt
ENGINEERING SERVICE	1 EA	1

SOLIDS EQUIP	Size	Hr

MUD PROPERTY SPECIFICATIONS

Weight	
Viscosity	
Filtrate	

REMARKS AND TREATMENT

REMARKS

TIME DISTR	Last 24 Hrs
Rig Up/Service	
Drilling	
Tripping	
Non-Productive Tim	

MUD VOL ACCTG	(bbl)
Oil Added	0
Water Added	0
Mud Received	0
Shakers	0
Evaporation	0
Centrifuge	0
Formation	0
Left in Hole	0
Other	0
Dumped	0

SOLIDS ANALYSIS (%/lb/bbl)	
NaCl	0 / 0.1
KCl	0 / 0.
Low Gravity	3.1/ 28.2
Bentonite	2.1/ 19.
Drill Solids	1 / 9.2
Weight Material	13.9/ 204.4
Chemical Conc	- / 0.
Inert/React	0.4077
Average SG	3.91
Carb/BiCarb (m mole/L)	1 / 19.9

MUD RHEOLOGY & HYDRAULICS	
n/k Values	
Tau0 (lb/100ft²)	
Bit Loss (psi / %)	
Bit HHP (hhp / HSI)	
Bit Jet Vel (ft/s)	
Ann Vel DP (ft/min)	
Ann Vel DC (ft/min)	
Crit Vel DP (ft/min)	
Crit Vel DC (ft/min)	

M-I ENGR / PHONE		RIG PHONE	WAREHOUSE PHONE	DAILY COST	CUMULATIVE COST
Cole Vanya	979-220-7701			USD 1,200.00	USD 2,400.00

MI SWACO

WATER-BASED MUD REPORT No. 3

Date	7/22/2010	Depth/TVD	ft / ft
Spud Date	7/20/2010	Mud Type	Spud Mud
Water Depth		Activity	

Operator : Stress Engineering
Report For : Kenneth Young
Well Name : Weatherford Tool Test
Contractor :
Report For :

Field/Area :
Description : Test
Location : Waller County
Well No. :

DRILLING ASSEMBLY		CASING	MUD VOLUME (bbl)
Bit Size 0. in		Surface	Hole
Nozzles 1/32"			
Drill Pipe Size 0. in	Length ft	Intermediate	Active Pits 60
Drill Pipe Size 0. in	Length ft	Intermediate	Total Circulating Vol
Drill Collar Size 0. in	Length ft	Production or Liner	In Storage 0

CIRCULATION DATA

Pump Make		
Pump Size	0. X 0.in	0. X 0.in
Pump Cap	gal/stk	gal/stk
Pump stk/min		
Flow Rate		gal/min
Bottoms Up		
Total Circ Time		
Circulating Pressure		

MUD PROPERTIES

Sample From		PIT@07:20	PIT@12:15	PIT@19:00	
Flow Line Temp	°F	-	-	-	
Depth/TVD	ft	-/-	-/-	-/-	
Mud Weight	lb/gal	12.25@100°F	12.3@95°F	12.2@110°F	
Funnel Viscosity	s/qt	-	-	-	
Rheology Temp	°F	120	120	120	
R600/R300		32/19	48/30	51/33	
R200/R100		-/-	-/-	-/-	
R6/R3		-/-	-/-	-/-	
PV	cP	13	18	18	
YP	lb/100ft²	6	12	15	
10s/10m/30m Gel	lb/100ft²	10/-/-	12/-/-	15/-/-	
API Fluid Loss	cc/30 min	17.5	17.2	17.0	
HTHP FL Temp	cc/30 min	-@-°F	-@-°F	-@-°F	
Cake API/HTHP	1/32"	6/-	6/-	7/-	
Solids	%Vol	16	16	16	
Oil/Water	%Vol	0/84	0/84	0/84	
Sand	%Vol	2.5	4.0	3.0	
MBT	lb/bbl	17.5	20	20	
pH		8.4	8.4	8.4	
Alkal Mud (Pm)		.1	.1	.1	
Pf/Mf		.05/.2	.05/.2	.05/.2	
Chlorides	mg/l	200	200	200	
Hardness Ca	mg/l	80	80	80	

PRODUCTS USED LAST 24 HRS

Products	Size	Amt
ENGINEERING SERVIC	1 EA	2
M-I BAR	100 LB BG	125
M-I GEL	100 LB BG	12
PLAY SAND	50 LB BG	35

SOLIDS EQUIP	Size	Hr

MUD PROPERTY SPECS

Weight	
Viscosity	
Filtrate	

REMARKS AND TREATMENT

REMARKS

2 ENGINEERING SERVICE CHARGES FOR TODAY TO ACCOUNT FOR ENGINEERING SERVICE CHARGE ON 7-19-2010.

TIME DISTR	Last 24 Hrs
Rig Up/Service	
Drilling	
Tripping	
Non-Productive Tim	

MUD VOL ACCTG	(bbl)
Oil Added	0
Water Added	65
Mud Received	0
Shakers	0
Evaporation	0
Centrifuge	0
Formation	0
Left in Hole	0
Other	0
Dumped	5.9

SOLIDS ANALYSIS (%/lb/bbl)	
NaCl	0 / 0.1
KCl	0 / 0.
Low Gravity	2.6/ 23.6
Bentonite	1.8/ 16.7
Drill Solids	0.8/ 6.9
Weight Material	13.4/ 197.
Chemical Conc	- / 0.
Inert/React	0.3492
Average SG	3.94
Carb/BiCarb (m mole/L)	1./ 19.9

MUD RHEOLOGY & HYDRAULICS		
n/k Values		
Tauy (lb/100ft²)		
Bit Loss (psi / %)		
Bit HHP (hhp / HSI)		
Bit Jet Vel (ft/s)		
Ann. Vel DP (ft/min)		
Ann. Vel DC (ft/min)		
Crit Vel DP (ft/min)		
Crit Vel DC (ft/min)		

M-I ENGR / PHONE		RIG PHONE	WAREHOUSE PHONE	DAILY COST	CUMULATIVE COST
Cole Vanya	979-220-7701		713-676-2127	USD 6,635.44	USD 9,035.44

MI SWACO

WATER-BASED MUD REPORT No. 4

Date	7/23/2010	Depth/TVD	ft / ft
Spud Date	7/20/2010	Mud Type	Spud Mud
Water Depth		Activity	

Operator: Stress Engineering
Report For: Kenneth Young
Well Name: Weatherford Tool Test
Contractor:
Report For:

Field/Area:
Description: Test
Location: Waller County
M-I Well No.:

DRILLING ASSEMBLY		CASING	MUD VOLUME (bbl)
Bit Size 0. in		Surface	Hole
Nozzles 1/32"			
Drill Pipe Size 0. in	Length ft	Intermediate	Active Pits 60
Drill Pipe Size 0. in	Length ft	Intermediate	Total Circulating Vol
Drill Collar Size 0. in	Length ft	Production or Liner	In Storage 0

CIRCULATION DATA

Pump Make		
Pump Size	0. X 0.in	0. X 0.in
Pump Cap	gal/stk	gal/stk
Pump stk/min		
Flow Rate	gal/min	
Bottoms Up		
Total Circ Time		
Circulating Pressure		

MUD PROPERTIES

Sample From		PIT@08:30	PIT@12:30
Flow Line Temp	°F	-	-
Depth/TVD	ft	-/-	-/-
Mud Weight	lb/gal	12.3@92°F	12.2@100°F
Funnel Viscosity	s/qt	-	-
Rheology Temp	°F	120	120
R600/R300		47/30	49/31
R200/R100		-/-	-/-
R6/R3		-/-	-/-
PV	cP	17	18
YP	lb/100ft²	13	13
10s/10m/30m Gel	lb/100ft²	12/-/-	13/-/-
API Fluid Loss	cc/30 min	17.0	17.0
HTHP FL Temp	cc/30 min	-@-°F	-@-°F
Cake API/HTHP	1/32"	7/-	6/-
Solids	%Vol	17	17
Oil/Water	%Vol	0/83	0/83
Sand	%Vol	3	3.5
MBT	lb/bbl	20	20
pH		8.4	8.4
Alkal Mud (Pm)		.1	.1
Pf/Mf		.05/.2	.05/.2
Chlorides	mg/l	200	200
Hardness Ca	mg/l	80	80

PRODUCTS USED LAST 24 HRS

Products	Size	Amt
ENGINEERING SERVICE	1 EA	1

SOLIDS EQUIP	Size	Hr

MUD PROPERTY SPECIFICATIONS

Weight	
Viscosity	
Filtrate	

REMARKS AND TREATMENT

REMARKS

TIME DISTR	Last 24 Hrs	MUD VOL ACCTG	(bbl)	SOLIDS ANALYSIS (%/lb/bbl)		MUD RHEOLOGY & HYDRAULICS	
Rig Up/Service		Oil Added	0	NaCl	0 / 0.1	n/k Values	
Drilling		Water Added	0	KCl	0 / 0.	Tauy (lb/100ft²)	
Tripping		Mud Received	0	Low Gravity	4.2/ 38.4	Bit Loss (psi / %)	
Non-Productive Tim		Shakers	0	Bentonite	1.9/ 17.7	Bit HHP (hhp / HSI)	
		Evaporation	0	Drill Solids	2.3/ 20.7	Bit Jet Vel (ft/s)	
		Centrifuge	0	Weight Material	12.8/ 187.8	Ann. Vel DP (ft/min)	
		Formation	0	Chemical Conc	- / 0.	Ann. Vel DC (ft/min)	
		Left in Hole	0	Inert/React	0.9198	Crit Vel DP (ft/min)	
		Other	0	Average SG	3.8	Crit Vel DC (ft/min)	
		Dumped	0	Carb/BiCarb (m mole/L)	1 / 19.9		

M-I ENGR / PHONE		RIG PHONE	WAREHOUSE PHONE	DAILY COST	CUMULATIVE COST
Cole Vanya	979-220-7701		713-676-2127	USD 1,200.00	USD 10,235.44

MI SWACO

WATER-BASED MUD REPORT No. 5

Date	7/26/2010	Depth/TVD	ft / ft
Spud Date	7/20/2010	Mud Type	Spud Mud
Water Depth		Activity	

Operator : Stress Engineering
Report For : Kenneth Young
Well Name : Weatherford Tool Test
Contractor :
Report For :

Field/Area :
Description : Test
Location : Waller County
Well No. : -

DRILLING ASSEMBLY		CASING	MUD VOLUME (bbl)
Bit Size 0. in		Surface	Hole
Nozzles 1/32"			
Drill Pipe Size 0. in	Length ft	Intermediate	Active Pits 60
Drill Pipe Size 0. in	Length ft	Intermediate	Total Circulating Vol
Drill Collar Size 0. in	Length ft	Production or Liner	In Storage 0

CIRCULATION DATA

Pump Make		
Pump Size	0. X 0.in	0. X 0.in
Pump Cap	gal/stk	gal/stk
Pump stk/min		
Flow Rate		gal/min
Bottoms Up		
Total Circ Time		
Circulating Pressure		

MUD PROPERTIES

Sample From		PIT@09:00	PIT@12:00	PIT@14:30	PIT@17:00
Flow Line Temp	°F	-	-	-	-
Depth/TVD	ft	-/-	-/-	-/-	-/-
Mud Weight	lb/gal	12.2@92°F	12.15@119°F	12.15@133°F	12.1@130°F
Funnel Viscosity	s/qt	-	-	-	-
Rheology Temp	°F	120	120	120	120
R600/R300		44/28	44/26	44/27	43/26
R200/R100		-/-	-/-	-/-	-/-
R6/R3		-/-	-/-	-/-	-/-
PV	cP	16	18	17	17
YP	lb/100ft²	12	8	10	9
10s/10m/30m Gel	lb/100ft²	9/-/-	8/-/-	8/-/-	7/-/-
API Fluid Loss	cc/30 min	-	-	-	-
HTHP FL Temp	cc/30 min	-@-°F	-@-°F	-@-°F	-@-°F
Cake API/HTHP	1/32"	-/-	-/-	-/-	-/-
Solids	%Vol	17	17	17	16
Oil/Water	%Vol	0/83	0/83	0/83	0/84
Sand	%Vol	3.5	3.5	3.5	3.5
MBT	lb/bbl	20	-	-	-
pH		8.4	8.7	8.1	8.0
Alkal Mud (Pm)		.1	-	-	-
Pf/Mf		.05/.2	-/-	-/-	-/-
Chlorides	mg/l	200	-	-	-
Hardness Ca	mg/l	80	-	-	-

PRODUCTS USED LAST 24 HRS

Products	Size	Amt
ENGINEERING SERVIC	1 EA	1

SOLIDS EQUIP

SOLIDS EQUIP	Size	Hr

MUD PROPERTY SPECS

Weight		
Viscosity		
Filtrate		

REMARKS AND TREATMENT

REMARKS

TIME DISTR	Last 24 Hrs
Rig Up/Service	
Drilling	
Tripping	
Non-Productive Tim	

MUD VOL ACCTG	(bbl)
Oil Added	0
Water Added	0
Mud Received	0
Shakers	0
Evaporation	0
Centrifuge	0
Formation	0
Left in Hole	0
Other	0
Dumped	0

SOLIDS ANALYSIS (%/lb/bbl)	
NaCl	0./0.1
KCl	0./0.
Low Gravity	5./45.2
Bentonite	1.9/16.8
Drill Solids	3.1/28.4
Weight Material	12./176.8
Chemical Conc	- / 0.
Inert/React	1.2612
Average SG	3.73
Carb/BiCarb (m mole/L)	1./19.9

MUD RHEOLOGY & HYDRAULICS	
n/k Values	
Tauy (lb/100ft²)	
Bit Loss (psi / %)	
Bit HHP (hhp / HSI)	
Bit Jet Vel (ft/s)	
Ann. Vel DP (ft/min)	
Ann. Vel DC (ft/min)	
Crit Vel DP (ft/min)	
Crit Vel DC (ft/min)	

M-I ENGR / PHONE		RIG PHONE	WAREHOUSE PHONE	DAILY COST	CUMULATIVE COST
Cole Vanya	979-220-7701		713-676-2127	USD 1,200.00	USD 11,435.44

MI SWACO

WATER-BASED MUD REPORT No. 6

Date	7/27/2010	Depth/TVD	ft / ft
Spud Date	7/20/2010	Mud Type	Spud Mud
Water Depth		Activity	

Operator : Stress Engineering
Report For : Kenneth Young
Well Name : Weatherford Tool Test
Contractor :
Report For :

Field/Area :
Description : Test
Location : Waller County
Well No. :

DRILLING ASSEMBLY		CASING	MUD VOLUME (bbl)	CIRCULATION DATA		
Bit Size 0. in		Surface	Hole	Pump Make		
Nozzles 1/32"				Pump Size	0. X 0.in	0. X 0.in
Drill Pipe Size 0. in	Length ft	Intermediate	Active Pits 55	Pump Cap	gal/stk	gal/stk
				Pump stk/min		
Drill Pipe Size 0. in	Length ft	Intermediate	Total Circulating Vol	Flow Rate		gal/min
				Bottoms Up		
Drill Collar Size 0. in	Length ft	Production or Liner	In Storage 0	Total Circ Time		
				Circulating Pressure		

MUD PROPERTIES

Sample From		PIT@07:30	PIT@10:00	PIT@15:00	
Flow Line Temp	°F	-	-	-	
Depth/TVD	ft	-/-	-/-	-/-	
Mud Weight	lb/gal	12.1@95°F	12.2@123°F	12.2@110°F	
Funnel Viscosity	s/qt	-	-	-	
Rheology Temp	°F	120	120	120	
R600/R300		41/26	50/32	51/32	
R200/R100		-/-	-/-	-/-	
R6/R3		-/-	-/-	-/-	
PV	cP	15	18	19	
YP	lb/100ft²	11	14	13	
10s/10m/30m Gel	lb/100ft²	6/-/-	8/-/-	7/-/-	
API Fluid Loss	cc/30 min	-	-	-	
HTHP FL Temp	cc/30 min	-@-°F	-@-°F	-@-°F	
Cake API/HTHP	1/32"	-/-	-/-	-/-	
Solids	%Vol	16	17	17	
Oil/Water	%Vol	0/84	0/83	0/83	
Sand	%Vol	3.5	3.5	3.5	
MBT	lb/bbl	-	-	-	
pH		8.1	8.2	8.2	
Alkal Mud (Pm)		-	-	-	
Pf/Mf		-/-	-/-	-/-	
Chlorides	mg/l	-	-	-	
Hardness Ca	mg/l	-	-	-	

PRODUCTS USED LAST 24 HRS

Products	Size	Amt
ENGINEERING SERVIC	1 EA	1
M-I GEL	100 LB BG	1

SOLIDS EQUIP

SOLIDS EQUIP	Size	Hr

MUD PROPERTY SPECS

Weight	
Viscosity	
Filtrate	

REMARKS AND TREATMENT

REMARKS

TIME DISTR	Last 24 Hrs
Rig Up/Service	
Drilling	
Tripping	
Non-Productive Tim	

MUD VOL ACCTG	(bbl)
Oil Added	0
Water Added	0
Mud Received	0
Shakers	0
Evaporation	0
Centrifuge	0
Formation	0
Left in Hole	0
Other	0
Dumped	5.11

SOLIDS ANALYSIS (%/lb/bbl)	
NaCl	0./ 0.
KCl	0./ 0.
Low Gravity	3.7/33.8
Bentonite	0./ 0.
Drill Solids	3.7/33.8
Weight Material	12.3/ 180.6
Chemical Conc	- / 0.
Inert/React	-
Average SG	3.83
Carb/BiCarb (m mole/L)	0./-0.1

MUD RHEOLOGY & HYDRAULICS	
n/K Values	
Tauy (lb/100ft²)	
Bit Loss (psi / %)	
Bit HHP (hhp / HSI)	
Bit Jet Vel (ft/s)	
Ann. Vel DP (ft/min)	
Ann. Vel DC (ft/min)	
Crit Vel DP (ft/min)	
Crit Vel DC (ft/min)	

M-I ENGR / PHONE		RIG PHONE	WAREHOUSE PHONE	DAILY COST	CUMULATIVE COST
Cole Vanya	979-220-7701		713-676-2127	USD 1,226.74	USD 12,662.18

MI SWACO

WATER-BASED MUD REPORT No. 7

Date	7/29/2010	Depth/TVD	ft / ft
Spud Date	7/20/2010	Mud Type	Spud Mud
Water Depth		Activity	

Operator : Stress Engineering
Report For : Kenneth Young
Well Name : Weatherford Tool Test
Contractor :
Report For :
Field/Area :
Description : Test
Location : Waller County
Well No. :

DRILLING ASSEMBLY

Bit Size 0. in	
Nozzles 1/32"	
Drill Pipe Size 0. in	Length ft
Drill Pipe Size 0. in	Length ft
Drill Collar Size 0. in	Length ft

CASING

Surface
Intermediate
Intermediate
Production or Liner

MUD VOLUME (bbl)

Hole	
Active Pits	55
Total Circulating Vol	
In Storage	0

CIRCULATION DATA

Pump Make		
Pump Size	0. X 0.in	0. X 0.in
Pump Cap	gal/stk	gal/stk
Pump stk/min		
Flow Rate		gal/min
Bottoms Up		
Total Circ Time		
Circulating Pressure		

MUD PROPERTIES

Sample From		PIT@08:40	PIT@14:00	PIT@16:20
Flow Line Temp	°F	-	-	-
Depth/TVD	ft	-/-	-/-	-/-
Mud Weight	lb/gal	12.15@90°F	12.05@130°F	12.05@136°F
Funnel Viscosity	s/qt	-	-	-
Rheology Temp	°F	120	120	120
R600/R300		58/38	49/29	51/31
R200/R100		-/-	-/-	-/-
R6/R3		-/-	-/-	-/-
PV	cP	20	20	20
YP	lb/100ft²	18	9	11
10s/10m/30m Gel	lb/100ft²	6/-/-	7/-/-	7/-/-
API Fluid Loss	cc/30 min	-	-	-
HTHP FL Temp	cc/30 min	-@-°F	-@-°F	-@-°F
Cake API/HTHP	1/32"	-/-	-/-	-/-
Solids	%Vol	16	16	16
Oil/Water	%Vol	0/84	0/84	0/84
Sand	%Vol	3.0	4.0	4.0
MBT	lb/bbl	-	-	-
pH		8.2	8.2	8.2
Alkal Mud (Pm)		-	-	-
Pf/Mf		-/-	-/-	-/-
Chlorides	mg/l	-	-	-
Hardness Ca	mg/l	-	-	-

PRODUCTS USED LAST 24 HRS

Products	Size	Amt
ENGINEERING SERVIC	1 EA	1

SOLIDS EQUIP	Size	Hr

MUD PROPERTY SPECS

Weight	
Viscosity	
Filtrate	

REMARKS AND TREATMENT

REMARKS

TIME DISTR	Last 24 Hrs
Rig Up/Service	
Drilling	
Tripping	
Non-Productive Tim	

MUD VOL ACCTG	(bbl)
Oil Added	0
Water Added	0
Mud Received	0
Shakers	0
Evaporation	0
Centrifuge	0
Formation	0
Left in Hole	0
Other	0
Dumped	0

SOLIDS ANALYSIS (%/lb/bbl)	
NaCl	0 / 0.
KCl	0 / 0.
Low Gravity	3.3/ 30.4
Bentonite	0 / 0.
Drill Solids	3.3/ 30.4
Weight Material	12.7/ 186.1
Chemical Conc	- / 0.
Inert/React	-
Average SG	3.87
Carb/BiCarb (m mole/L)	0.7 / -0.1

MUD RHEOLOGY & HYDRAULICS	
n/k Values	
Tauy (lb/100ft²)	
Bit Loss (psi / %)	
Bit HHP (hhp / HSI)	
Bit Jet Vel (ft/s)	
Ann. Vel DP (ft/min)	
Ann. Vel DC (ft/min)	
Crit Vel DP (ft/min)	
Crit Vel DC (ft/min)	

M-I ENGR / PHONE		RIG PHONE	WAREHOUSE PHONE	DAILY COST	CUMULATIVE COST
Cole Vanyz	979-220-7701		713-676-2127	USD 1,200.00	USD 13,862.18

MI SWACO

WATER-BASED MUD REPORT No. 8

Date	7/30/2010	Depth/TVD	ft / ft
Spud Date	7/20/2010	Mud Type	Spud Mud
Water Depth		Activity	

Operator : Stress Engineering
Report For : Kenneth Young
Well Name : Weatherford Tool Test
Contractor :
Report For :

Field/Area :
Description : Test
Location : Waller County
Well No. :

DRILLING ASSEMBLY

Bit Size 0. in	
Nozzles 1/32"	
Drill Pipe Size 0. in	Length ft
Drill Pipe Size 0. in	Length ft
Drill Collar Size 0. in	Length ft

CASING

Surface
Intermediate
Intermediate
Production or Liner

MUD VOLUME (bbl)

Hole	
Active Pits	50
Total Circulating Vol	
In Storage	0

CIRCULATION DATA

Pump Make		
Pump Size	0. X 0.in	0. X 0.in
Pump Cap	gal/stk	gal/stk
Pump stk/min		
Flow Rate	gal/min	
Bottoms Up		
Total Circ Time		
Circulating Pressure		

MUD PROPERTIES

Sample From		PIT@06:50	PIT@09:30	PIT@11:55
Flow Line Temp	°F	-	-	-
Depth/TVD	ft	-/-	-/-	-/-
Mud Weight	lb/gal	12.35@95°F	12.25@138°F	12.35@145°F
Funnel Viscosity	s/qt	-	-	-
Rheology Temp	°F	120	120	120
R600/R300		53/32	54/33	57/34
R200/R100		-/-	-/-	-/-
R6/R3		-/-	-/-	-/-
PV	cP	21	21	23
YP	lb/100ft²	11	12	11
10s/10m/30m Gel	lb/100ft²	5/-/-	6/-/-	6/-/-
API Fluid Loss	cc/30 min	-	-	-
HTHP Fl. Temp	cc/30 min	-@-°F	-@-°F	-@-°F
Cake API/HTHP	1/32"	-/-	-/-	-/-
Solids	%Vol	17	17	17
Oil/Water	%Vol	0/83	0/83	0/83
Sand	%Vol	4.0	3.5	3.5
MBT	lb/bbl	-	-	-
pH		8.2	8.2	8.2
Alkal Mud (Pm)		-	-	-
Pf/Mf		-/-	-/-	-/-
Chlorides	mg/l	-	-	-
Hardness Ca	mg/l	-	-	-

PRODUCTS USED LAST 24 HRS

Products	Size	Amt
ENGINEERING SERVIC	1 EA	1
M-I BAR	100 LB BG	11

SOLIDS EQUIP

SOLIDS EQUIP	Size	Hr

MUD PROPERTY SPECS

Weight	
Viscosity	
Filtrate	

REMARKS AND TREATMENT

REMARKS

TIME DISTR Last 24 Hrs

Rig Up/Service	
Drilling	
Tripping	
Non-Productive Tim	

MUD VOL ACCTG (bbl)

Oil Added	0
Water Added	0
Mud Received	0
Shakers	0
Evaporation	0
Centrifuge	0
Formation	0
Left in Hole	0
Other	0
Dumped	5.749

SOLIDS ANALYSIS (%/lb/bbl)

NaCl	0/0.
KCl	0/0.
Low Gravity	3.8/34.9
Bentonite	0/0.
Drill Solids	3.8/34.9
Weight Material	13.2/193.5
Chemical Conc	- / 0
Inert/React	-
Average SG	3.84
Carb/BiCarb (m mole/L)	0/-0.1

MUD RHEOLOGY & HYDRAULICS

n/k Values	
Tauy (lb/100ft²)	
Bit Loss (psi / %)	
Bit HHP (hhp / HSI)	
Bit Jet Vel (ft/s)	
Ann. Vel DP (ft/min)	
Ann. Vel DC (ft/min)	
Crit Vel DP (ft/min)	
Crit Vel DC (ft/min)	

M-I ENGR / PHONE		RIG PHONE	WAREHOUSE PHONE	DAILY COST	CUMULATIVE COST
Cole Vanya	979-220-7701		713-676-2127	USD 1,544.48	USD 15,406.67

WATER-BASED MUD REPORT No. 9

MI SWACO

Date	8/2/2010	Depth/TVD	ft / ft
Spud Date	7/20/2010	Mud Type	Spud Mud
Water Depth		Activity	

Operator : Stress Engineering
Report For : Kenneth Young
Well Name : Weatherford Tool Test
Contractor :
Report For :

Field/Area :
Description : Test
Location : Waller County
Well No. :

DRILLING ASSEMBLY		CASING	MUD VOLUME (bbl)
Bit Size 0. in		Surface	Hole
Nozzles 1/32"			
Drill Pipe Size 0. in	Length ft	Intermediate	Active Pits 65
Drill Pipe Size 0. in	Length ft	Intermediate	Total Circulating Vol
Drill Collar Size 0. in	Length ft	Production or Liner	In Storage 0

CIRCULATION DATA

Pump Make		
Pump Size	0. X 0.in	0. X 0.in
Pump Cap	gal/stk	gal/stk
Pump stk/min		
Flow Rate		gal/min
Bottoms Up		
Total Circ Time		
Circulating Pressure		

MUD PROPERTIES

Sample From		PIT@07:30	PIT@12:40	PIT@15:30	PIT@17:30
Flow Line Temp	°F	-	-	-	-
Depth/TVD	ft	-/-	-/-	-/-	-/-
Mud Weight	lb/gal	12.1@111°F	12.2@142°F	12.2@156°F	12.2@162°F
Funnel Viscosity	s/qt	-	-	-	
Rheology Temp	°F	120	120	120	120
R600/R300		50/32	46/27	54/34	57/36
R200/R100		-/-	-/-	-/-	-/-
R6/R3		-/-	-/-	-/-	-/-
PV	cP	18	19	20	21
YP	lb/100ft²	14	8	14	15
10s/10m/30m Gel	lb/100ft²	7/-/-	7/-/-	8/-/-	8/-/-
API Fluid Loss	cc/30 min	-	-	-	-
HTHP FL Temp	cc/30 min	-@-°F	-@-°F	-@-°F	-@-°F
Cake API/HTHP	1/32"	-/-	-/-	-/-	-/-
Solids	%Vol	15	16	16	16
Oil/Water	%Vol	/85	/84	/84	/84
Sand	%Vol	3.5	4	4	3.5
MBT	lb/bbl	-	-	-	
pH		8.2	8.2	8.1	8.2
Alkal Mud (Pm)		-	-	-	-
Pf/Mf		-/-	-/-	-/-	-/-
Chlorides	mg/l	-	-	-	-
Hardness Ca	mg/l	-	-	-	-

PRODUCTS USED LAST 24 HRS

Products	Size	Amt
ENGINEERING SERVIC	1 EA	1

SOLIDS EQUIP	Size	Hr

MUD PROPERTY SPECS

Weight	
Viscosity	
Filtrate	

REMARKS AND TREATMENT

REMARKS

TIME DISTR	Last 24 Hrs
Rig Up/Service	
Drilling	-
Tripping	
Non-Productive Tm	

MUD VOL ACCTG	(bbl)
Oil Added	0
Water Added	0
Mud Received	0
Shakers	0
Evaporation	0
Centrifuge	0
Formation	0
Left in Hole	0
Other	0
Dumped	0

SOLIDS ANALYSIS (%/lb/bbl)	
NaCl	0 / 0.
KCl	0 / 0.
Low Gravity	1.7 / 15.6
Bentonite	0 / 0.
Drill Solids	1.7 / 15.6
Weight Material	13.3 / 195.3
Chemical Conc	- / 0.
Inert/React	-
Average SG	4.02
Carb/BiCarb (m mole/L)	0 / -0.1

MUD RHEOLOGY & HYDRAULICS	
n/K Values	
Tauy (lb/100ft²)	
Bit Loss (psi / %)	
Bit HHP (hhp / HSI)	
Bit Jet Vel (ft/s)	
Ann. Vel DP (ft/min)	
Ann. Vel DC (ft/min)	
Crit Vel DP (ft/min)	
Crit Vel DC (ft/min)	

M-I ENGR / PHONE		RIG PHONE	WAREHOUSE PHONE	DAILY COST	CUMULATIVE COST
Glenn Beixert	936-697-5852		713-676-2127	USD 1,200.00	USD 17,313.21

MI SWACO

WATER-BASED MUD REPORT No. 10

Date	8/6/2010	Depth/TVD	ft / ft
Spud Date	7/20/2010	Mud Type	Spud Mud
Water Depth		Activity	-

Operator : Stress Engineering
Report For : Kenneth Young
Well Name : Weatherford Tool Test
Contractor :
Report For :

Field/Area :
Description : Test
Location : Waller County
Well No. :

DRILLING ASSEMBLY		CASING	MUD VOLUME (bbl)
Bit Size 0. in		Surface	Hole
Nozzles 1/32"			
Drill Pipe Size 0. in	Length ft	Intermediate	Active Pits 81
Drill Pipe Size 0. in	Length ft	Intermediate	Total Circulating Vol
Drill Collar Size 0. in	Length ft	Production or Liner	In Storage 0

CIRCULATION DATA

Pump Make		
Pump Size	0. X 0.in	0. X 0.in
Pump Cap	gal/stk	gal/stk
Pump stk/min		
Flow Rate		gal/min
Bottoms Up		
Total Circ Time		
Circulating Pressure		

MUD PROPERTIES

Sample From		PIT@11:00
Flow Line Temp	°F	-
Depth/TVD	ft	-/-
Mud Weight	lb/gal	13.95@134°F
Funnel Viscosity	s/qt	-
Rheology Temp	°F	120
R600/R300		68/40
R200/R100		-/-
R6/R3		-/-
PV	cP	28
YP	lb/100ft²	12
10s/10m/30m Gel	lb/100ft²	9/-/-
API Fluid Loss	cc/30 min	-
HTHP FL Temp	cc/30 min	-@-°F
Cake API/HTHP	1/32"	-/-
Solids	%Vol	22
Oil/Water	%Vol	/78
Sand	%Vol	2.5
MBT	lb/bbl	-
pH		8.1
Alkal Mud (Pm)		-
Pf/Mf		-/-
Chlorides	mg/l	-
Hardness Ca	mg/l	-

PRODUCTS USED LAST 24 HRS

Products	Size	Amt
ENGINEERING SERVIC	1 EA	3
M-I BAR	100 LB BG	244
M-I GEL	100 LB BG	16

SOLIDS EQUIP	Size	Hr

MUD PROPERTY SPECS

Weight	
Viscosity	
Filtrate	

REMARKS AND TREATMENT

REMARKS

TIME DISTR	Last 24 Hrs
Rig Up/Service	
Drilling	
Tripping	
Non-Productive Time	

MUD VOL ACCTG	(bbl)
Oil Added	0
Water Added	63
Mud Received	0
Shakers	0
Evaporation	0
Centrifuge	0
Formation	0
Left in Hole	0
Other	0
Dumped	65

SOLIDS ANALYSIS (%/lb/bbl)	
NaCl	0/0.
KCl	0/0.
Low Gravity	1.8/16.7
Bentonite	0/0.
Drill Solids	1.8/16.7
Weight Material	20.2/296.5
Chemical Conc	- / 0
Inert/React	-
Average SG	4.07
Carb/BiCarb (m mole/L)	0./-0.1

MUD RHEOLOGY & HYDRAULICS		
n/K Values		
Tauy (lb/100ft²)		
Bit Loss (psi / %)		
Bit HHP (hhp / HSI)		
Bit Jet Vel (ft/s)		
Ann. Vel DP (ft/min)		
Ann. Vel DC (ft/min)		
Crit Vel DP (ft/min)		
Crit Vel DC (ft/min)		

M-I ENGR / PHONE		RIG PHONE	WAREHOUSE PHONE	DAILY COST	CUMULATIVE COST
Glenn Beisert	936-697-5852		713-676-2127	USD 11,669.08	USD 28,982.30

MI SWACO

WATER-BASED MUD REPORT No. 11

Date	8/13/2010	Depth/TVD	ft / ft
Spud Date	7/20/2010	Mud Type	Spud Mud
Water Depth		Activity	

Operator : Stress Engineering
Report For : Kenneth Young
Well Name : Weatherford Tool Test
Contractor :
Report For :

Field/Area :
Description : Test
Location : Waller County
Well No. :

DRILLING ASSEMBLY		CASING	MUD VOLUME (bbl)	CIRCULATION DATA		
Bit Size 0. in		Surface	Hole	Pump Make		
Nozzles 1/32"				Pump Size	0. X 0.in	0. X 0.in
Drill Pipe Size 0. in	Length ft	Intermediate	Active Pits 89	Pump Cap	gal/stk	gal/stk
				Pump stk/min		
Drill Pipe Size 0. in	Length ft	Intermediate	Total Circulating Vol	Flow Rate		gal/min
				Bottoms Up		
Drill Collar Size 0. in	Length ft	Production or Liner	In Storage 0	Total Circ Time		
				Circulating Pressure		

MUD PROPERTIES

Sample From		PIT@11:30	PIT@13:30		
Flow Line Temp	°F	-	-		
Depth/TVD	ft	-/-	-/-		
Mud Weight	lb/gal	13.95@154°F	13.95@163°F		
Funnel Viscosity	s/qt	-			
Rheology Temp	°F	120	120		
R600/R300		68/40	67/39		
R200/R100					
R6/R3					
PV	cP	28	28		
YP	lb/100ft²	12	11		
10s/10m/30m Gel	lb/100ft²	9/ /	9/ /		
API Fluid Loss	cc/30 min				
HTHP FL Temp	cc/30 min				
Cake API/HTHP	1/32"				
Solids	%Vol	22	22		
Oil/Water	%Vol	/78	/78		
Sand	%Vol	3	3		
MBT	lb/bbl				
pH		8.2	8.1		
Alkal Mud (Pm)					
Pf/Mf					
Chlorides	mg/l				
Hardness Ca	mg/l				

PRODUCTS USED LAST 24 HRS

Products	Size	Amt
ENGINEERING SERVIC	1 EA	1
M-I BAR	100 LB BG	40
DRIVE-BY ENGINEER	1 EA	2
TRUCKING SERVICE	100 LB	880
PALLETS	1 EA	19
SHRINK WRAPPING	1 EA	19
OTHER SERVICE - PAS	1 EA	1

SOLIDS EQUIP	Size	Hr

MUD PROPERTY SPECS

Weight	
Viscosity	
Filtrate	

REMARKS AND TREATMENT

REMARKS

TIME DISTR	Last 24 Hrs	MUD VOL ACCTG	(bbl)	SOLIDS ANALYSIS (%/lb/bbl)		MUD RHEOLOGY & HYDRAULICS	
Rig Up/Service		Oil Added	0	NaCl	0./ 0.	n/k Values	
Drilling		Water Added	5	KCl	0./ 0.	Tauy (lb/100ft²)	
Tripping		Mud Received	0	Low Gravity	1.8/ 16.7	Bit Loss (psi / %)	
Non-Productive Tim		Shakers	0	Bentonite	0./ 0.	Bit HHP (hhp / HSI)	
		Evaporation	0	Drill Solids	1.8/ 16.7	Bit Jet Vel (ft/s)	
		Centrifuge	0	Weight Material	20.2/ 296.5	Ann. Vel DP (ft/min)	
		Formation	0	Chemical Conc	- / 0.	Ann. Vel DC (ft/min)	
		Left in Hole	0	Inert/React	-	Crit Vel DP (ft/min)	
		Other	0	Average SG	4.07	Crit Vel DC (ft/min)	
		Dumped	0	Carb/BiCarb (m mole/L)	0./ -0.1		

M-I ENGR / PHONE		RIG PHONE	WAREHOUSE PHONE	DAILY COST	CUMULATIVE COST
Glenn Beisert	936-697-5852		713-676-2127	USD 6,745.52	USD 35,727.81

MI SWACO

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

ANALYTICAL SERVICES LABORATORY

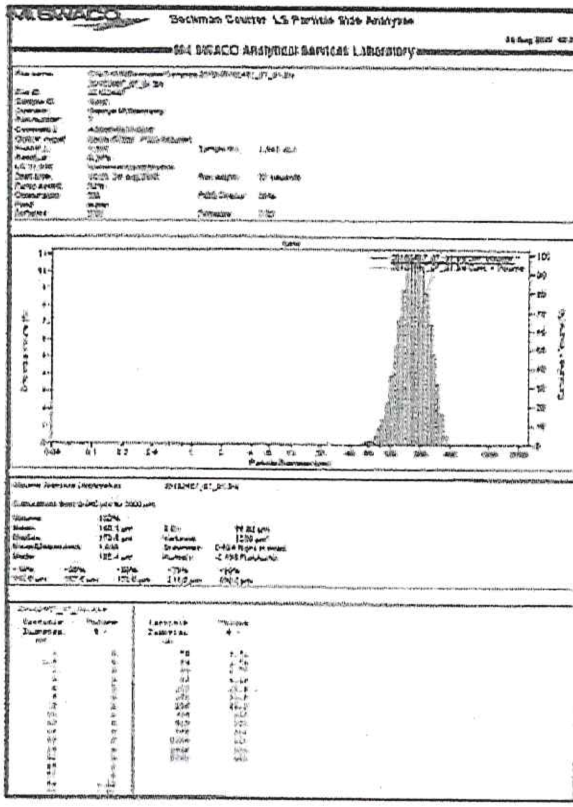
Project Number : AS096-0817-2010 **Analyst :** George McMennamy **Date :** 8-26-2010

Sample Identification: One sand sample (LM#20102487)

Request : PSD

Testing Procedure : Beckman Coulter LS for Particle Size.

Data:



Mesh	Micron	Inches
4	4760	0.185
6	3360	0.131
8	2380	0.093
12	1680	0.065
16	1190	0.046
20	840	0.0328
30	590	0.0232
40	420	0.0164
50	297	0.0116
60	250	0.0097
70	210	0.0082
80	177	0.0069
100	149	0.0058
140	105	0.0041
200	74	0.0029
230	62	0.0023
270	53	0.0021
325	44	0.0017
400	37	0.0015
625	20	0.0008
1250	10	0.0004
2500	5	0.0002

Conclusion: The sand size is approximately 60 microns to 400 microns. This is approximately 40 to 230 mesh.

Copies to: Glenn Beisert-Jack
Marc Churan

Signed: *George McMennamy*

MI SWACO

WATER-BASED MUD REPORT No. 12

Date	8/30/2010	Depth/TVD	ft / ft
Spud Date	7/20/2010	Mud Type	Spud Mud
Water Depth		Activity	

Operator : Stress Engineering
Report For : Kenneth Young
Well Name : Weatherford Tool Test
Contractor :
Report For :

Field/Area :
Description : Test
Location : Waller County
Well No. :

DRILLING ASSEMBLY		CASING	MUD VOLUME (bbl)
Bit Size 0. in		Surface	Hole
Nozzles 1/32"			
Drill Pipe Size 0. in	Length ft	Intermediate	Active Pits 90
Drill Pipe Size 0. in	Length ft	Intermediate	Total Circulating Vol
Drill Collar Size 0. in	Length ft	Production or Liner	In Storage 0

CIRCULATION DATA

Pump Make		
Pump Size	0. X 0.in	0. X 0.in
Pump Cap	gal/stk	gal/stk
Pump stk/min		
Flow Rate	gal/min	
Bottoms Up		
Total Circ Time		
Circulating Pressure		

MUD PROPERTIES

Sample From		PIT@08:00	PIT@10:00	PIT@15:30	
Flow Line Temp	°F	112	120	126	
Depth/TVD	ft				
Mud Weight	lb/gal	14.1@112°F	14.1@120°F	14.05@126°F	
Funnel Viscosity	s/qt				
Rheology Temp	°F	120	120	120	
R600/R300		62/40	58/36	60/38	
R200/R100					
R6/R3					
PV	cP	22	22	22	
YP	lb/100ft²	18	14	16	
10s/10m/30m Gel	lb/100ft²	9//	9//	10//	
API Fluid Loss	cc/30 min				
HTHP FL Temp	cc/30 min				
Cake API/HTHP	1/32"				
Solids	%Vol	22	22	22	
Oil/Water	%Vol	/78	/78	/78	
Sand	%Vol	3	3	3	
MBT	lb/bbl				
pH		7.9	7.8	7.8	
Alkal Mud (Pm)					
Pf/Mf					
Chlorides	mg/l				
Hardness Ca	mg/l				

PRODUCTS USED LAST 24 HRS

Products	Size	Amt
ENGINEERING SERVIC	1 EA	1
M-I BAR	100 LB BG	16

SOLIDS EQUIP	Size	Hr

MUD PROPERTY SPECS

Weight	
Viscosity	
Filtrate	

REMARKS AND TREATMENT

REMARKS

TIME DISTR	Last 24 Hrs
Rig Up/Service	
Drilling	
Tripping	
Non-Productive Time	

MUD VOL ACCTG	(bbl)
Oil Added	0
Water Added	0
Mud Received	0
Shakers	0
Evaporation	0
Centrifuge	0
Formation	0
Left in Hole	0
Other	0
Dumped	0

SOLIDS ANALYSIS (%/lb/bbl)	
NaCl	0./0.
KCl	0./0.
Low Gravity	0.7/6.4
Bentonite	0./0.
Drill Solids	0.7/6.4
Weight Material	21.3/313.
Chemical Conc	- / 0.
Inert/React	-
Average SG	4.15
Carb/BiCarb (m mole/L)	0./-0.1

MUD RHEOLOGY & HYDRAULICS	
n/k Values	
Tauy (lb/100ft²)	
Bit Loss (psi / %)	
Bit HHP (hhp / HSI)	
Bit Jet Vel (ft/s)	
Ann. Vel DP (ft/min)	
Ann. Vel DC (ft/min)	
Crit Vel DP (ft/min)	
Crit Vel DC (ft/min)	

M-I ENGR / PHONE		RIG PHONE	WAREHOUSE PHONE	DAILY COST	CUMULATIVE COST
Jason Keeling	713-591-2351		713-676-2127	USD 1,701.07	USD 37,428.88
Glenn Beisert	936-697-5852				

MI SWACO
A Schlumberger Company
5950 NORTH COURSE DRIVE, HOUSTON, TX 77072
281 561-1383 FAX 281 561-7240

ANALYTICAL SERVICES LABORATORY

Project Number : AS024-0903-2010 **Analyst :** Tyler Adams **Date :** 9/3/2010

Sample Identification: Sand Mud from MOHR Engineering

Lab Master # : 20102699

Request : Sieve Analysis

Testing Procedure : Wet Sieve Analysis

Test Data:

Sieve Analysis:

	Play 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	0.75 wt% solids
-100 mesh and +200 mesh	3.25 wt% solids
-200 mesh and +325 mesh	8.88 wt% solids
-325 mesh	86.77 wt% solids

Copies to: Jack Littlefield / Kenneth Young / Jay Forrester
Marc Churan

Signed: *Tyler Adams*

MI SWACO
A Schlumberger Company
5950 NORTH COURSE DRIVE, HOUSTON, TX 77072
281 561-1383 FAX 281 561-7240

ANALYTICAL SERVICES LABORATORY

Project Number : AS025-0903-2010 **Analyst :** Tyler Adams **Date :** 9/3/2010

Sample Identification: Sand Mud from MOHR Engineering

Lab Master # : 20102700

Request : Sieve Analysis and PSD

Testing Procedure : Wet Sieve Analysis and Beckman Coulter Particle Size Analysis

Test Data:

Sieve Analysis:

	MOHR Engineering
+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	0.22 wt% solids
-80 mesh and +100 mesh	1.78 wt% solids
-100 mesh and +200 mesh	3.00 wt% solids
-200 mesh and +325 mesh	7.84 wt% solids
-325 mesh	87.14 wt% solids

Copies to: Jack Littlefield / Kelly Hall / Jason Keeling
Pat Keeling / Jay Forrester / Marc Churan

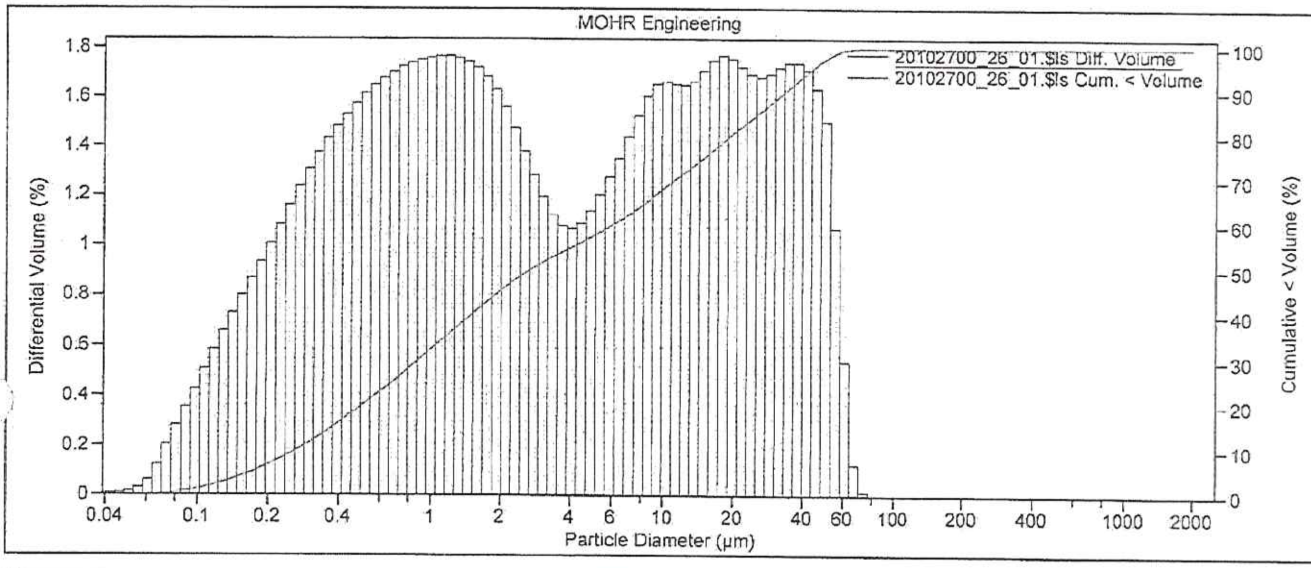
Signed: *Tyler Adams*

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.$ls 20102700_26_01.$ls		
File ID:	20102700		
Sample ID:	MOHR Engineering		
Operator:	Tyler Adams		
Run number:	26		
Comment 1:	Sand from Test Well		
Comment 2:	AS025-0903-2010		
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
Median:	2.690 µm	Variance:	200.2 µm^2
Mean/Median ratio:	3.785	Skewness:	1.685 Right skewed
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 µm	Volume % <	Particle Diameter µm	Volume % <
1	32.5	75	99.997
1.5	40.2	84	100
2	45.3	90	100
3	51.5	96	100
4	54.9	128	100
6	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
32	89.4	2000	100
48	96.8		
50	97.4		
64	99.9		
72	99.99		

MI SWACO

WATER-BASED MUD REPORT No. 13

Date	9/3/2010	Depth/TVD	ft / ft
Spud Date	7/20/2010	Mud Type	Spud Mud
Water Depth		Activity	Circulating/Testing

Operator : Stress Engineering
Report For : Kenneth Young
Well Name : Weatherford Tool Test
Contractor :
Report For :

Field/Area :
Description : Test
Location : Waller County
Well No. :

DRILLING ASSEMBLY		CASING	MUD VOLUME (bbl)
Bit Size 0. in		Surface	Hole
Nozzles 1/32"			
Drill Pipe Size 0. in	Length ft	Intermediate	Active Pits 90
Drill Pipe Size 0. in	Length ft	Intermediate	Total Circulating Vol
Drill Collar Size 0. in	Length ft	Production or Liner	In Storage 0

CIRCULATION DATA		
Pump Make		
Pump Size	0. X 0.in	0. X 0.in
Pump Cap	gal/stk	gal/stk
Pump stk/min		
Flow Rate	gal/min	
Bottoms Up		
Total Circ Time		
Circulating Pressure		

MUD PROPERTIES

Sample From		Pit@09:30	Pit@12:30	Pit@14:45	Pit@16:45
Flow Line Temp	°F				
Depth/TVD	ft				
Mud Weight	lb/gal	13.95@140°F	13.95@144°F	14.0@148°F	14.0@148°F
Funnel Viscosity	s/qt				
Rheology Temp	°F	120	120	120	120
R600/R300		70/40	67/38	77/43	95/55
R200/R100					
R6/R3					
PV	cP	30	29	34	40
YP	lb/100ft²	10	9	9	15
10s/10m/30m Gel	lb/100ft²	8/ /	9/ /	9/ /	10/ /
API Fluid Loss	cc/30 min				
HTHP Fl. Temp	cc/30 min				
Cake API/HTHP	1/32"				
Solids	%Vol	22	22	22	22
Oil/Water	%Vol	0/78	0/78	0/78	0/78
Sand	%Vol	2.5	2.5	2.5	2.25
MBT	lb/bbl	22.5	25	25	25
pH		9.2	9.1	9.0	8.9
Alkal Mud (Pm)					
Pf/Mf					
Chlorides	mg/l				
Hardness Ca	mg/l				

PRODUCTS USED LAST 24 HRS

Products	Size	Amt
ENGINEERING SERVIC	1 EA	2
M-I BAR	100 LB BG	24
M-I GEL	100 LB BG	8
TANNATHIN	50 LB BG	5
CAUSTIC SODA	50 LB BG	1

SOLIDS EQUIP	Size	Hr

MUD PROPERTY SPECS

Weight	
Viscosity	
Filtrate	

REMARKS AND TREATMENT

REMARKS

TIME DISTR	Last 24 Hrs
Rig Up/Service	
Drilling	
Tripping	
Non-Productive Time	

MUD VOL ACCTG	(bbl)
Oil Added	0
Water Added	0
Mud Received	0
Shakers	0
Evaporation	0
Centrifuge	0
Formation	0
Left in Hole	0
Other	0
Dumped	0

SOLIDS ANALYSIS (%/lb/bbl)	
NaCl	0./0.
KCl	0./0.
Low Gravity	1.8/16.7
Bentonite	2.6/23.2
Drill Solids	-0.7/-6.5
Weight Material	20.2/296.5
Chemical Conc	- / 0.
Inert/React	-0.2586
Average SG	4.07
Carb/BiCarb (m mole/L)	0./-0.1

MUD RHEOLOGY & HYDRAULICS	
n/k Values	
Tau0 (lb/100ft²)	
Bit Loss (psi/%)	
Bit HHP (hhp/HSI)	
Bit Jet Vel (ft/s)	
Ann. Vel DP (ft/min)	
Ann. Vel DC (ft/min)	
Crit Vel DP (ft/min)	
Crit Vel DC (ft/min)	

M-I ENGR / PHONE		RIG PHONE	WAREHOUSE PHONE	DAILY COST	CUMULATIVE COST
Jason Keeling	713-591-2351		713-676-2127	USD 3,702.59	USD 41,131.48
Glenn Beisert	936-697-5852				

MI SWACO

WATER-BASED MUD REPORT No. 14

Operator : Stress Engineering	**Field/Area :**	**Depth/TVD :**	0 ft / 0 ft
Report For : Kenneth Young	**Description :** Test	**Date :**	9/8/2010
Well Name : Weatherford Tool Test	**Location :** Waller County	**Spud Date :**	7/20/2010
Contractor :	**Water Depth :** 0 ft	**Mud Type :**	Spud Mud
Report For :	**Rig Name :**	**Activity :**	Circulating

DRILLING ASSEMBLY	CASING	MUD VOLUME (bbl)	
ft, -in		Hole	Active Pits
ft, -in			90
ft, -in		Total Circulating Volume	
ft, -in		90	
ft, -in		Depth Drilled Last 24 hr	
ft, -in		ft	
Nozzles 0 1/32"		Volume Drilled Last 24 hr	
Bit 0-in 0		bbl	

CIRCULATION DATA		
Pump Make		
Pump Liner x Stk	0x0 in	0x0 in
Pump Capacity gal/stk		
Pump stk/min	0@0%	0@0%
Flow Rate		gal/min
Pump Pressure		psi
Bottoms Up		
Total Circulation		

MUD PROPERTIES

Sample From		Pit 9:00	Pit 10:00	Pit 12:00	Pit 15:00
FlowLine Temp	°F				
Depth/TVD	ft	/	/	/	/
Mud Weight /Temp	lb/gal	14.0@	14.1@	14.0@	14.0@
Funnel Viscosity	s/qt				
Rheology Temp	°F	120	120	120	120
R600/R300		98/56	83/46	82/47	102/59
R200/R100		/	/	/	/
R6/R3		/	/	/	/
PV	cP	42	37	35	43
YP	lb/100ft²	14	9	12	16
10s/10m/30m Gel	lb/100ft²	9//	9//	8//	9//
API Fluid Loss	cc/30min				
HTHP Fluid Loss	cc/30min	.0@	.0@	.0@	.0@
Cake APT/HT	1/32"	/	/	/	/
Solids	%Vol	22	22	22	22
Oil/Water	%Vol	/78	/78	/78	/78
Sand	%Vol	3	2.25	2.5	2.5
MBT	lb/bbl				
pH / Temp		.0@	.0@	.0@	.0@
Alkal Mud (Pm)					
Pf/Mf		.00/.00	.00/.00	.00/.00	.00/.00
Chlorides	mg/L				
Hardness (Ca++)					
Reserve Volume	bbl				

PRODUCTS USED Last 24 hr

Products	Size	Amount
ENGINEERING SERVICE	1. EA	1
DUO-VIS	25. LB BG	1

SOLIDS CONTROL EQUIPMENT Last 24 hr

Type	Model/Size	Hrs Used

MUD PROPERTY SPECS

		Actual
Weight		14.0
Viscosity		
Filtrate		

REMARKS AND TREATMENT

REMARKS

TIME DISTRIBUTION Last 24 hrs	
Rig Up/Service	
Drilling	
Tripping	
Non-Productive Tim	

MUD VOL ACCTG (bbl)	
Oil Added	
Water Added	
Mud Received	
Mud Returned	
Shakers	
Evaporation	
Centrifuge	
Formation	
Left in Hole	
Other	
Dumped	
Sandtrap	

SOLIDS ANALYSIS (%/lb/bbl)	
NaCl	0./ 0.
KCl	0./ 0.
Low Gravity	2.2/ 20.1
Bentonite	0./ 0.
Drill Solids	2.2/ 20.1
Weight Material	19.8/ 290.9
Chemical Conc	- / 0.
Inert/React	-
Average SG	4.04

RHEOLOGY & HYDRAULICS	
n	
k	
Tauy	
Bit Press Loss/%	
Bit HHP/HIS	
Jet Velocity	
Va Pipe	
Va Collars	
CVa Pipe	
CVa Collars	
ECD @Shoe	
ECD at TD	

M-I ENGR / PHONE	RIG PHONE	WAREHOUSE PHONE	DAILY COST	CUMULATIVE COST
Glenn Beisert 936-697-5852 Jason Keeling 713-591-2351		713-676-2127	$1,740.42	$42,871.89

MI SWACO

WATER-BASED MUD REPORT No. 14

Operator :	Stress Engineering	**Field/Area :**	0	**Depth/TVD :**	0 ft / 0 ft
Report For :	Kenneth Young	**Description :**	Test	**Date :**	9/8/2010
Well Name :	Weatherford Tool Test	**Location :**	Waller County	**Spud Date :**	7/20/2010
Contractor:	0	**Water Depth :**	0 ft	**Mud Type :**	Spud Mud
Report For :	0	**Rig Name :**	0	**Activity :**	0

DRILLING ASSEMBLY	CASING
ft, -in	0
ft, -in	0
ft, -in	0
ft, -in	0
ft, -in	0
ft, -in	0
Nozzles 0 1/32"	0
Bit 0-in 0	0

MUD VOLUME (bbl)	
Hole	Active Pits
0	60
Total Circulating Volume	
90	
Depth Drilled Last 24 hr	
0 ft	
Volume Drilled Last 24 hr	
0 bbl	

CIRCULATION DATA		
Pump Make	0	0
Pump Liner x Stk	0x0 in	0x0 in
Pump Capacity gal/stk	0	0
Pump stk/min	0@0%	0@0%
Flow Rate	0 gal/min	
Pump Pressure	0 psi	
Bottoms Up	0	
Total Circulation	0	

MUD PROPERTIES

Sample From		PIT 16:45			
FlowLine Temp	°F				
Depth/TVD	ft				
Mud Weight /Temp	lb/gal	13.95@			
Funnel Viscosity	s/qt				
Rheology Temp	°F	120			
R600/R300		92/53			
R200/R100					
R6/R3					
PV	cP	39			
YP	lb/100ft²	14			
10s/10m/30m Gel	lb/100ft²	9//			
API Fluid Loss	cc/30min				
HTHP Fluid Loss	cc/30min				
Cake APT/HT	1/32"				
Solids	%Vol	22			
Oil/Water	%Vol	0/78			
Sand	%Vol	3			
MBT	lb/bbl				
pH / Temp					
Alkal Mud (Pm)					
Pf/Mf	0				
Chlorides	mg/L				
Hardness (Ca++)					
Reserve Volume	bbl	0			

PRODUCTS USED Last 24 hr

Products	Size	Amount
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0

SOLIDS CONTROL EQUIPMENT Last 24 hr

Type	Model/Size	Hrs Used
0	0	0.0
0	0	0.0
0	0	0.0
0	0	0.0
0	0	0.0
0	0	0.0
0	0	0.0
0	0	0.0
0	0	0.0
0	0	0.0
0	0	0.0

MUD PROPERTY SPECS

		Actual
Weight	0	14.1
Viscosity	0	0
Filtrate	0	0

REMARKS AND TREATMENT

0

REMARKS

0

TIME DISTRIBUTION Last 24 hrs

Rig Up/Service	0
Drilling	0
Tripping	0
Non-Productive Time	0
0	0
0	0
0	0
0	0
0	0
0	0

MUD VOL ACCTG (bbl)

Oil Added	0
Water Added	0
Mud Received	0
Mud Returned	0
Shakers	0
Evaporation	0
Centrifuge	0
Formation	0
Left in Hole	0
Other	0
Dumped	0
Sandtrap	0
0	0
0	0

SOLIDS ANALYSIS (%/lb/bbl)

NaCl	0./ 0.
KCl	0./ 0.
Low Gravity	0./ 0.
Bentonite	0./ 0.
Drill Solids	0./ 0.
Weight Material	0./ 0.
Chemical Conc	0./ 0.
Inert/React	-
Average SG	-
0	0

RHEOLOGY & HYDRAULICS

n	0
k	0
Tauy	0
Bit Press Loss/%	0
Bit HHP/HIS	0
Jet Velocity	0
Va Pipe	0
Va Collars	0
CVa Pipe	0
CVa Collars	0
ECD @Shoe	0
ECD at TD	0

M-I ENGR / PHONE	RIG PHONE	WAREHOUSE PHONE	DAILY COST	CUMULATIVE COST
Cole Vanya 979-220-7701		713-676-2127		

MI SWACO

WATER-BASED MUD REPORT No. 15

Operator : Stress Engineering	**Field/Area :**	**Depth/TVD :**	0 ft / 0 ft
Report For : Kenneth Young	**Description :** Test	**Date :**	9/9/2010
Well Name : Weatherford Tool Test	**Location :** Waller County	**Spud Date :**	7/20/2010
Contractor:	**Water Depth :** 0 ft	**Mud Type :**	Spud Mud
Report For :	**Rig Name :**	**Activity :**	

DRILLING ASSEMBLY	CASING	MUD VOLUME (bbl)	
ft, -in		Hole	Active Pits
ft, -in			90
ft, -in		Total Circulating Volume	
ft, -in		90	
ft, -in		Depth Drilled Last 24 hr	
ft, -in		ft	
Nozzles 0 1/32"		Volume Drilled Last 24 hr	
Bit 0-in 0		bbl	

CIRCULATION DATA		
Pump Make		
Pump Liner x Stk	0x0 in	0x0 in
Pump Capacity gal/stk		
Pump stk/min	0@0%	0@0%
Flow Rate		gal/min
Pump Pressure		psi
Bottoms Up		
Total Circulation		

MUD PROPERTIES					
Sample From		PIT 7:45	PIT 10:45	PIT 12:45	PIT 14:45
FlowLine Temp	°F				
Depth/TVD	ft	/	/	/	/
Mud Weight /Temp	lb/gal	14.1@	14.1@	14.1@	14.1@
Funnel Viscosity	s/qt				
Rheology Temp	°F	120	120	120	120
R600/R300		90/52	83/47	75/41	80/45
R200/R100		/	/	/	/
R6/R3		/	/	/	/
PV	cP	38	36	34	35
YP	lb/100ft²	14	11	7	10
10s/10m/30m Gel	lb/100ft²	6//	6//	6//	6//
API Fluid Loss	cc/30min				
HTHP Fluid Loss	cc/30min	.0@	.0@	.0@	.0@
Cake APT/HT	1/32"	/	/	/	/
Solids	%Vol				
Oil/Water	%Vol	/	/	/	/
Sand	%Vol	2.5	2.5	2.5	2.5
MBT	lb/bbl				
pH / Temp		.0@	.0@	.0@	.0@
Alkal Mud (Pm)					
Pf/Mf		.00/.00	.00/.00	.00/.00	.00/.00
Chlorides	mg/L				
Hardness (Ca++)					
Reserve Volume	bbl				

PRODUCTS USED Last 24 hr		
Products	Size	Amount
ENGINEERING SERVICE	1. EA	1
M-I BAR	100. LB BG	35

SOLIDS CONTROL EQUIPMENT Last 24 hr		
Type	Model/Size	Hrs Used

MUD PROPERTY SPECS		Actual
Weight		14.1
Viscosity		
Filtrate		

REMARKS AND TREATMENT

REMARKS

TIME DISTRIBUTION Last 24 hrs	
Rig Up/Service	
Drilling	
Tripping	
Non-Productive Tim	

MUD VOL ACCTG (bbl)	
Oil Added	
Water Added	
Mud Received	
Mud Returned	
Shakers	
Evaporation	
Centrifuge	
Formation	
Left in Hole	
Other	
Dumped	
Sandtrap	

SOLIDS ANALYSIS (%/lb/bbl)	
NaCl	0./ 0.
KCl	0./ 0.
Low Gravity	0.109790752
Bentonite	0./ 0.
Drill Solids	0.109790752
Weight Material	42.5/ 625.4
Chemical Conc	- / 0.
Inert/React	-
Average SG	-

RHEOLOGY & HYDRAULICS	
n	
k	
Tauy	
Bit Press Loss/%	
Bit HHP/HIS	
Jet Velocity	
Va Pipe	
Va Collars	
CVa Pipe	
CVa Collars	
ECD @Shoe	
ECD at TD	

M-I ENGR / PHONE	RIG PHONE	WAREHOUSE PHONE	DAILY COST	CUMULATIVE COST
Cole Vanya 979-220-7701		713-676-2127	$2,296.09	$45,167.98

MI SWACO

WATER-BASED MUD REPORT No. 17

Date	10/8/2010	Depth/TVD	ft / ft
Spud Date	7/20/2010	Mud Type	Spud Mud
Water Depth		Activity	

Operator : Stress Engineering
Report For : Kenneth Young
Well Name :
Contractor :
Report For :

Field/Area :
Description : Test
Location : Waller County
Well No. :

DRILLING ASSEMBLY

Bit Size 0. in		
Nozzles 1/32"		
Drill Pipe Size 0. in	Length ft	
Drill Pipe Size 0. in	Length ft	
Drill Collar Size 0. in	Length ft	

CASING

Surface
Intermediate
Intermediate
Production or Liner

MUD VOLUME (bbl)

Hole	
Active Pits	60
Total Circulating Vol	
In Storage	0

CIRCULATION DATA

Pump Make		
Pump Size	0. X 0.in	0. X 0.in
Pump Cap	gal/stk	gal/stk
Pump stk/min		
Flow Rate		gal/min
Bottoms Up		
Total Circ Time		
Circulating Pressure		

MUD PROPERTIES

Sample From		PIT@08:00
Flow Line Temp	°F	
Depth/TVD	ft	
Mud Weight	lb/gal	14.0
Funnel Viscosity	s/qt	
Rheology Temp	°F	120
R600/R300		72/41
R200/R100		
R6/R3		
PV	cP	31
YP	lb/100ft²	10
10s/10m/30m Gel	lb/100ft²	6/ /
API Fluid Loss	cc/30 min	
HTHP FL Temp	cc/30 min	
Cake API/HTHP	1/32"	
Solids	%Vol	
Oil/Water	%Vol	
Sand	%Vol	2.25
MBT	lb/bbl	
pH		
Alkal Mud (Pm)		
Pf/Mf		
Chlorides	mg/l	
Hardness Ca	mg/l	

PRODUCTS USED LAST 24 HRS

Products	Size	Amt
M-I BAR	100 LB BG	4
DRIVE-BY ENGINEER	1 EA	1

SOLIDS EQUIP | Size | Hr

MUD PROPERTY SPECS

Weight
Viscosity
Filtrate

REMARKS AND TREATMENT

REMARKS

TIME DISTR Last 24 Hrs

Rig Up/Service	
Drilling	
Tripping	
Non-Productive Time	

MUD VOL ACCTG (bbl)

Oil Added	0
Water Added	0
Mud Received	0
Shakers	0
Evaporation	0
Centrifuge	0
Formation	0
Left in Hole	0
Other	0
Dumped	0

SOLIDS ANALYSIS (%/lb/bbl)

NaCl	0./ 0.
KCl	0./ 0.
Low Gravity	43.3/ -394
Bentonite	0./ 0.
Drill Solids	43.3/ -394
Weight Material	43.3/ 636.4
Chemical Conc	- / 0.
Inert/React	-
Average SG	-
Carb/BiCarb (m mole/l)	0./ -0.1

MUD RHEOLOGY & HYDRAULICS

n/k Values
Tauy (lb/100ft²)
Bit Loss (psi / %)
Bit HHP (hhp / HSI)
Bit Jet Vel (ft/s)
Ann Vel DP (ft/min)
Ann Vel DC (ft/min)
Crit Vel DP (ft/min)
Crit Vel DC (ft/min)

M-I ENGR / PHONE		RIG PHONE	WAREHOUSE PHONE	DAILY COST	CUMULATIVE COST
Cole Vanya	979-220-7701		713-676-2127	USD 600.27	USD 47,124.83

MI SWACO

WATER-BASED MUD REPORT No. 18

Date	10/12/2010	Depth/TVD	ft / ft
Spud Date	7/20/2010	Mud Type	Spud Mud
Water Depth		Activity	

Operator : Stress Engineering
Report For : Kenneth Young
Well Name :
Contractor :
Report For :

Field/Area :
Description : Test
Location : Waller County
Well No. :

DRILLING ASSEMBLY		CASING	MUD VOLUME (bbl)
Bit Size 0. in		Surface	Hole
Nozzles 1/32"			
Drill Pipe Size 0. in	Length ft	Intermediate	Active Pits 60
Drill Pipe Size 0. in	Length ft	Intermediate	Total Circulating Vol
Drill Collar Size 0. in	Length ft	Production or Liner	In Storage 0

CIRCULATION DATA

Pump Make		
Pump Size	0. X 0.in	0. X 0.in
Pump Cap	gal/stk	gal/stk
Pump stk/min		
Flow Rate		gal/min
Bottoms Up		
Total Circ Time		
Circulating Pressure		

MUD PROPERTIES

Sample From		PITS@14:00
Flow Line Temp	°F	
Depth/TVD	ft	
Mud Weight	lb/gal	14.05@120°F
Funnel Viscosity	s/qt	
Rheology Temp	°F	
R600/R300		
R200/R100		
R6/R3		
PV	cP	
YP	lb/100ft²	
10s/10m/30m Gel	lb/100ft²	
API Fluid Loss	cc/30 min	
HTHP Fl. Temp	cc/30 min	
Cake API/HTHP	1/32"	
Solids	%Vol	
Oil/Water	%Vol	
Sand	%Vol	
MBT	lb/bbl	
pH		
Alkal Mud (Pm)		
Pf/Mf		
Chlorides	mg/l	
Hardness Ca	mg/l	

PRODUCTS USED LAST 24 HRS

Products	Size	Amt
DRIVE-BY ENGINEER	1 EA	1

SOLIDS EQUIP	Size	Hr

MUD PROPERTY SPECS

Weight
Viscosity
Filtrate

REMARKS AND TREATMENT

REMARKS

TIME DISTR	Last 24 Hrs
Rig Up/Service	
Drilling	
Tripping	
Non-Productive Time	

MUD VOL ACCTG	(bbl)
Oil Added	0
Water Added	0
Mud Received	0
Shakers	0
Evaporation	0
Centrifuge	0
Formation	0
Left in Hole	0
Other	0
Dumped	0

SOLIDS ANALYSIS (%/lb/bbl)	
NaCl	0/0.
KCl	0/0.
Low Gravity	42.9/-390.
Bentonite	0/0.
Drill Solids	42.9/-390.
Weight Material	42.9/630.9
Chemical Conc	- / 0.
Inert/React	-
Average SG	•
Carb/HCarb (m mole/L)	0/-0.1

MUD RHEOLOGY & HYDRAULICS	
n/k Values	
Tauy (lb/100ft²)	
Bit Loss (psi / %)	
Bit HHP (hhp / HSI)	
Bit Jet Vel (ft/s)	
Ann. Vel DP (ft/min)	
Ann. Vel DC (ft/min)	
Crit Vel DP (ft/min)	
Crit Vel DC (ft/min)	

M-I ENGR / PHONE		RIG PHONE	WAREHOUSE PHONE	DAILY COST	CUMULATIVE COST
Cole Vanya	979-220-7701		713-676-2127	USD 475.00	USD 47,599.83

MI SWACO

WATER-BASED MUD REPORT No. 19

Date	10/15/2010	Depth/TVD	ft / ft
Spud Date	7/20/2010	Mud Type	Spud Mud
Water Depth		Activity	

Operator : Stress Engineering
Report For : Kenneth Young
Well Name :
Contractor :
Report For :

Field/Area :
Description : Test
Location : Waller County
Well No. :

DRILLING ASSEMBLY		CASING	MUD VOLUME (bbl)	CIRCULATION DATA		
Bit Size 0. in		Surface	Hole	Pump Make		
Nozzles 1/32"				Pump Size	0. X 0.in	0. X 0.in
Drill Pipe Size 0. in	Length ft	Intermediate	Active Pits 60	Pump Cap	gal/stk	gal/stk
				Pump stk/min		
Drill Pipe Size 0. in	Length ft	Intermediate	Total Circulating Vol	Flow Rate		gal/min
				Bottoms Up		
Drill Collar Size 0. in	Length ft	Production or Liner	In Storage 0	Total Circ Time		
				Circulating Pressure		

MUD PROPERTIES

Sample From		PIT@08:45			
Flow Line Temp	°F				
Depth/TVD	ft				
Mud Weight	lb/gal	14.05			
Funnel Viscosity	s/qt				
Rheology Temp	°F				
R600/R300					
R200/R100					
R6/R3					
PV	cP				
YP	lb/100ft²				
10s/10m/30m Gel	lb/100ft²				
API Fluid Loss	cc/30 min				
HTHP FL Temp	cc/30 min				
Cake API/HTHP	1/32"				
Solids	%Vol				
Oil/Water	%Vol				
Sand	%Vol				
MBT	lb/bbl				
pH					
Alkal Mud (Pm)					
Pf/Mf					
Chlorides	mg/l				
Hardness Ca	mg/l				

PRODUCTS USED LAST 24 HRS

Products	Size	Amt
DUO-VIS	25 LB BG	1
DRIVE-BY ENGINEERI	1 EA	1

SOLIDS EQUIP	Size	Hr

MUD PROPERTY SPECS

Weight
Viscosity
Filtrate

REMARKS AND TREATMENT

REMARKS

TIME DISTR	Last 24 Hrs
Rig Up/Service	
Drilling	
Tripping	
Non-Productive Tim	

MUD VOL ACCTG	(bbl)
Oil Added	0
Water Added	0
Mud Received	0
Shakers	0
Evaporation	0
Centrifuge	0
Formation	0
Left in Hole	0
Other	0
Dumped	0

SOLIDS ANALYSIS (%/lb/bbl)	
NaCl	0 / 0.
KCl	0 / 0.
Low Gravity	42.9/ -390.
Bentonite	0 / 0.
Drill Solids	42.9/ -390.
Weight Material	42.9/ 630.9
Chemical Conc	- / 0.
Inert/React	-
Average SG	-
Carb/BiCarb (m mole/L)	0 / -0.1

MUD RHEOLOGY & HYDRAULICS	
n/k Values	
Tauy (lb/100ft²)	
Bit Loss (psi / %)	
Bit HHP (hhp / HSI)	
Bit Jet Vel (ft/s)	
Ann. Vel DP (ft/min)	
Ann. Vel DC (ft/min)	
Crit Vel DP (ft/min)	
Crit Vel DC (ft/min)	

M-I ENGR / PHONE		RIG PHONE	WAREHOUSE PHONE	DAILY COST	CUMULATIVE COST
Cole Vanya	979-220-7701		713-676-2127	USD 1,015.42	USD 48,615.24

MI SWACO

WATER-BASED MUD REPORT No. 20

Date	10/20/2010	Depth/TVD	ft / ft
Spud Date	7/20/2010	Mud Type	Spud Mud
Water Depth		Activity	

Operator : Stress Engineering
Report For : Kenneth Young
Well Name :
Contractor :
Report For :

Field/Area :
Description : Test
Location : Waller County
Well No. :

DRILLING ASSEMBLY		CASING	MUD VOLUME (bbl)
Bit Size 0. in		Surface	Hole
Nozzles 1/32"			
Drill Pipe Size 0. in	Length ft	Intermediate	Active Pits 50
Drill Pipe Size 0. in	Length ft	Intermediate	Total Circulating Vol
Drill Collar Size 0. in	Length ft	Production or Liner	In Storage 0

CIRCULATION DATA

Pump Make		
Pump Size	0. X 0.in	0. X 0.in
Pump Cap	gal/stk	gal/stk
Pump stk/min		
Flow Rate		gal/min
Bottoms Up		
Total Circ Time		
Circulating Pressure		

MUD PROPERTIES

Sample From		PITS@07:25
Flow Line Temp	°F	
Depth/TVD	ft	
Mud Weight	lb/gal	14.05
Funnel Viscosity	s/qt	
Rheology Temp	°F	120
R600/R300		50/31
R200/R100		
R6/R3		
PV	cP	19
YP	lb/100ft²	12
10s/10m/30m Gel	lb/100ft²	9/ /
API Fluid Loss	cc/30 min	
HTHP FL Temp	cc/30 min	
Cake API/HTHP	1/32"	
Solids	%Vol	
Oil/Water	%Vol	
Sand	%Vol	1.75
MBT	lb/bbl	
pH		
Alkal Mud (Pm)		
Pf/Mf		
Chlorides	mg/l	
Hardness Ca	mg/l	

PRODUCTS USED LAST 24 HRS

Products	Size	Amt
M-I BAR	100 LB BG	36
DRIVE-BY ENGINEER)	1 EA	1

SOLIDS EQUIP	Size	Hr

MUD PROPERTY SPECS

Weight
Viscosity
Filtrate

REMARKS AND TREATMENT

REMARKS

TIME DISTR	Last 24 Hrs
Rig Up/Service	
Drilling	
Tripping	
Non-Productive Tim	

MUD VOL ACCTG	(bbl)
Oil Added	0
Water Added	0
Mud Received	0
Shakers	0
Evaporation	0
Centrifuge	0
Formation	0
Left in Hole	0
Other	0
Dumped	12.45

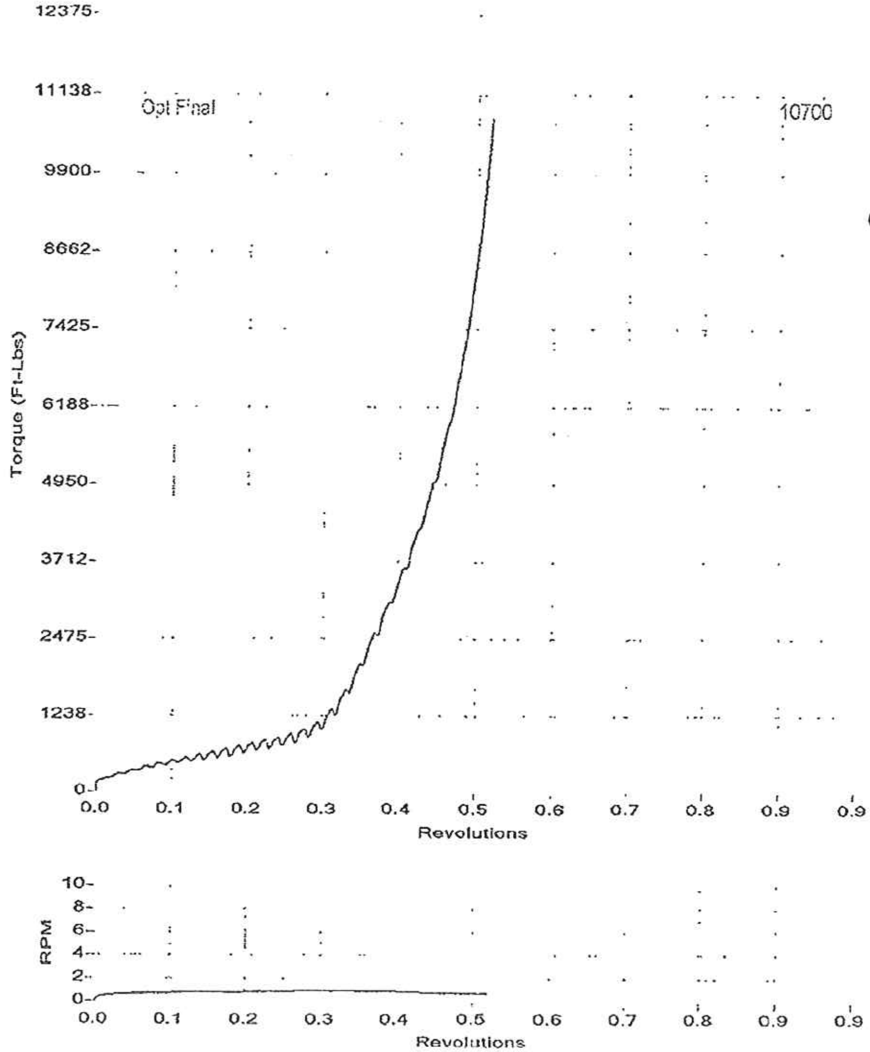
SOLIDS ANALYSIS (%/lb/bbl)	
NaCl	0/0.
KCl	0/0.
Low Gravity	42.9/-390
Bentonite	0/0.
Drill Solids	42.9/-390
Weight Material	42.9/630.9
Chemical Conc	- / 0.
Inert/React	-
Average SG	
Carb/BiCarb (m mole/L)	0.7-0.1

MUD RHEOLOGY & HYDRAULICS	
n/k Values	
Tauy (lb/100ft²)	
Bit Loss (psi / %)	
Bit HHP (hhp / HSI)	
Bit Jet Vel (ft/s)	
Ann. Vel DP (ft/min)	
Ann. Vel DC (ft/min)	
Crit Vel DP (ft/min)	
Crit Vel DC (ft/min)	

M-I ENGR / PHONE		RIG PHONE	WAREHOUSE PHONE	DAILY COST	CUMULATIVE COST
Cole Vanya	979-220-7701		713-676-2127	USD 1,602.40	USD 50,217.65

L

Annex L Connection Make/Break



Dispatch@
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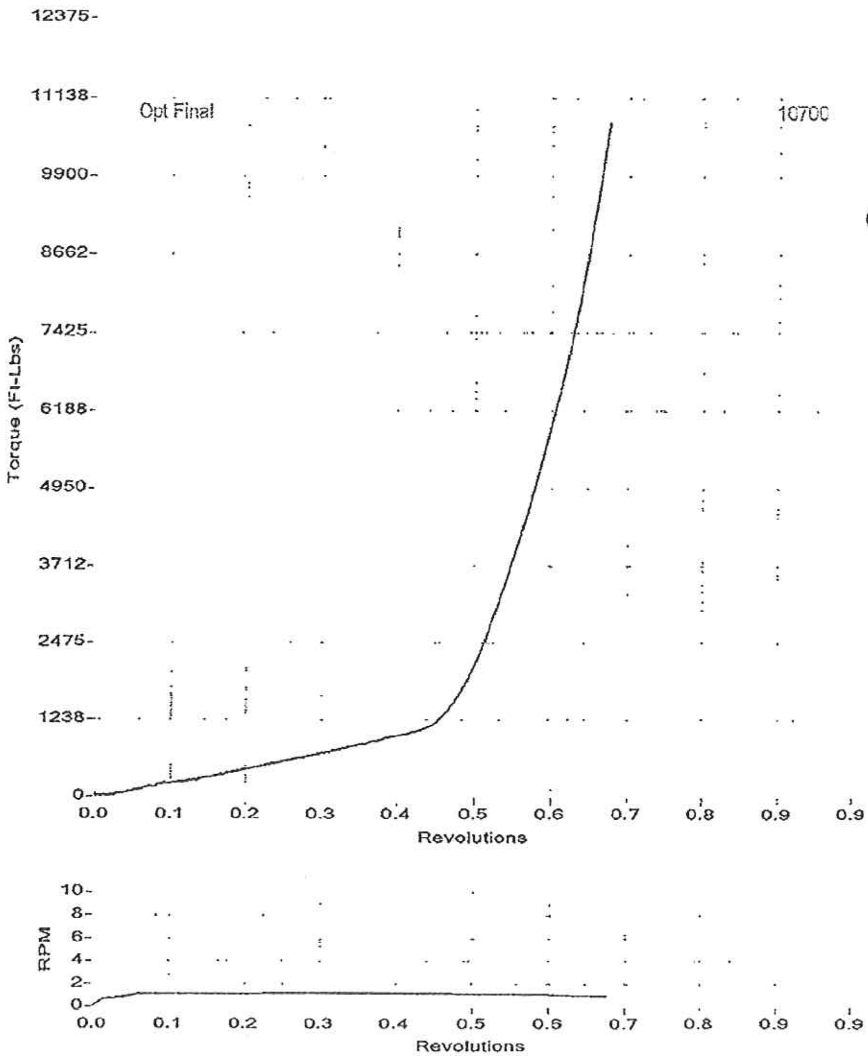
Masters.com
(800) 882-3928

Date: 07-15-2010	Time: 19:12:05
Job: 10-1091	Joint: 1
Cust:	STRESS ENG - WALLER
Rep:	KEN YOUNG
PO Number:	1751225
Location:	WALLER
Description:	7 32# Q125 513
Operator 1: 8 JUNEMANN	Operator 2: 74 ACUNA
Opt Final Torque:	10700 Ft-Lbs.
Dump Torque:	10650 Ft-Lbs.
Dump Torque Reset:	2396 Ft-Lbs.
Arm Length:	48.0 In.
Encoder Pulse/Rev:	33897.0
Final Torque:	10791 Ft-Lbs.
Peak Torque:	10791 Ft-Lbs.
Final Revolutions:	0.492
Average RPM:	0.7
Data Points:	2523
Ave Points/Rev:	5124.2
Turn Direction:	Counter-Clockwise
Result:	Accept
Comments:	CPL ~~PIN~~ x B
Comments:	BiX
Comments:	CJ 7/15/10



Dispatch@
Bucking
Masters.com
(800) 882-3928

Date: 07-15-2010	Time: 19:14:20
Job: 10-1091	Joint: 2
Cust:	STRESS ENG - WALLER
Rep:	KEN YOUNG
PO Number:	1751225
Location:	WALLER
Description:	7 32# Q125 513
Operator 1: 8 JUNEMANN	Operator 2: 74 ACUNA
Opt Final Torque:	10700 Ft-Lbs.
Dump Torque:	10650 Ft-Lbs.
Dump Torque Reset:	2396 Ft-Lbs.
Arm Length:	48.0 In.
Encoder Pulse/Rev:	33897.0
Final Torque:	10751 Ft-Lbs.
Peak Torque:	10751 Ft-Lbs.
Final Revolutions:	0.640
Average RPM:	1.0
Data Points:	2356
Ave Points/Rev:	3678.4
Turn Direction:	Counter-Clockwise
Result:	Accept
Comments:	CPL BOX x A
Comments:	Pm
Comments:	CJ

7/15/10

Stress Engineering Services
Torque Turn
Calibration

Load Cell

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

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

Daq 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

Control Board

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

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: 1125899
Capacity: 50k Lbs.
Shunt: 18160.00 Lbs.

Power Tong

<4> 38.81 Inches

Daq Gain	Daq Offset
4485.52	-0.006
Ctrl Gain	**Ctrl Offset**
4486.33	-0.007

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

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

Daq Board

Raw Volts	-0.006	Volts
Load Cell	-0.38	Lbs
Torque	-1.22	Ft Lbs
Gain	4485.52	Ft Lbs/V
Offset	-0.006	Volts

Control Board

Raw Volts	-0.007	Volts
Load Cell	0.07	Lbs
Torque	0.21	Ft Lbs
Gain	4486.33	Ft Lbs/V
Offset	-0.007	Volts

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: 1125899
Capacity: 50k Lbs.
Shunt: 18160.00 Lbs.

Power Tong

<4> 38.81 Inches

Daq Gain	Daq Offset
4486.97	-0.006

Ctrl Gain	Ctrl Offset
4488.50	-0.007

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

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

Daq Board

Raw Volts	4.042	Volts
Load Cell	18161.45	Lbs
Torque	58737.14	Ft Lbs
Gain	4486.97	Ft Lbs/V
Offset	-0.006	Volts

Control Board

Raw Volts	4.039	Volts
Load Cell	18160.75	Lbs
Torque	58734.88	Ft Lbs
Gain	4488.50	Ft Lbs/V
Offset	-0.007	Volts

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: 1112622

Capacity: 50k Lbs.

Shunt: 17850.00 Lbs.

Power Tong

<4> 38.81 Inches

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

Daq 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

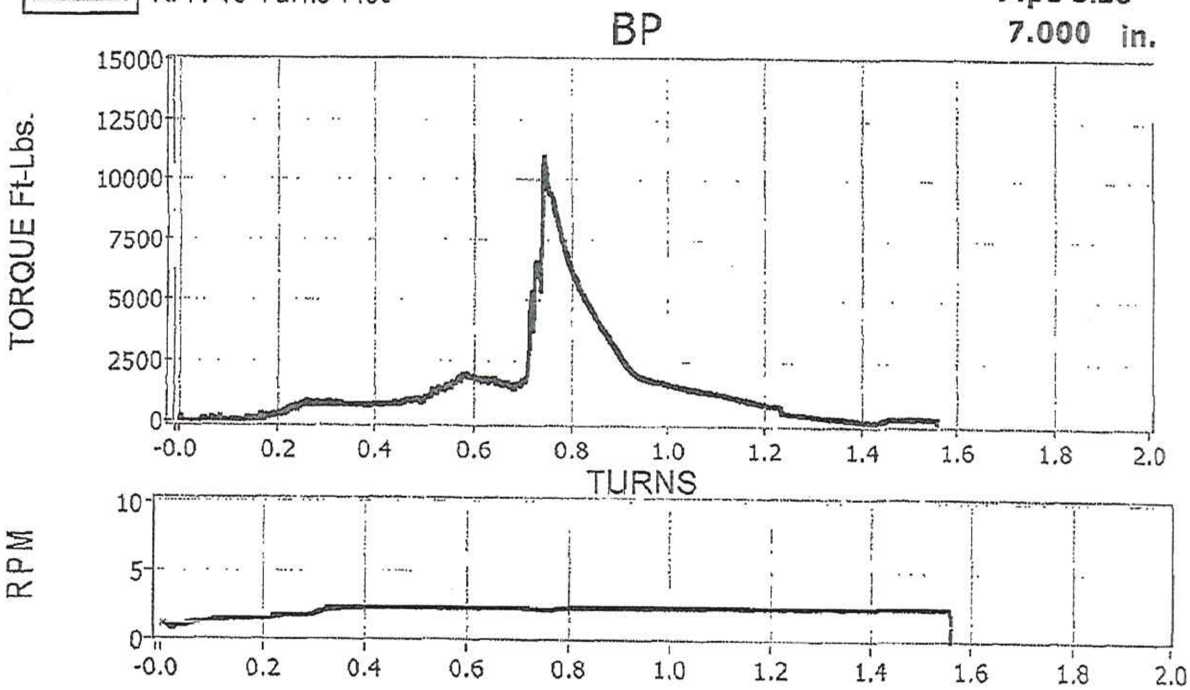
Control Board

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

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 1601072

Pipe Size 7.000 in.



BreakOut

BreakOut # 1	Moment Arm: 38.81 inches
Pin Id : B	Box Id TOP
File Name : 1601072\TT_0001.dat	
Maximum Torque	10987 Ft-Lbs

Operator :
JF

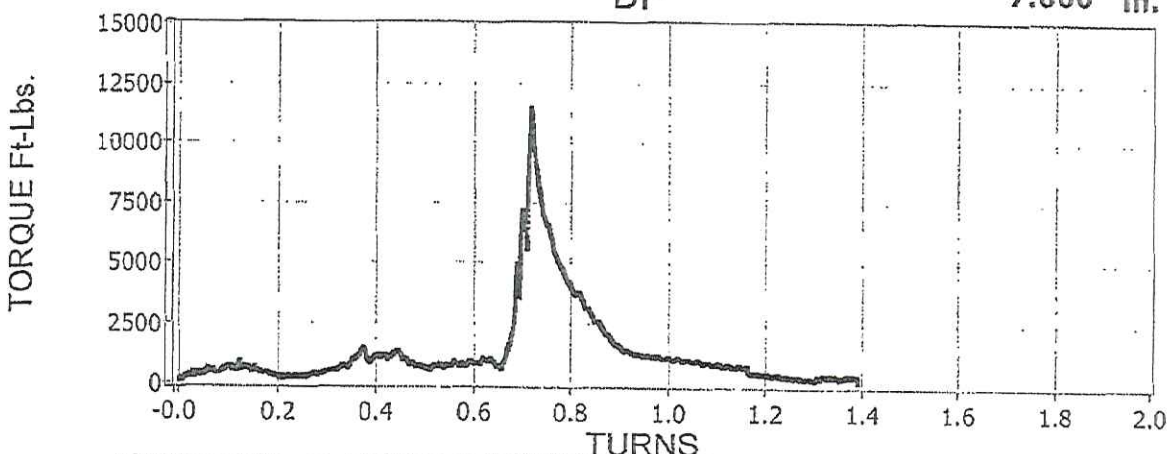
Date : Time of Test
7/21/2010 : 11:33:01 AM

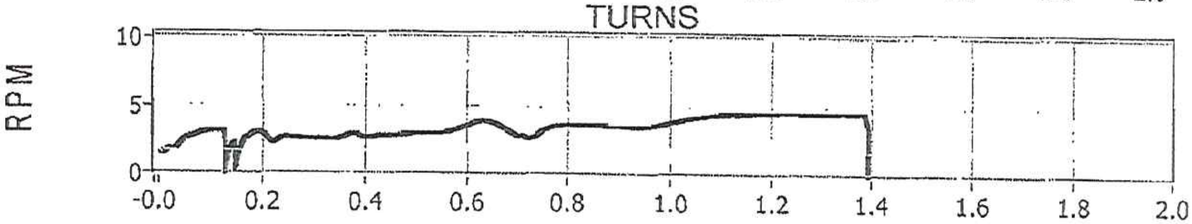
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 1601072

Pipe Size
7.000 in.

BP





BreakOut

BreakOut # 1	**Moment Arm:** 38.81 inches
Pin Id : PIN	**Box Id** A
File Name : 1601072\TT_0002.dat	
Maximum Torque	11452 Ft-Lbs

Operator :
JF

Date : Time of Test
7/21/2010 : 11:53:26 AM

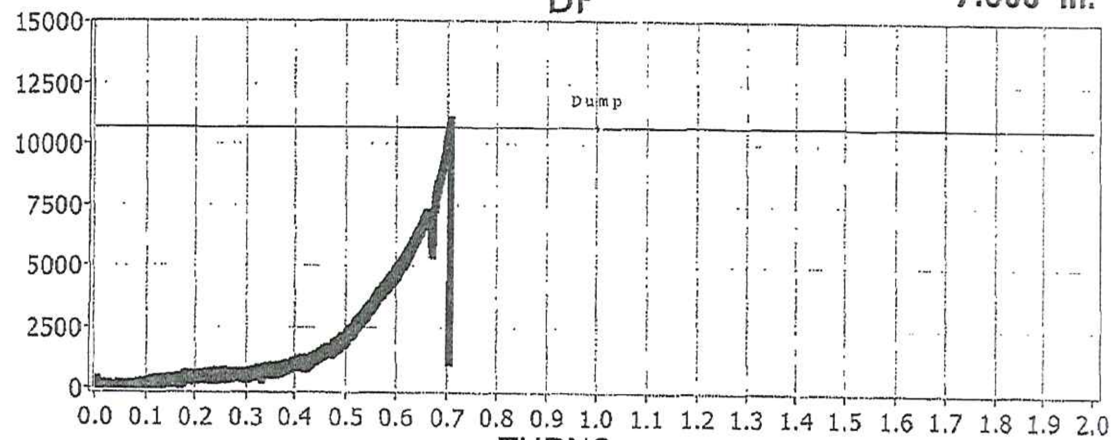
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

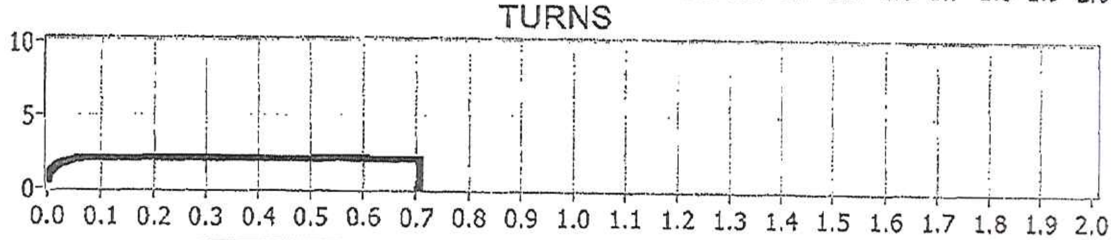
MakeUp

Project Number 16010

Pipe Size
7.000 in.

BP





MakeUp # 1	**Moment 38.81 inches**	
Pin Id : FC#1	**Box Id : A**	
File Name : 1601072\TT_0003.dat		
Reference Torque	**200**	**Ft-Lbs**
Dump Torque	**10700**	**Ft-Lbs**
Overshoot (Max-Dump)	**331**	**Ft-Lbs**
Maximum Torque	**11031**	**Ft-Lbs**
Shoulder	**-139**	**Ft-Lbs**
Delta Torque	**11169**	**Ft-Lbs**
Turns @ Max. Torque	**0.706**	**Turns**
Shoulder Turns	**0.057**	**Turns**
Delta Turns	**0.649**	**Turns**
Total Turns	**0.706**	**Turns**
Thread Lubricant	**BOL 72733**	
Pin Lubricant	**14**	**Grams**
Box Lubricant	**28**	**Grams**

Operator: JF **Date:Time of Test 7/21/2010 : 12:14:14 PM**

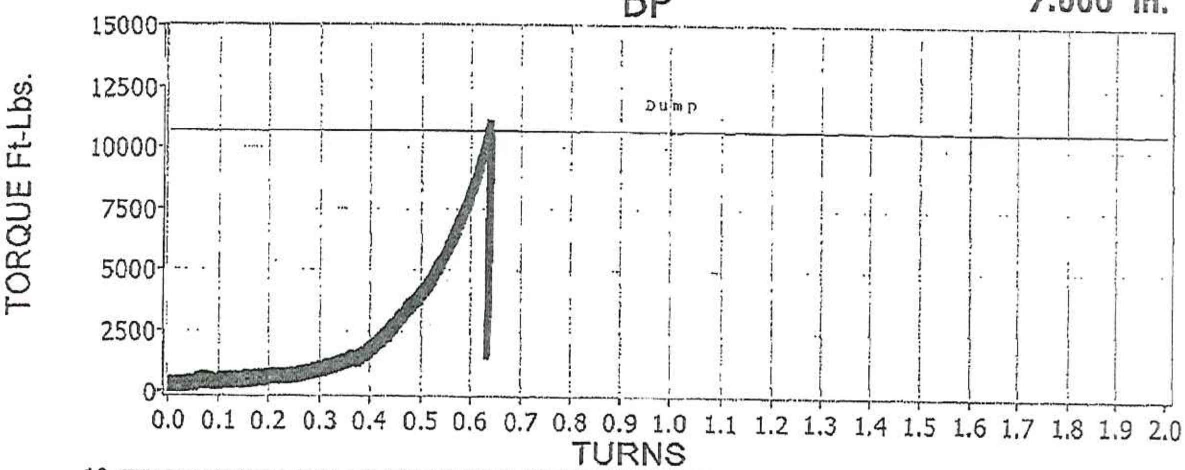
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

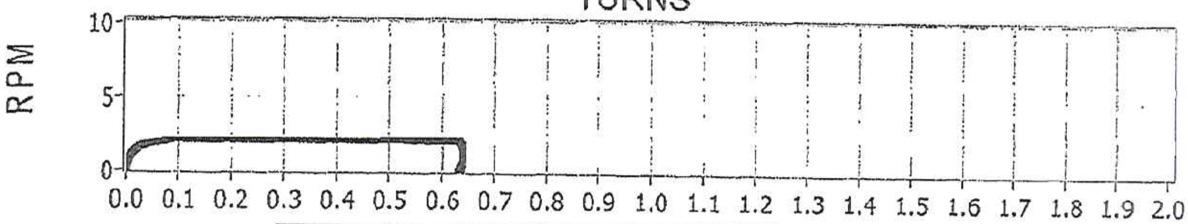
MakeUp

Project Number 16010

Pipe Size
7.000 in.

BP

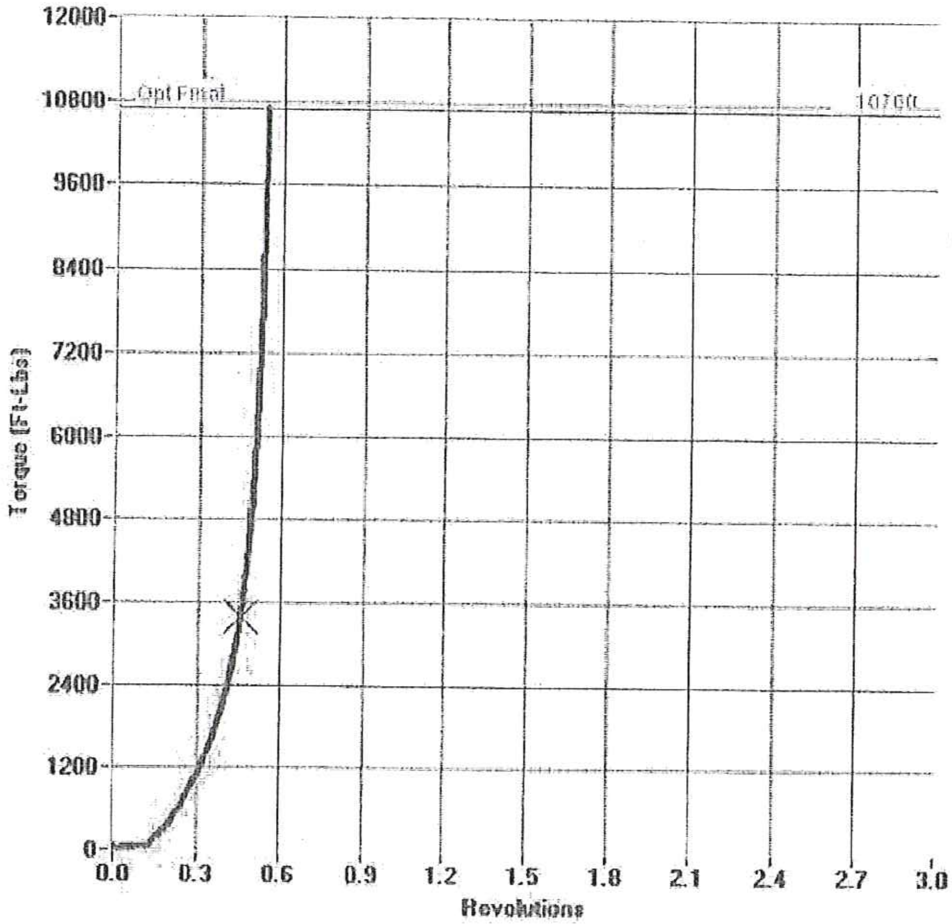


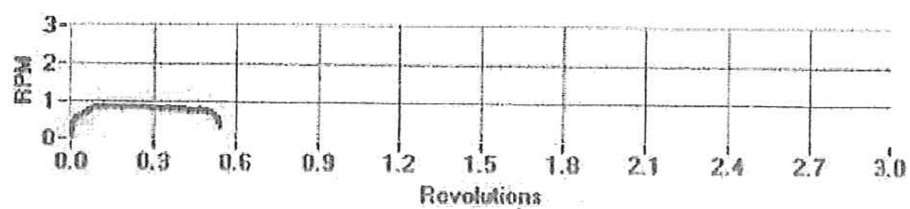


MakeUp # 1	**Moment 38.81 inches**
Pin Id : B	**Box Id : FC#1**
File Name : 1601072\TT_0004.dat	

Reference Torque	**200**	**Ft-Lbs**
Dump Torque	**10700**	**Ft-Lbs**
Overshoot (Max-Dump)	**326**	**Ft-Lbs**
Maximum Torque	**11026**	**Ft-Lbs**
Shoulder	**31**	**Ft-Lbs**
Delta Torque	**10995**	**Ft-Lbs**
Turns @ Max. Torque	**0.637**	**Turns**
Shoulder Turns	**0.003**	**Turns**
Delta Turns	**0.634**	**Turns**
Total Turns	**0.637**	**Turns**
Thread Lubricant	**BOL 72733**	
Pin Lubricant	**16**	**Grams**
Box Lubricant	**30**	**Grams**

Operator: JF **Date:Time of Test 7/21/2010 : 12:32:22 PM**





Dispatch@
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(800) 882-3920

Date: 07-23-2010	Time: 18:56:05
Job: 10-1131	Joint: 1
Cust:	STRESS
Rep:	KEN YOUNG
PO Number:	1601072 YOK
Location:	WALLER
Description:	7 23# Q125 513
Operator 1: 104 RAMON	Operator 2: 7 CHAD H
Opt Final Torque:	10700 Ft-Lbs.
Dump Torque:	10550 Ft-Lbs.
Dump Torque Reset:	2374 Ft-Lbs.
Arm Length:	48.0 In.
Encoder Pulse/Rev:	33897.0
Final Torque:	**10721 Ft-Lbs.**
Peak Torque:	**10721 Ft-Lbs.**
Final Revolutions:	**0.540**
Average RPM:	**0.5**
Data Points:	**3988**
Ave Points/Rev:	**7386.5**
Turn Direction:	**Counter-Clockwise**
Shoulder Torque:	**3378 Ft-Lbs.**
Shoulder Revs:	**0.450**
Delta Torque:	**7343**
Delta Turn:	**0.090**
Result:	Accept
Comments:	FC-01 PIN (MODLE M45AP) x
Comments:	BOX A
Comments:	

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: 1112622

Capacity: 50k Lbs.

Shunt: 17850.00 Lbs.

Power Tong

<4> - 38.81 Inches

Daq 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

Daq 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

Control Board

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

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: 1112622
Capacity: 50k Lbs.
Shunt: 17850.00 Lbs.

Power Tong

<4> 38.81 Inches

Daq Gain	Daq Offset
4406.76	-0.003
Ctrl Gain	**Ctrl Offset**
4405.30	-0.005

Cal time date
7/28/2010 7:53 AM

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

Daq Board

Raw Volts	-0.003	Volts
Load Cell	0.04	Lbs
Torque	0.13	Ft Lbs
Gain	4406.76	Ft Lbs/V
Offset	-0.003	Volts

Control Board

Raw Volts	-0.005	Volts
Load Cell	-0.24	Lbs
Torque	-0.77	Ft Lbs
Gain	4405.30	Ft Lbs/V
Offset	-0.005	Volts

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: 1112622

Capacity: 50k Lbs.

Shunt: 17850.00 Lbs.

Power Tong

<4> 38.81 Inches

Daq Gain	Daq Offset
4410.56	-0.003
Ctrl Gain	**Ctrl Offset**
4410.52	-0.005

Cal time date

7/28/2010 7:53 AM

Calibration File

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

Daq 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

Control Board

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

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: 1112622

Capacity: 50k Lbs.

Shunt: 17850.00 Lbs.

Power Tong

<4> 38.81 Inches

Daq Gain	Daq Offset
4407.03	-0.016

Ctrl Gain	Ctrl Offset
4407.87	-0.018

Cal time date

7/28/2010 7:53 AM

Calibration File

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

Daq Board

Raw Volts	4.035	Volts
Load Cell	17849.90	Lbs
Torque	57729.54	Ft Lbs
Gain	4407.03	Ft Lbs/V
Offset	-0.016	Volts

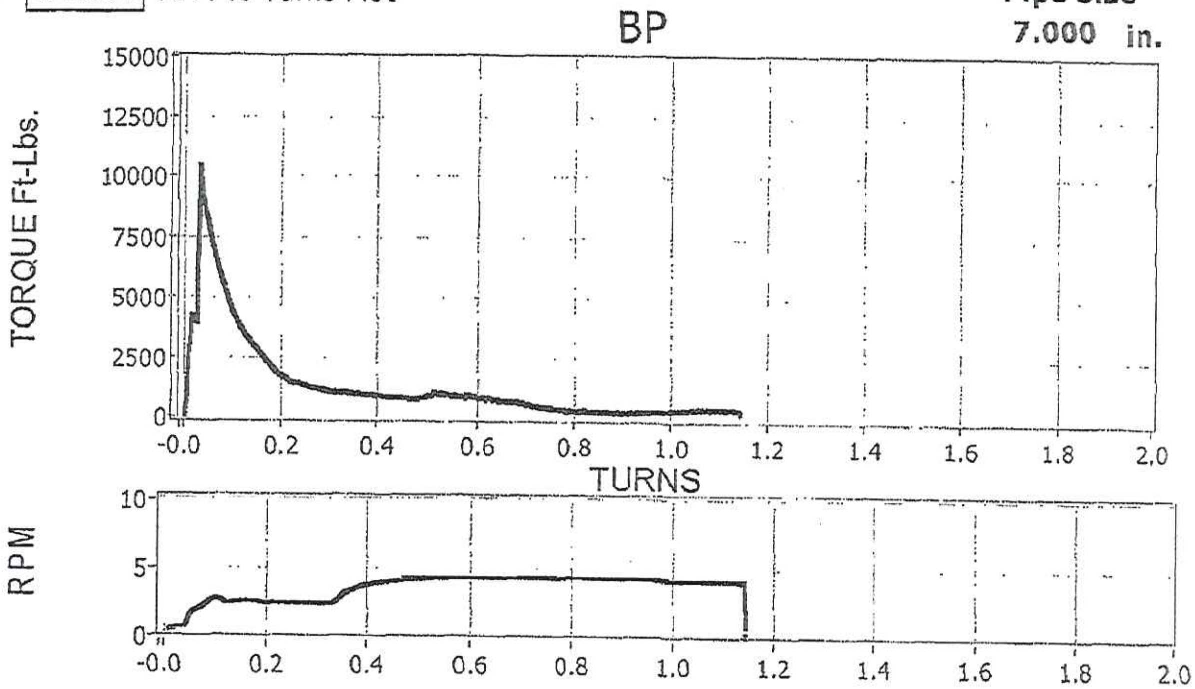
Control Board

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

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 1601072

Pipe Size 7.000 in.



BreakOut

BreakOut # 2	Moment Arm: 38.81 inches
Pin Id : B	Box Id FC#1
File Name : 1601072\TT_0005.dat	
Maximum Torque	10435 Ft-Lbs

Operator :
JF

Date : Time of Test
7/28/2010 : 7:55:30 AM

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: 1112622

Capacity: 50k Lbs.

Shunt: 17850.00 Lbs.

Power Tong

<4> 38.81 Inches

Daq Gain	Daq Offset
4407.03	-0.018

Ctrl Gain	Ctrl Offset
4407.87	-0.019

Cal time date

7/29/2010 7:30 AM

Calibration File

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

Daq 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

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: 1112622
Capacity: 50k Lbs.
Shunt: 17850.00 Lbs.

Power Tong

<4> 38.81 Inches

Daq Gain	Daq Offset
4410.56	-0.005

Ctrl Gain	Ctrl Offset
4410.52	-0.006

Cal time date
7/29/2010 7:30 AM

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

Daq Board

Raw Volts	-0.005	Volts
Load Cell	-0.09	Lbs
Torque	-0.30	Ft Lbs
Gain	4410.56	Ft Lbs/V
Offset	-0.005	Volts

Control Board

Raw Volts	-0.006	Volts
Load Cell	0.32	Lbs
Torque	1.04	Ft Lbs
Gain	4410.52	Ft Lbs/V
Offset	-0.006	Volts

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N:	1112622	
Capacity:	50k	Lbs.
Shunt:	17850.00	Lbs.

Power Tong

<4> 38.81 Inches

Daq Gain	Daq Offset
4410.26	-0.005

Ctrl Gain	Ctrl 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

Daq 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

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: 1112622
Capacity: 50k Lbs.
Shunt: 17850.00 Lbs.

Power Tong

<4> 38.81 Inches

Daq Gain	Daq Offset
4406.72	-0.018

Ctrl Gain	Ctrl Offset
4406.81	-0.019

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

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

Daq Board

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

Control Board

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

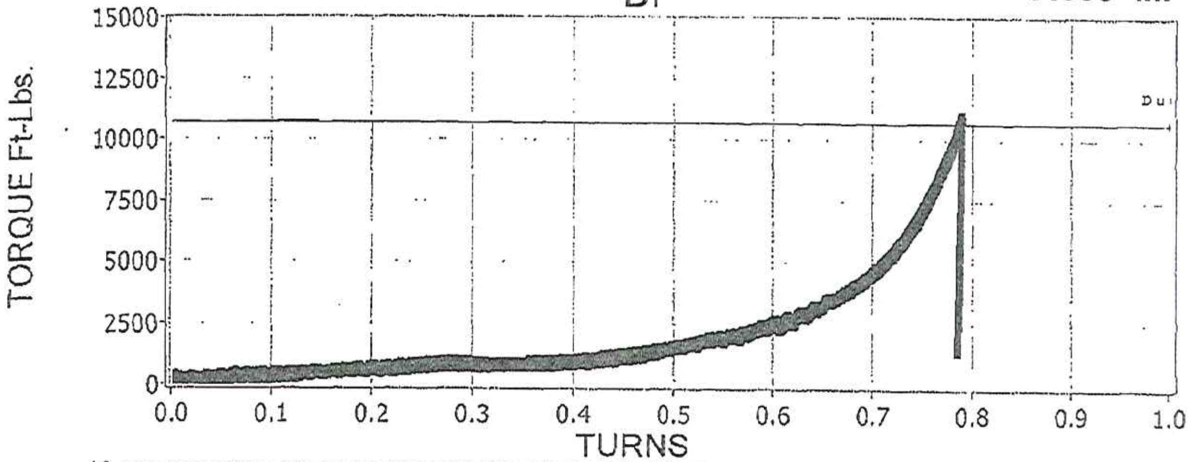
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

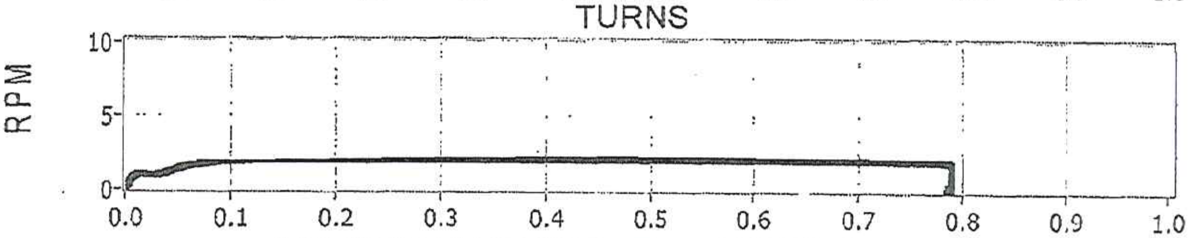
MakeUp

Project Number 16010

Pipe Size 7.000 in.

BP





MakeUp # 3	**Moment 38.81 inches**
Pin Id : B	**Box Id : FC #1**
File Name : 1601072\TT_0006.dat	

Reference Torque	**200**	**Ft-Lbs**
Dump Torque	**10700**	**Ft-Lbs**
Overshoot (Max-Dump)	**372**	**Ft-Lbs**
Maximum Torque	**11072**	**Ft-Lbs**
Shoulder	**-123**	**Ft-Lbs**
Delta Torque	**11195**	**Ft-Lbs**
Turns @ Max. Torque	**0.789**	**Turns**
Shoulder Turns	**0.001**	**Turns**
Delta Turns	**0.788**	**Turns**
Total Turns	**0.789**	**Turns**
Thread Lubricant	**BOL 72733**	
Pin Lubricant	**12**	**Grams**
Box Lubricant	**22**	**Grams**

Operator: JF **Date:Time of Test 7/29/2010 : 7:36:39 AM**

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N:	1112622	
Capacity:	50k	Lbs.
Shunt:	17850.00	Lbs.

Power Tong

<4> 38.81 Inches

Daq Gain	Daq Offset
4406.76	-0.018

Ctrl Gain	Ctrl Offset
4405.30	-0.019

Cal time date

8/3/2010 10:56 AM

Calibration File

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

Daq Board

Raw Volts	-0.005	Volts
Load Cell	57.70	Lbs
Torque	186.60	Ft Lbs
Gain	4406.76	Ft Lbs/V
Offset	-0.018	Volts

Control Board

Raw Volts	-0.006	Volts
Load Cell	59.22	Lbs
Torque	191.52	Ft Lbs
Gain	4405.30	Ft Lbs/V
Offset	-0.019	Volts

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: 1125899

Capacity: 50k Lbs.

Shunt: 18160.00 Lbs.

Power Tong

<4> 38.81 Inches

Daq Gain	Daq Offset
4485.98	-0.005

Ctrl Gain	Ctrl Offset
4486.15	-0.006

Cal time date

8/3/2010 10:56 AM

Calibration File

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

Daq Board

Raw Volts	-0.005	Volts
Load Cell	0.24	Lbs
Torque	0.77	Ft Lbs
Gain	4485.98	Ft Lbs/V
Offset	-0.005	Volts

Control Board

Raw Volts	-0.006	Volts
Load Cell	-0.20	Lbs
Torque	-0.64	Ft Lbs
Gain	4486.15	Ft Lbs/V
Offset	-0.006	Volts

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: 1125899

Capacity: 50k Lbs.

Shunt: 18160.00 Lbs.

Power Tong

<4> 38.81 Inches

Daq Gain	Daq Offset
4487.15	-0.005

Ctrl Gain	Ctrl Offset
4488.62	-0.006

Cal time date

8/3/2010 10:56 AM

Calibration File

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

Daq Board

Raw Volts	4.042	Volts
Load Cell	18160.35	Lbs
Torque	58733.58	Ft Lbs
Gain	4487.15	Ft Lbs/V
Offset	-0.005	Volts

Control Board

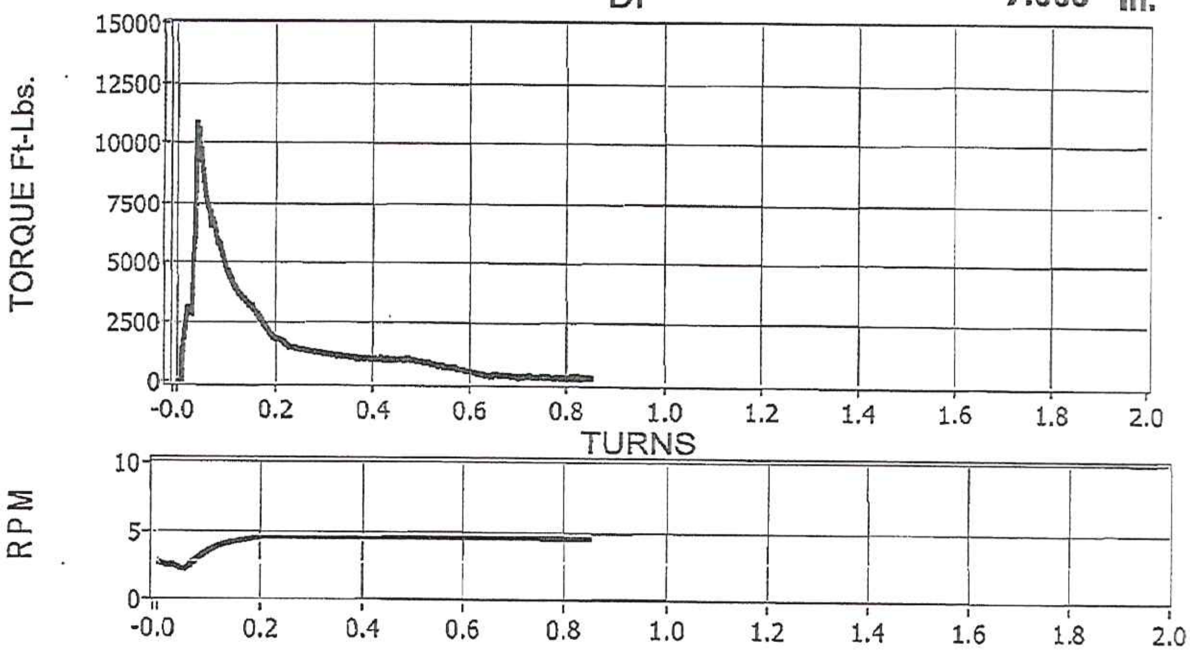
Raw Volts	4.040	Volts
Load Cell	18161.40	Lbs
Torque	58737.00	Ft Lbs
Gain	4488.62	Ft Lbs/V
Offset	-0.006	Volts

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 1601072

Pipe Size 7.000 in.

BP



BreakOut

BreakOut # 3	**Moment Arm:** 38.81 inches
Pin Id : B	**Box Id** FC#1
File Name : 1601072\TT_0007.dat	
Maximum Torque	10879 Ft-Lbs

Operator :
JF

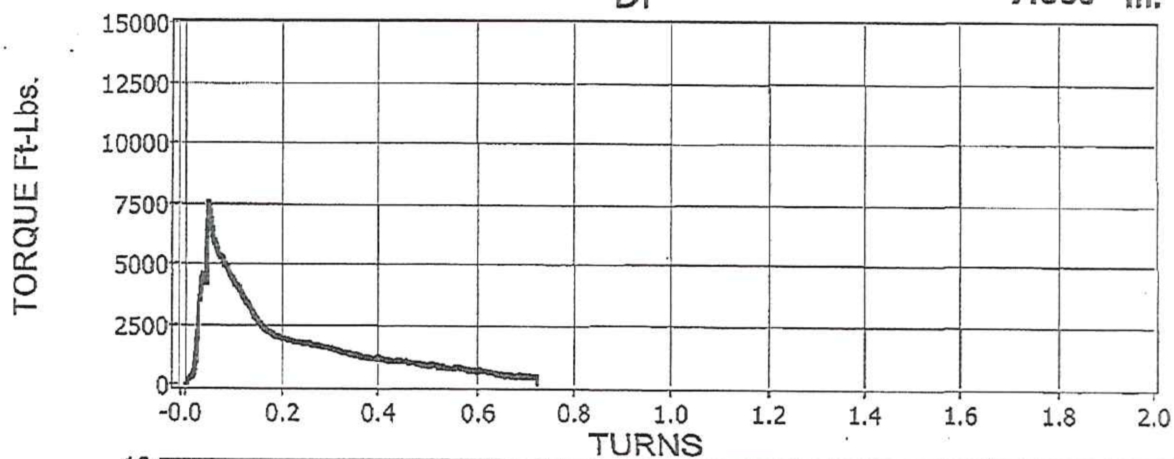
Date : Time of Test
8/3/2010 : 11:15:49 AM

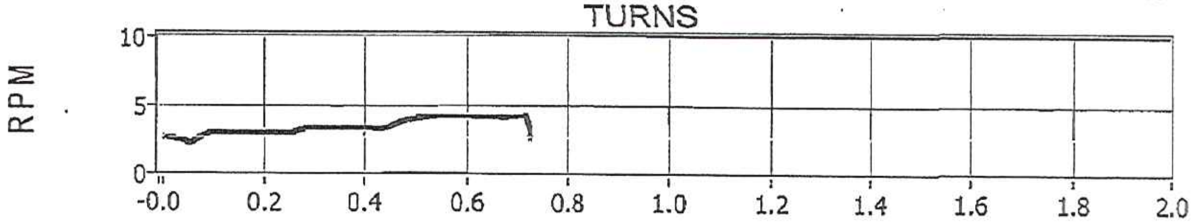
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 1601072

Pipe Size 7.000 in.

BP





BreakOut

BreakOut # 3	**Moment Arm:** 38.81 inches
Pin Id : FC#1	**Box Id** A
File Name : 1601072\TT_0008.dat	
Maximum Torque	7593 Ft-Lbs

Operator :
JF

Date : Time of Test
8/3/2010 : 11:24:51 AM

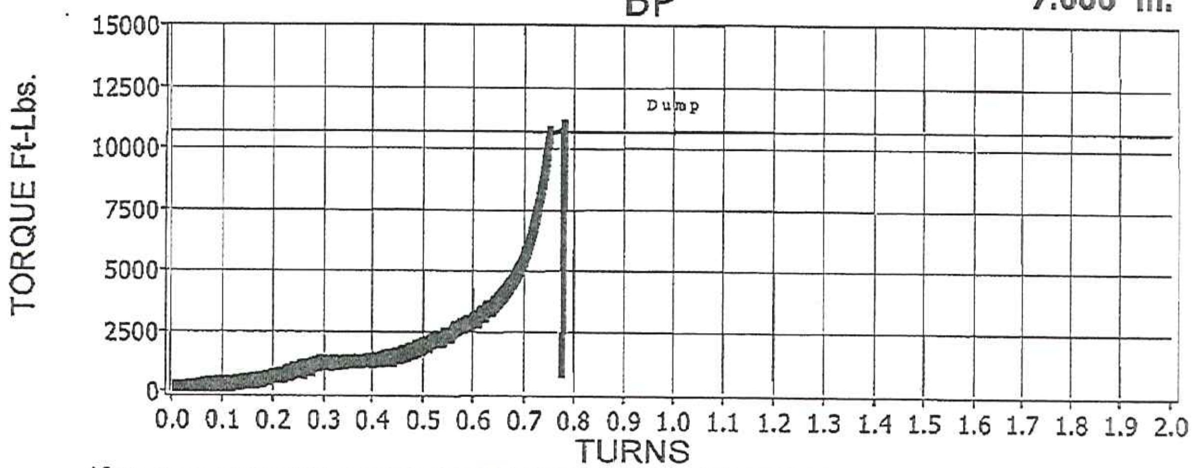
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

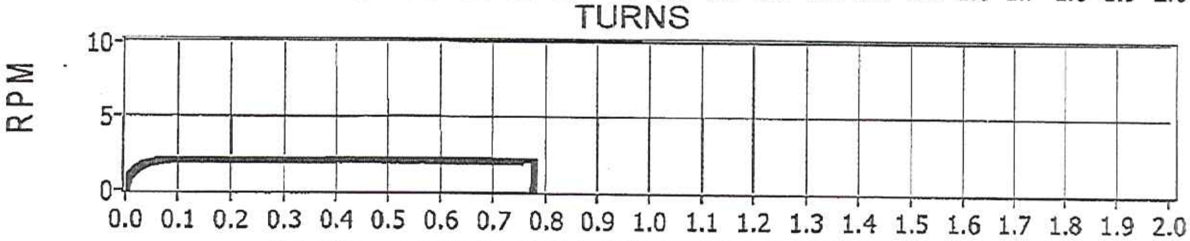
MakeUp

Project Number 16010

Pipe Size
7.000 in.

BP





MakeUp # 1	**Moment 38.81 inches**
Pin Id : B	**Box Id : FC#2**
File Name : 1601072\TT_0009.dat	

Reference Torque	**200**	**Ft-Lbs**
Dump Torque	**10700**	**Ft-Lbs**
Overshoot (Max-Dump)	**383**	**Ft-Lbs**
Maximum Torque	**11083**	**Ft-Lbs**
Shoulder	**-86**	**Ft-Lbs**
Delta Torque	**11169**	**Ft-Lbs**
Turns @ Max. Torque	**0.778**	**Turns**
Shoulder Turns	**0.010**	**Turns**
Delta Turns	**0.768**	**Turns**
Total Turns	**0.778**	**Turns**
Thread Lubricant	**BOL 72733**	
Pin Lubricant	**13**	**Grams**
Box Lubricant	**15**	**Grams**

Operator: JF **Date:Time of Test 8/3/2010 : 11:41:28 AM**

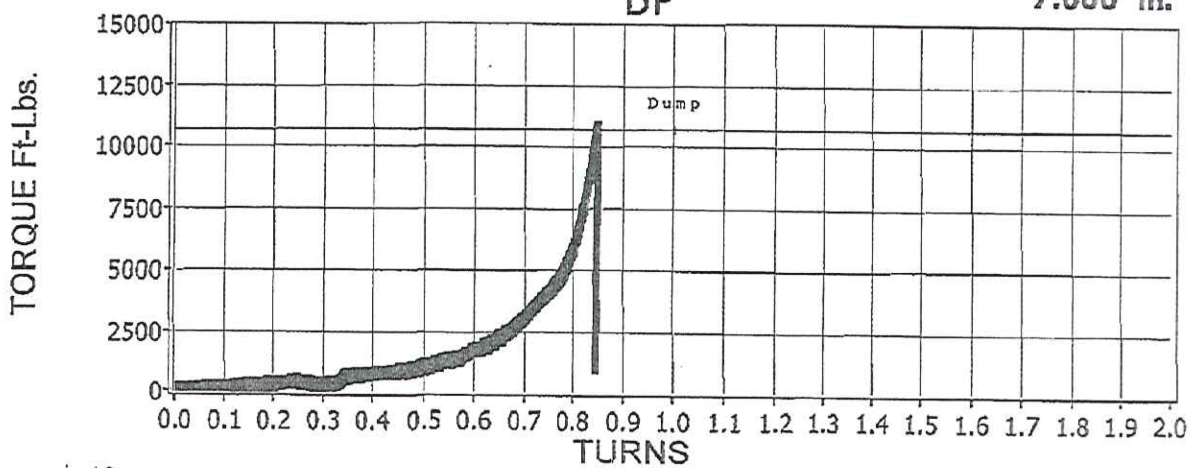
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

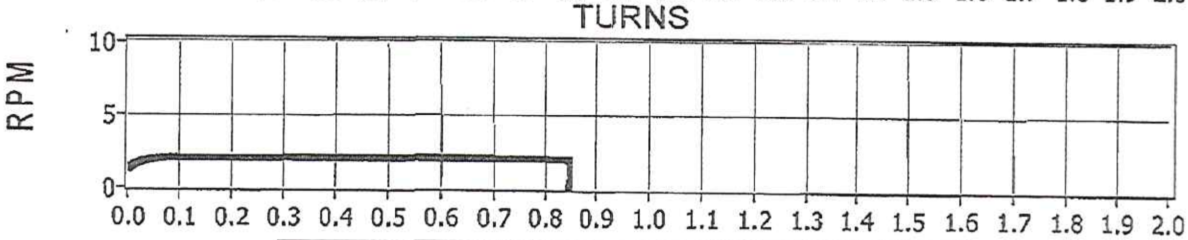
MakeUp

Project Number 16010

Pipe Size 7.000 in.

BP





MakeUp # 1	**Moment 38.81 inches**
Pin Id : A	**Box Id : FC#2**
File Name : 1601072\TT_0010.dat	

Reference Torque	**200 Ft-Lbs**
Dump Torque	**10700 Ft-Lbs**
Overshoot (Max-Dump)	**239 Ft-Lbs**
Maximum Torque	**10939 Ft-Lbs**
Shoulder	**-113 Ft-Lbs**
Delta Torque	**11052 Ft-Lbs**
Turns @ Max. Torque	**0.848 Turns**
Shoulder Turns	**0.083 Turns**
Delta Turns	**0.765 Turns**
Total Turns	**0.848 Turns**
Thread Lubricant	**BOL 72733**
Pin Lubricant	**10 Grams**
Box Lubricant	**17 Grams**

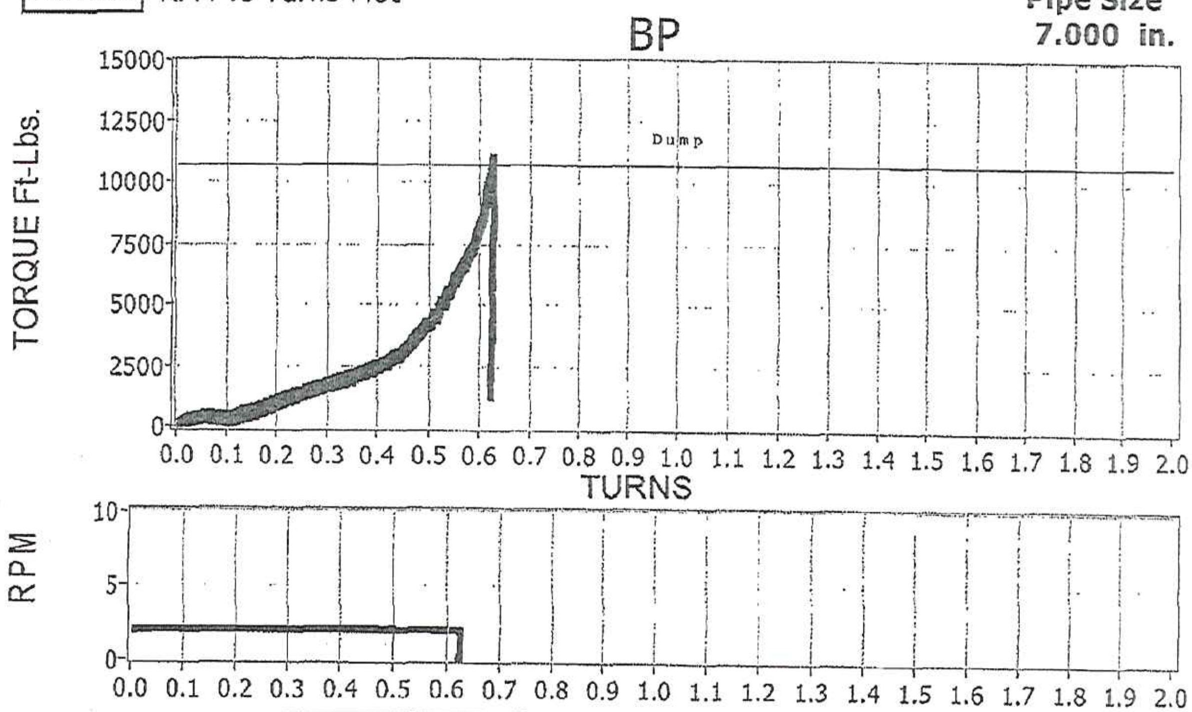
Operator: JF **Date:Time of Test 8/3/2010 : 11:53:20 AM**

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

MakeUp

Project Number 16010

Pipe Size 7.000 in.



MakeUp # 1	**Moment 38.81 inches**
Pin Id : FC#3	**Box Id : A**
File Name : 1601072\TT_0011.dat	

Reference Torque	**200**	**Ft-Lbs**
Dump Torque	**10700**	**Ft-Lbs**
Overshoot (Max-Dump)	**365**	**Ft-Lbs**
Maximum Torque	**11065**	**Ft-Lbs**
Shoulder	**109**	**Ft-Lbs**
Delta Torque	**10957**	**Ft-Lbs**
Turns @ Max. Torque	**0.625**	**Turns**
Shoulder Turns	**0.102**	**Turns**
Delta Turns	**0.523**	**Turns**
Total Turns	**0.625**	**Turns**
Thread Lubricant	**BOL 72733**	
Pin Lubricant	**13**	**Grams**
Box Lubricant	**15**	**Grams**

Operator: JF **Date:Time of Test 9/9/2010 : 5:59:08 PM**

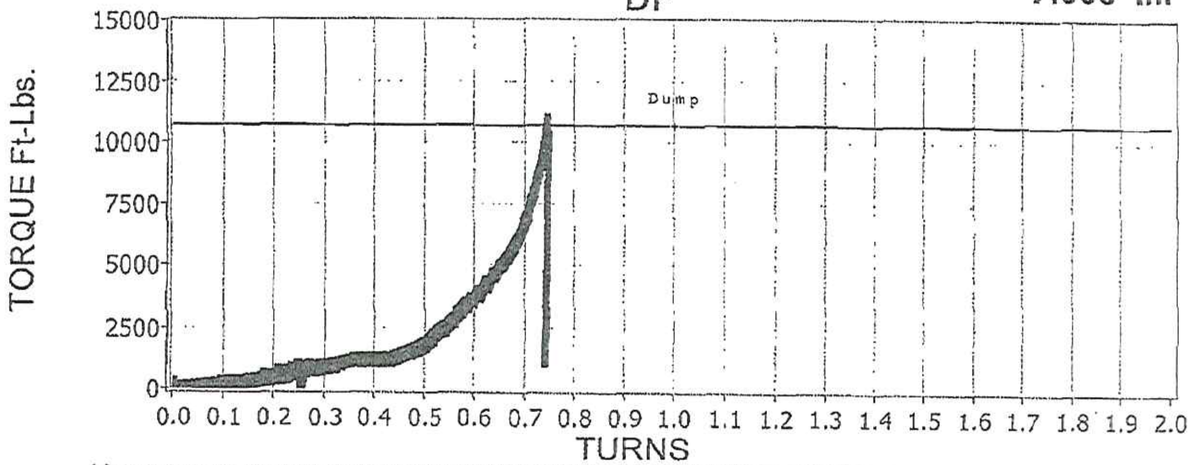
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

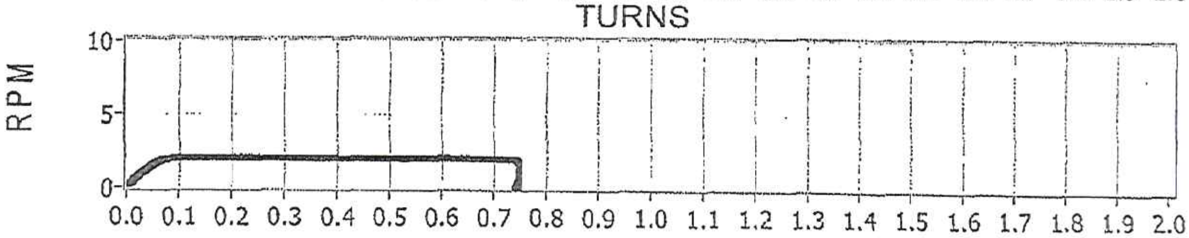
MakeUp

Project Number 16010

Pipe Size
7.000 in.

BP





MakeUp # 1	**Moment 38.81 inches**	
Pin Id : B	**Box Id : FC#3**	
File Name : 1601072\TT_0012.dat		
Reference Torque	**200**	**Ft-Lbs**
Dump Torque	**10700**	**Ft-Lbs**
Overshoot (Max-Dump)	**357**	**Ft-Lbs**
Maximum Torque	**11057**	**Ft-Lbs**
Shoulder	**-257**	**Ft-Lbs**
Delta Torque	**11313**	**Ft-Lbs**
Turns @ Max. Torque	**0.746**	**Turns**
Shoulder Turns	**0.253**	**Turns**
Delta Turns	**0.492**	**Turns**
Total Turns	**0.746**	**Turns**
Thread Lubricant	**BOL 72733**	
Pin Lubricant	**11**	**Grams**
Box Lubricant	**17**	**Grams**

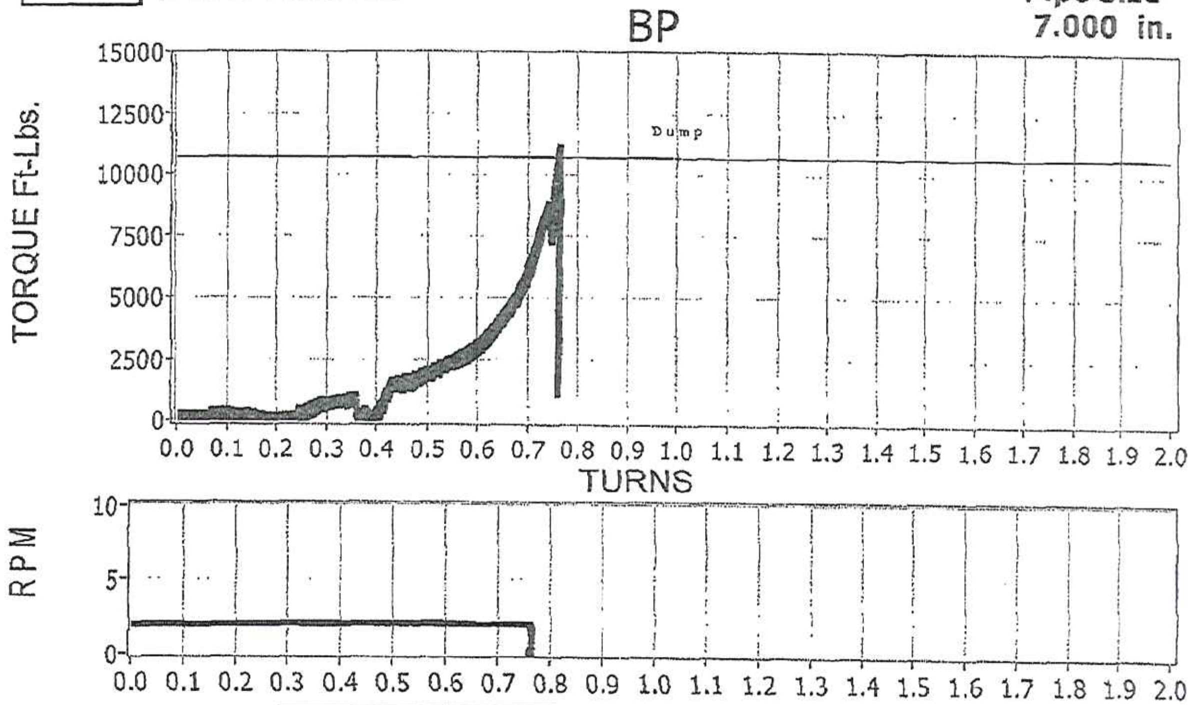
Operator: JF **Date:Time of Test 9/9/2010 : 6:23:29 PM**

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

MakeUp

Project Number 16010

Pipe Size 7.000 in.



MakeUp # 1	**Moment 38.81 inches**
Pin Id : B	**Box Id : FC#5**
File Name : \TT_0001.dat	

Reference Torque	**200**	**Ft-Lbs**
Dump Torque	**10700**	**Ft-Lbs**
Overshoot (Max-Dump)	**407**	**Ft-Lbs**
Maximum Torque	**11107**	**Ft-Lbs**
Shoulder	**-293**	**Ft-Lbs**
Delta Torque	**11400**	**Ft-Lbs**
Turns @ Max. Torque	**0.763**	**Turns**
Shoulder Turns	**0.367**	**Turns**
Delta Turns	**0.396**	**Turns**
Total Turns	**0.763**	**Turns**
Thread Lubricant	**BOL 72733**	
Pin Lubricant	**11**	**Grams**
Box Lubricant	**18**	**Grams**

Operator: JF **Date:Time of Test 9/20/2010 : 2:24:13 PM**

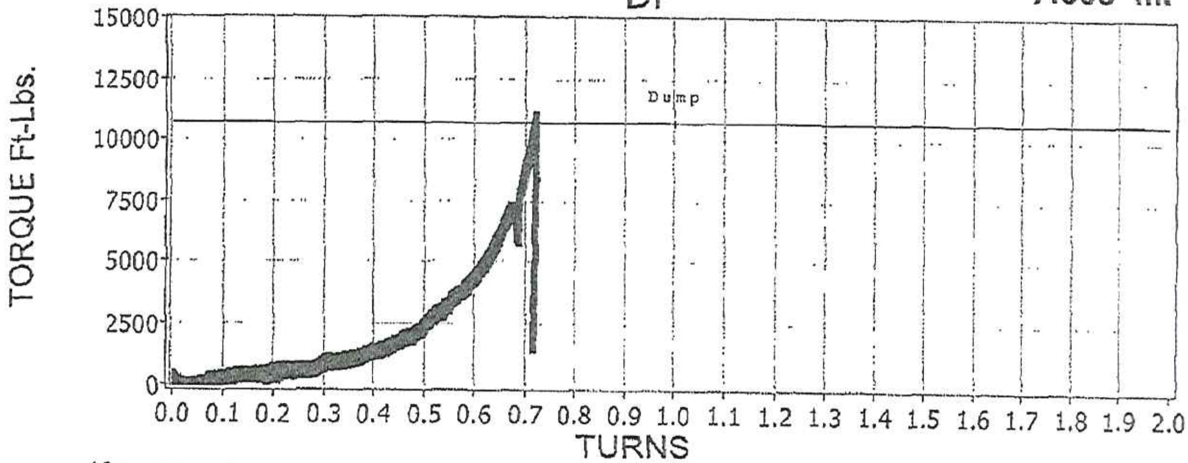
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

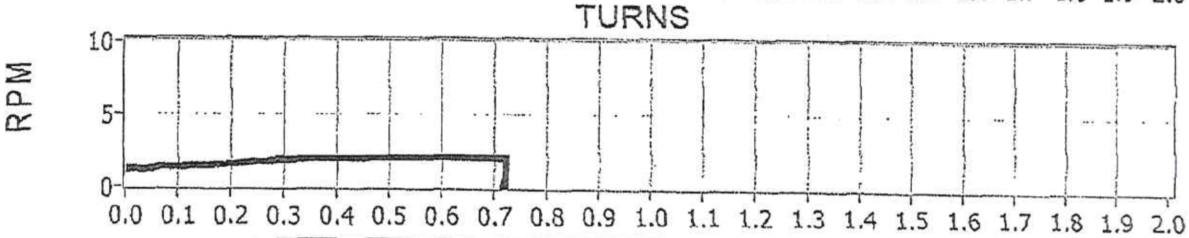
MakeUp

Project Number 16010

Pipe Size 7.000 in.

BP





MakeUp # 1	**Moment 38.81 inches**
Pin Id : FC#5	**Box Id : A**
File Name : C:\\TT_0014.dat	

Reference Torque	**200**	**Ft-Lbs**
Dump Torque	**10700**	**Ft-Lbs**
Overshoot (Max-Dump)	**377**	**Ft-Lbs**
Maximum Torque	**11077**	**Ft-Lbs**
Shoulder	**-176**	**Ft-Lbs**
Delta Torque	**11252**	**Ft-Lbs**
Turns @ Max. Torque	**0.720**	**Turns**
Shoulder Turns	**0.052**	**Turns**
Delta Turns	**0.668**	**Turns**
Total Turns	**0.720**	**Turns**
Thread Lubricant	**BOL 72733**	
Pin Lubricant	**12**	**Grams**
Box Lubricant	**18**	**Grams**

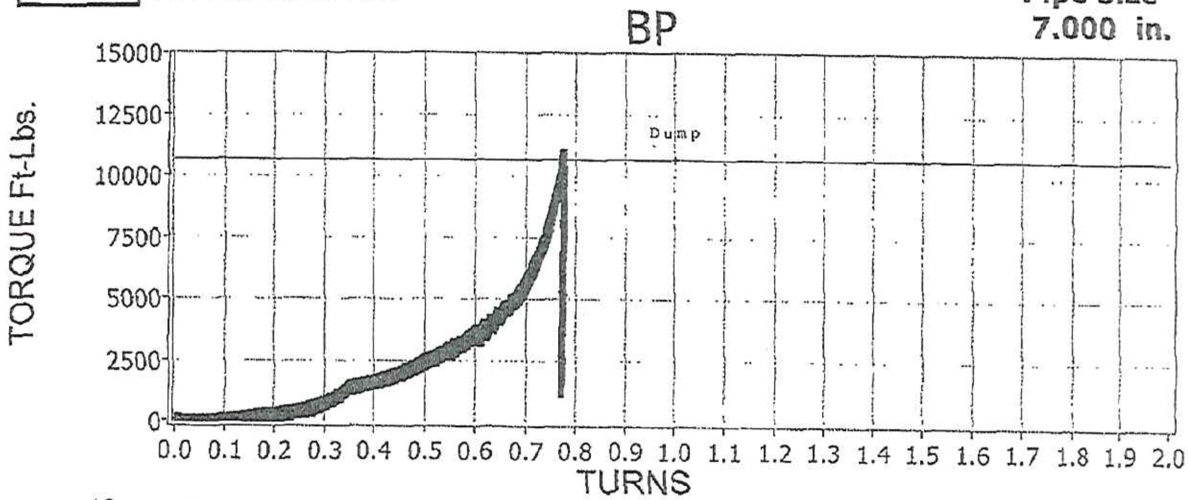
Operator: JF **Date:Time of Test 9/20/2010 : 3:00:35 PM**

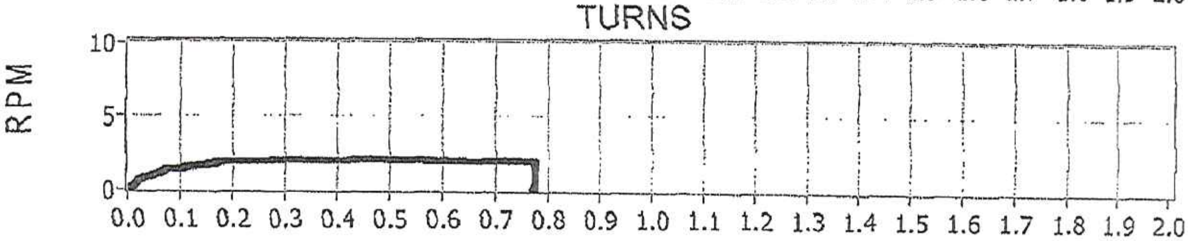
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

MakeUp

Project Number 16010

Pipe Size
7.000 in.





MakeUp # 1	**Moment 38.81 inches**	
Pin Id : FC#5	**Box Id : A**	
File Name : 1601072\TT_0015.dat		
Reference Torque	**200**	**Ft-Lbs**
Dump Torque	**10700**	**Ft-Lbs**
Overshoot (Max-Dump)	**316**	**Ft-Lbs**
Maximum Torque	**11016**	**Ft-Lbs**
Shoulder	**-209**	**Ft-Lbs**
Delta Torque	**11226**	**Ft-Lbs**
Turns @ Max. Torque	**0.775**	**Turns**
Shoulder Turns	**0.010**	**Turns**
Delta Turns	**0.764**	**Turns**
Total Turns	**0.775**	**Turns**
Thread Lubricant	**BOL 72733**	
Pin Lubricant	**12**	**Grams**
Box Lubricant	**13**	**Grams**

Operator: JCS **Date:Time of Test 10/11/2010 : 2:09:48 PM**

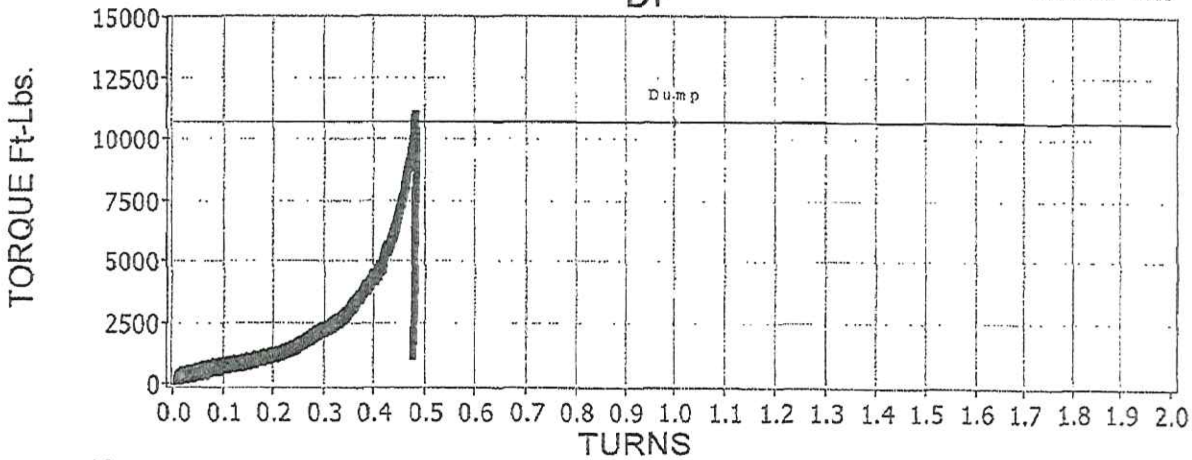
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

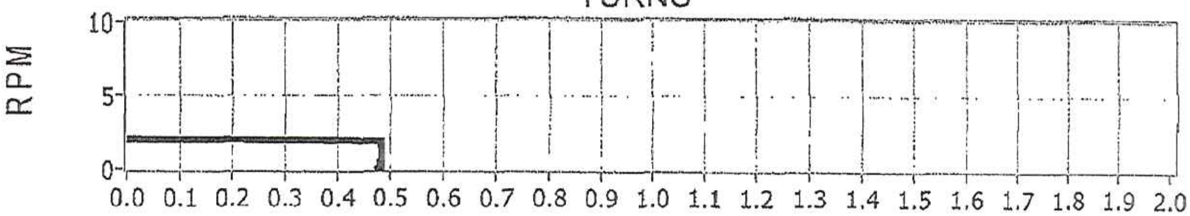
MakeUp

Project Number 16010

Pipe Size 7.000 in.

BP





MakeUp # 1	**Moment**	**38.81 inches**
Pin Id : B	**Box Id : FC#4**	
File Name : 1601072\TT_0016.dat		
Reference Torque	**200**	**Ft-Lbs**
Dump Torque	**10700**	**Ft-Lbs**
Overshoot (Max-Dump)	**357**	**Ft-Lbs**
Maximum Torque	**11057**	**Ft-Lbs**
Shoulder	**642**	**Ft-Lbs**
Delta Torque	**10415**	**Ft-Lbs**
Turns @ Max. Torque	**0.482**	**Turns**
Shoulder Turns	**0.052**	**Turns**
Delta Turns	**0.431**	**Turns**
Total Turns	**0.482**	**Turns**
Thread Lubricant	**BOL 72733**	
Pin Lubricant	**9**	**Grams**
Box Lubricant	**16**	**Grams**

Operator: JCS **Date:Time of Test 10/14/2010 : 9:51:41 AM**

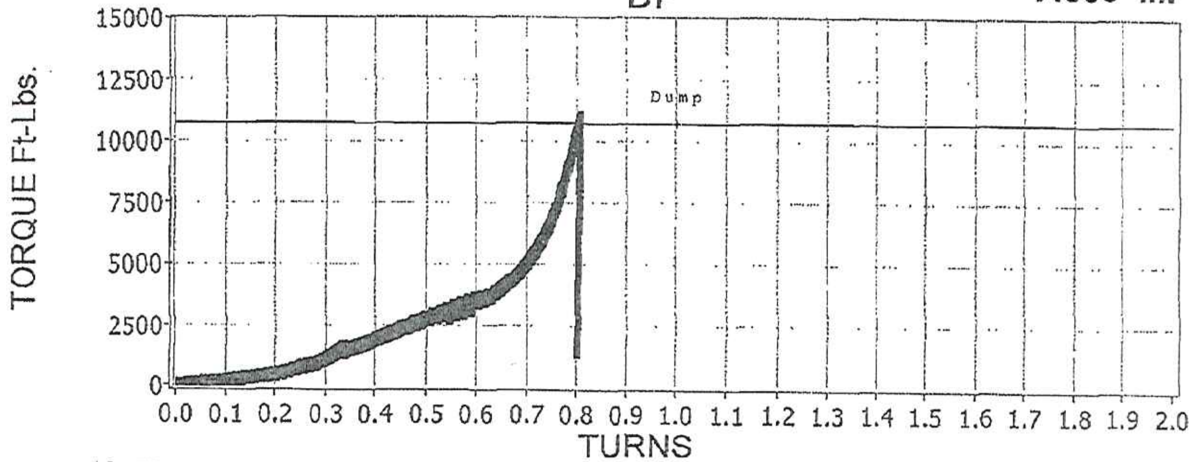
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

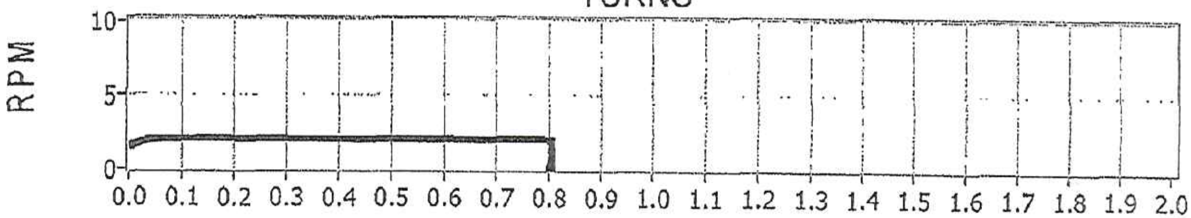
MakeUp

Project Number 16010

Pipe Size
7.000 in.

BP





MakeUp # 1	**Moment 38.81 inches**
Pin Id : FC#4	**Box Id : A**
File Name : 1601072\TT_0017.dat	

Reference Torque	**200**	**Ft-Lbs**
Dump Torque	**10700**	**Ft-Lbs**
Overshoot (Max-Dump)	**409**	**Ft-Lbs**
Maximum Torque	**11109**	**Ft-Lbs**
Shoulder	**-49**	**Ft-Lbs**
Delta Torque	**11158**	**Ft-Lbs**
Turns @ Max. Torque	**0.803**	**Turns**
Shoulder Turns	**0.076**	**Turns**
Delta Turns	**0.727**	**Turns**
Total Turns	**0.804**	**Turns**
Thread Lubricant	**BOL 72733**	
Pin Lubricant	**12**	**Grams**
Box Lubricant	**11**	**Grams**

Operator: JCS **Date:Time of Test 10/14/2010 : 10:13:53**

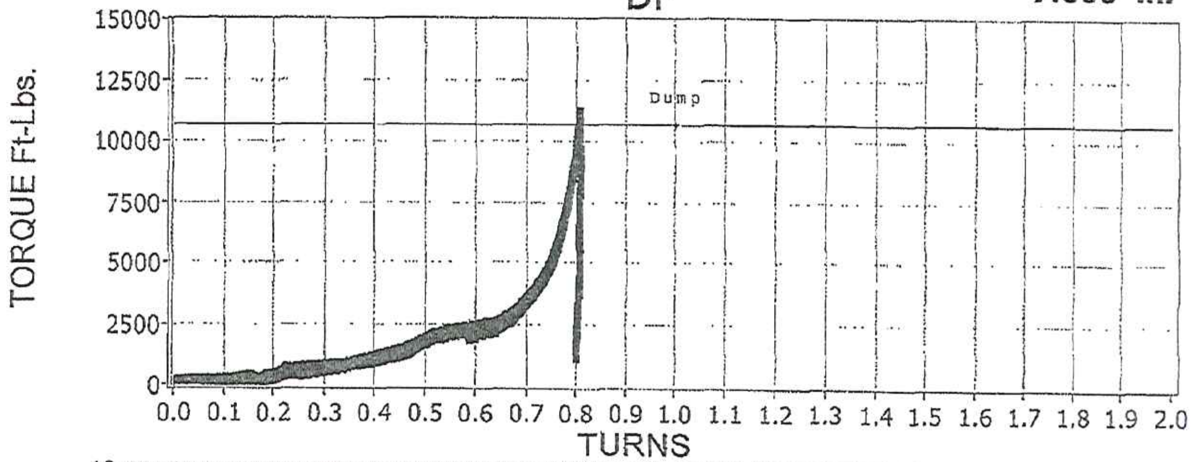
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

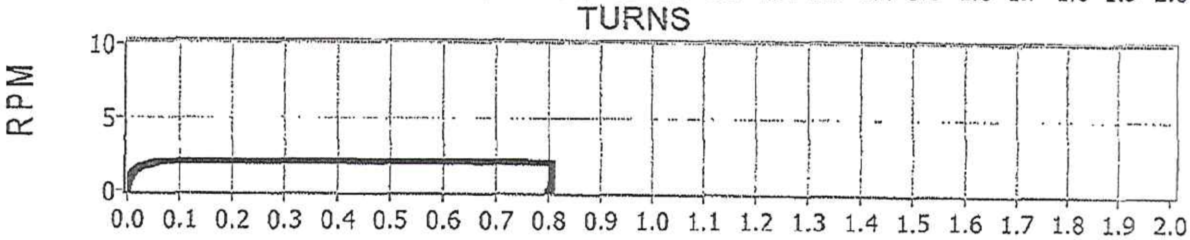
MakeUp

Project Number 16010

Pipe Size 7.000 in.

BP





MakeUp # 1	Moment 38.81 inches
Pin Id : B	Box Id : FC#4
File Name : 1601072\TT_0018	

Reference Torque	200	Ft-Lbs
Dump Torque	10700	Ft-Lbs
Overshoot (Max-Dump)	610	Ft-Lbs
Maximum Torque	11310	Ft-Lbs
Shoulder	-206	Ft-Lbs
Delta Torque	11516	Ft-Lbs
Turns @ Max. Torque	0.805	Turns
Shoulder Turns	0.000	Turns
Delta Turns	0.805	Turns
Total Turns	0.805	Turns
Thread Lubricant	BOL 72733	
Pin Lubricant	10	Grams
Box Lubricant	17	Grams

Operator: JCS **Date:Time of Test 10/18/2010 : 5:53:40 PM**

M

Annex M Calibration

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

CALIBRATION CERTIFICATE

CUSTOMER: **MOHR ENGINEERING**

13602 WESTLAND EAST BLVD

Transducer Make:	Dynisco	Transducer Model:	G830-300-5M-K73
Transducer S/N:	490645465	Transducer Range:	0 - 5000 psi
Reference and testing conditions:		979.312 gals	23°C +/- 1.5 deg
		Excitation	4.999 volts

CALIBRATION READINGS (as left)

ACTUAL (psi)	READING 1 (mv)	CONVERTED (psi)	PERCENT ERROR % 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
5000	14.917	5000	0.00

All readings within manufacturer tolerence (+/- .5% F.S.)

CONVERSION FACTORS (Reading - Offset)*gain

Shunt Reading (millivolts)	Shunt Reading (psi)	Offset (millivolts)	Gain (psi/mv)
11.922	**4000**	-0.058	333.90

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: May 16, 2010

SIGNED: [signature] RECALL: May 16, 2011

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

CALIBRATION CERTIFICATE

CUSTOMER: **MOHR ENGINEERING**

13602 WESTLAND EAST BLVD

Transducer Make:	Dynisco	Transducer Model:	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 (psi)	READING 1 (mv)	CONVERTED (psi)	PERCENT ERROR % of FS
0	0.058	0	0.00
500	1.565	499	-0.01
1000	3.073	999	-0.01
2000	6.089	1999	-0.02
3000	9.107	2999	-0.02
4000	12.125	4000	-0.01
5000	15.143	5000	0.00

All readings within manufacturer tolerence (+/- .5% F.S.)

CONVERSION FACTORS (Reading - Offset)*gain

Shunt Reading (millivolts)	Shunt Reading (psi)	Offset (millivolts)	Gain (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

SIGNED: [signature]

DATE: June 19, 2010

RECALL: June 19, 2011

Downstream Accumulator

STS
Specialized Tech Services

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

CALIBRATION CERTIFICATE

CUSTOMER:	**Stress Engineering / Waller Division**		
42403 Old Houston 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 READINGS (as left)

ACTUAL (psi)	READING 1 (mv)	CONVERTED (psi)	PERCENT ERROR % 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

All readings within manufacturer tolerence (+/- .5% F.S.)

CONVERSION FACTORS (Reading - Offset)*gain

Shunt Reading (millivolts)	Shunt Reading (psi)	Offset (millivolts)	Gain (psi/mv)
11.93	**7950**	0.04	668.40

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: May 16, 2010

SIGNED: [signature] — RECALL: May 16, 2011

Blancett®

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: 1
SHIP NUMBER: 247202
DATE: 07/08/2010
CUST PO NUMBER: J8740
CSR: BLB

PACKING LIST

SOLD TO: B44131
POWER ASSOCIATE INT'L.,JIM EXT.102
281-458-7020
13117 GREENRIVER DR 281-458-9124
HOUSTON TX 77044
USA

SHIP TO: 000056
MOHR ENGINEERING
13602 WESTLAND EAST BLVD
HOUSTON TX 77041
USA

SHIP VIA: UPS TRACK # 1ZV300E50349068767
FOB: SHIPPING POINT TERMS: 0 -- 0 DAYS; 0 -- 0 DAYS; NET 30
TOTAL PCS: 1 WEIGHT (LBS): 18.90

TAG PO:1751225-JEK

LN#:	ITEM/CATALOG ITEM	ORDER QTY	QUANTITY DUE	SHIPPED QTY	BACKORDER QTY
003	B000005 CERTIFICATE, CALIBRATION; 5-POINT	1	1	1	0
002	B28SLM-AB MONITOR; B2800, SMP, LP, MM, GAL	1	1	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:	111-520
Serial Number:	070810706
Sensor Type:	Magnetic Pickup
Output type:	Frequency
Minimum Flow:	40 GPM 151.4 LPM
Maximum Flow:	400 GPM 1514.2 LPM
Calibration Date:	July 8, 2010
Calibration Interval:	12 Months
Cal. Liquid:	Water
Ambient Temperature:	73.81 °F
Ambient Humidity:	54.38 %RH
Linear Points:	5

Master Meter:

Std uncertainty:	±0.25%
Traceability No:	TFM-1671
Model No:	OPTIFLUX 4000C
Serial No:	A053003

Customer Information:

Customer Name:	POWER ASSOCIATE INT'L.,INC.
Customer No:	B44131
Order No:	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 % Rate
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

UUT Calibration Data Table In LPM:

Flow Standard	Actual LPM	UUT Hz	UUT Temp °F	Visc. cSt	UUT F/V Hz/cSt	UUT K Cyc/Liter	(Hz*60)/NK LPM	Linear COEFF.	Raw Err % Rate
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: [signature] Kris Kulig

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-STD-45662A

QS248
Rev. A
'06/08

Calibration Information Sheet

Customer	WO No.	Model No.	SN
Omega Engineering	C6-020540	FD-410	57836

Meter Rev	Software Ver.	Output	Technician	Mfg. Date
FL1.11	1.11	4-20mA	DJM	7/19/2010

Comments
Calibrated with transducer S/N 57838

Temperature	Relative Humidity	Pipe Size	Scale	Flow Units
73.73 °F	57.64 %	Multi	0-30fps	FPS

Actual Flow 1	Actual Flow 2	Actual Flow 3	Actual Flow 4	Actual Flow 5
2.000	4.000	6.000	8.000	10.000

Indicated Flow 1	Indicated Flow 2	Indicated Flow 3	Indicated Flow 4	Indicated Flow 5
2.087	4.070	6.104	8.019	9.971

Calibration Statement

The flow measurement system listed above was certified in accordance with ISO procedure DAS-207-001 (Meter Certification Procedure). The equipment and methods used to generate the System Performance section of this certificate are traceable to NIST and conforms to ISO9001:2008. All certifications are conducted with tap waterat 70 F (21 C) and 1.0 cSt, calibrations for alternate fluids have been mathmatically corrected and are not traceable to NIST. The test equipment used in this certification are as follows:

Flow Loop Number: 8 | Standard: Optiflux 4300 | Calibration Due: 09-11-10

Pipe Type: 3" SCH 80 PVC | Serial Number: A05-8371 | Uncertainty: +/-0.5% of Reading

I certify that the flow measurement system listed above was operated and data was recorded in accordance with DAS-207-001.

Test Performed By: [signature] on the date of 7/19/2010.

Test Certified By: Michelle Hoberger on the date of 19 July 2010.

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

29 July 2009

Calibration Report

Owner: Stress Engineering Services, Inc.
42403 Old Houston Highway
Waller, Texas 77484

Ambient Temp: 77.8 F

Machine: MTS 20,000Lb Universal Testing Machine
MTS Load Cell 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 Error		Load, in Lbs:		Machine Error		Repeatability:	
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:	Serial:	Class "A" Range, in Lbs:	Verified:
Sensotec Load Cell	658345	1,560 - 25,000	16 Oct 2008

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:
20,000	1,995 – 20,010

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:	Verified:
Sensotec Load Cell	658345	1,560 - 25,000	16 Oct 2008

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.
42403 Old Houston Highway
Waller, Texas 77484

Ambient Temp: 76.3 F

Machine: MTS 20,000Lb Universal Testing Machine
MTS Load Cell *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:		Machine Error		Load, in Lbs:		Machine Error		Repeatability:	
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%	0	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:	Verified:
Sensotec Load Cell	658345	1,560 - 25,000	16 Oct 2008

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

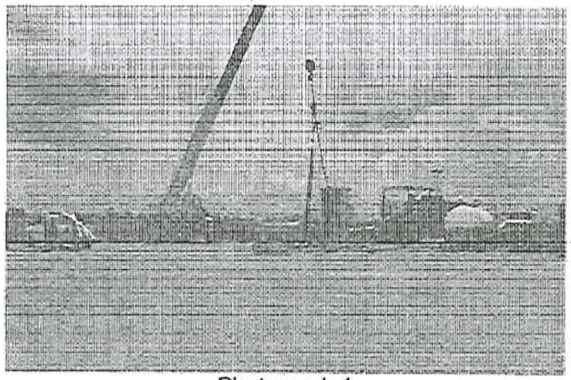
RCN Enterprises, Inc.
371 Bowler Road
Waller, Texas 77484

29 July 2009

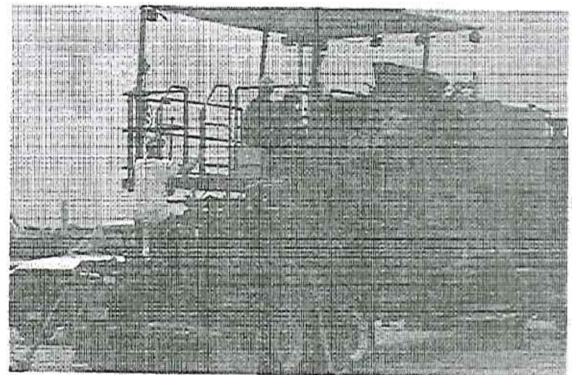
N

Annex N Photographs

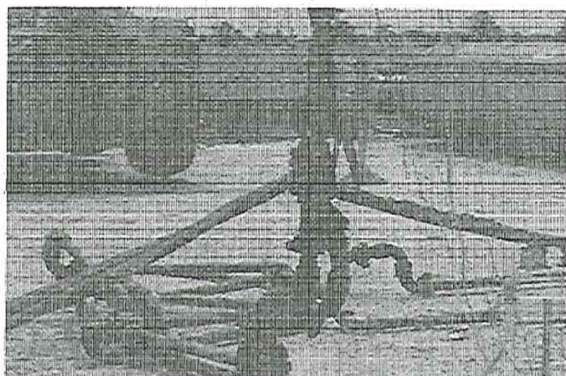
Equipment Setup for FC SN 29679918-01 Reverse-Flow Tests



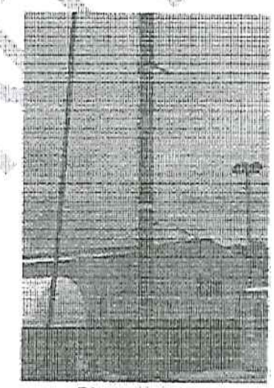
Photograph 1



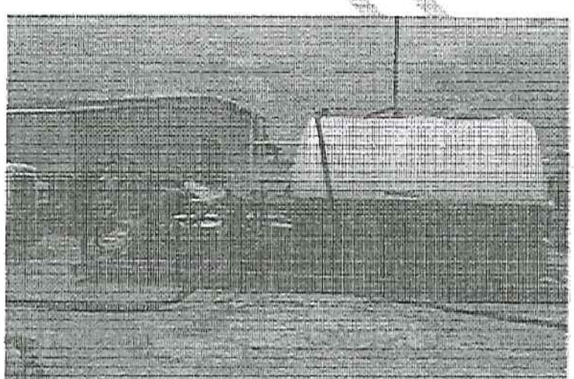
Photograph 2



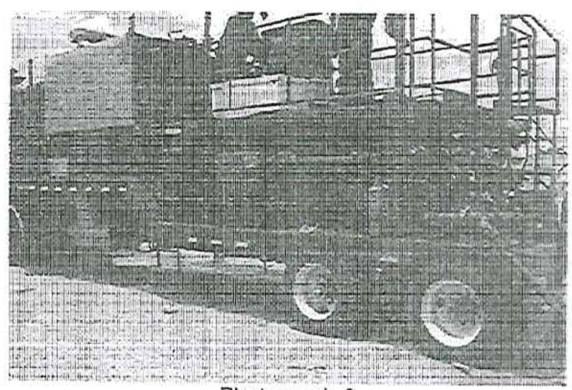
Photograph 3



Photograph 4

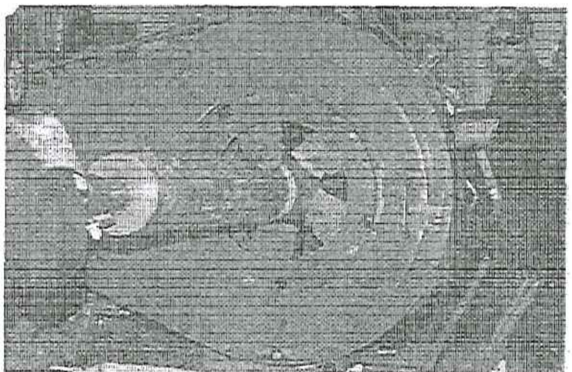


Photograph 5

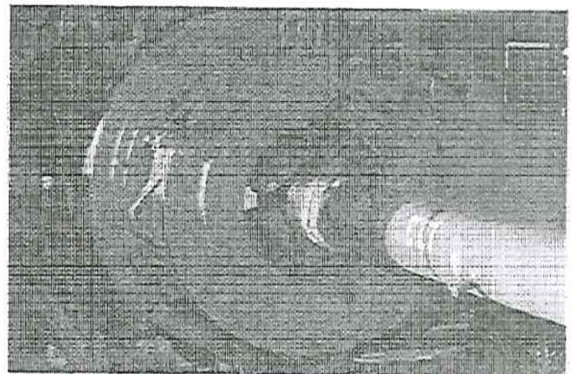


Photograph 6

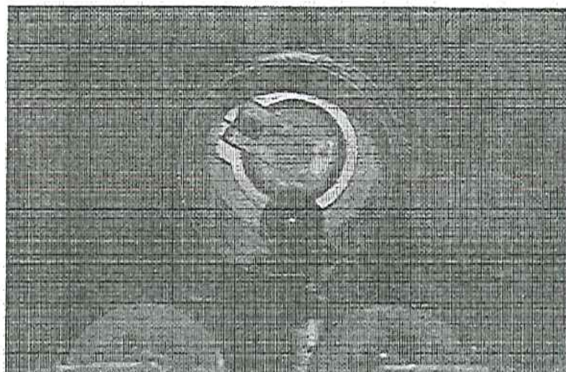
Break-out/Make-up of FC SN 29679918-01 after Conversion



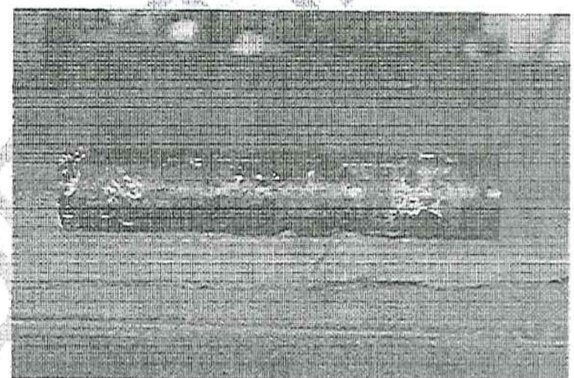
Photograph 7



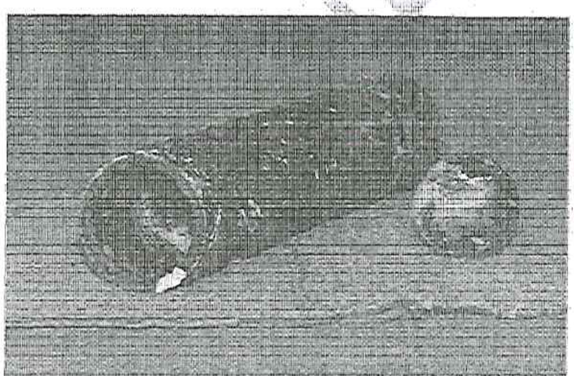
Photograph 8



Photograph 9

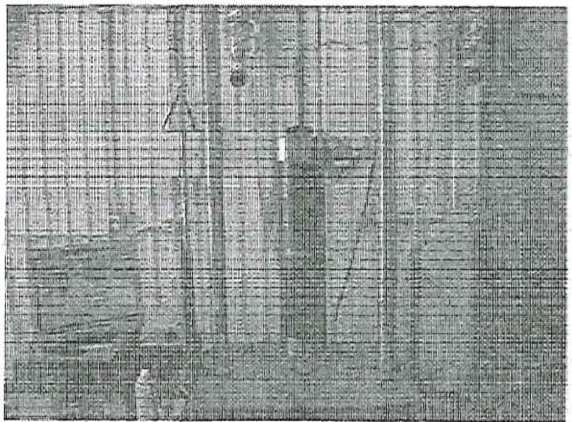


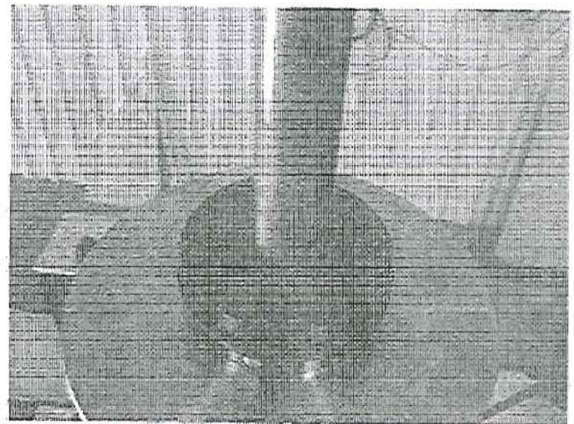
Photograph 10

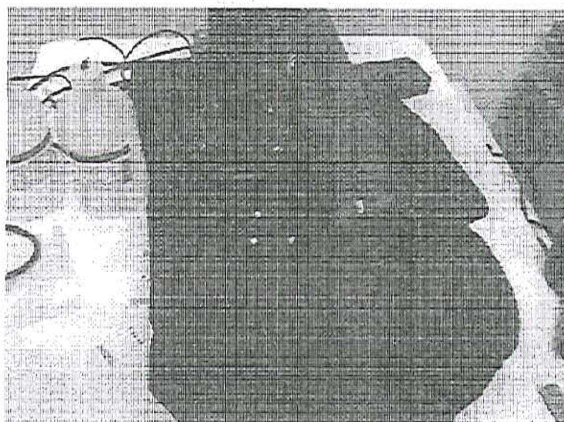


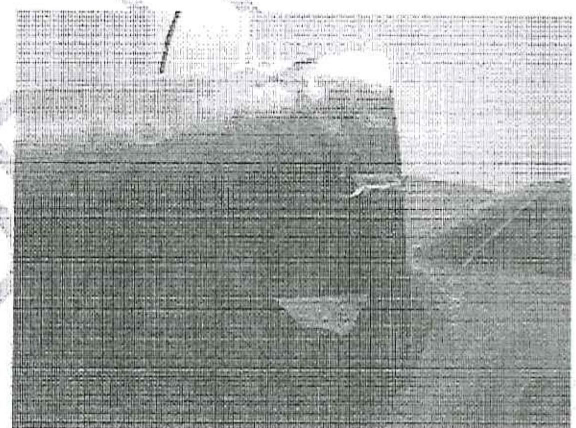
Photograph 11

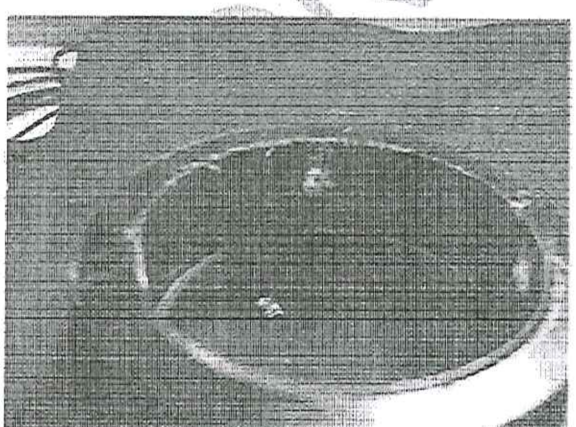
Conversion Mechanical Failure Test

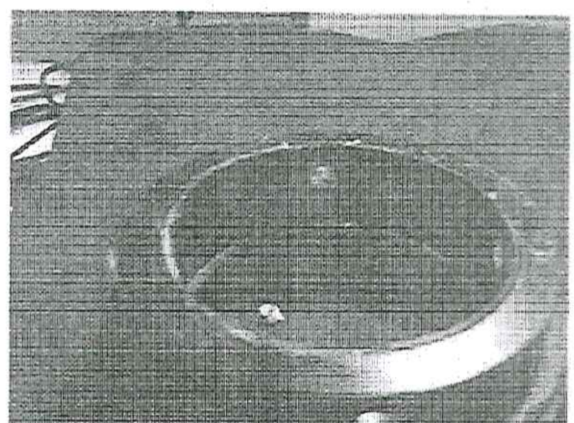

Photograph 12


Photograph 13

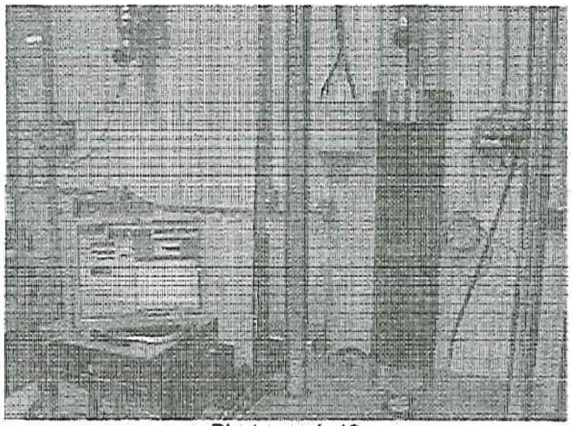

Photograph 14

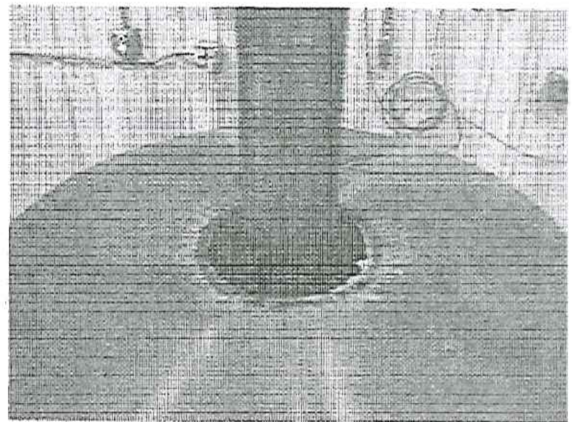

Photograph 15

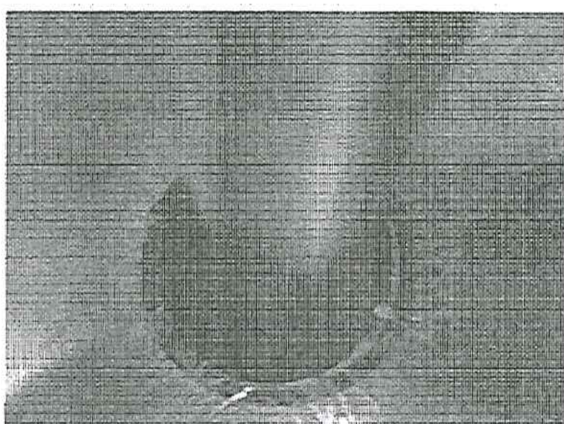

Photograph 16

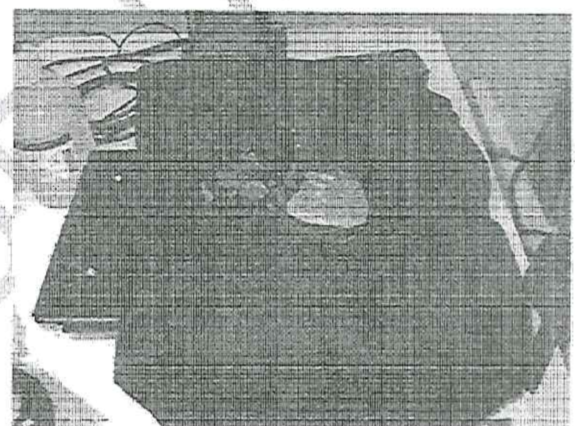

Photograph 17

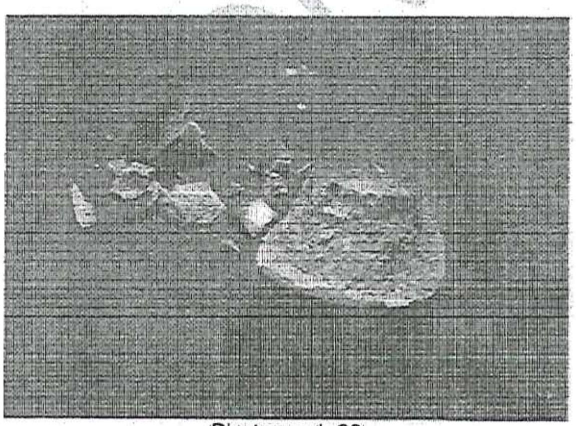
Auto-Fill Tube Lower Ball Seat Mechanical Failure Test


Photograph 18

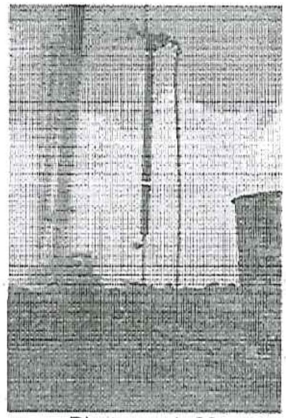

Photograph 19


Photograph 20

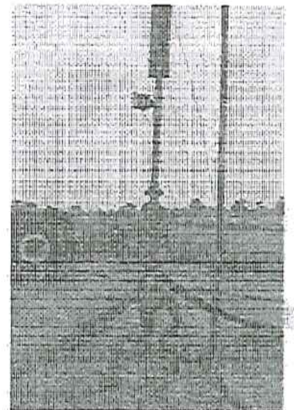

Photograph 21


Photograph 22

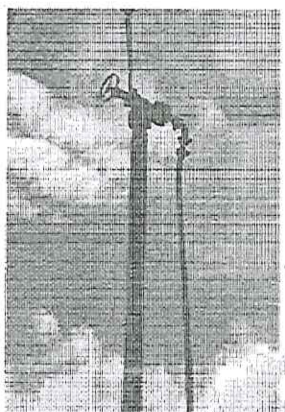
Equipment Setup for FC SN 29679918-02 Reverse-Flow Tests



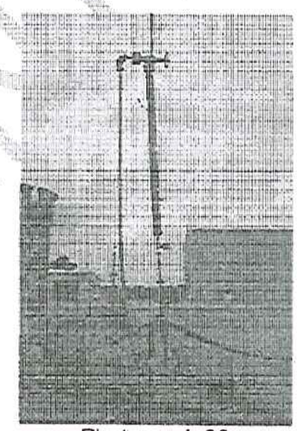
Photograph 23



Photograph 24

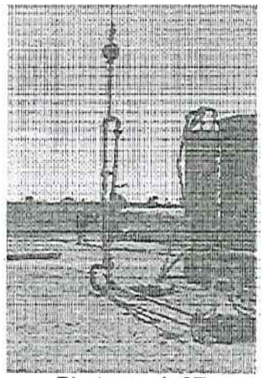


Photograph 25

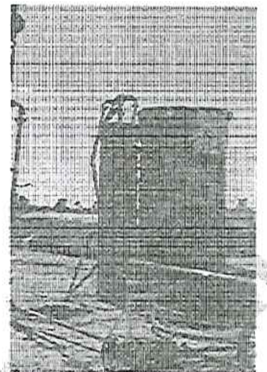


Photograph 26

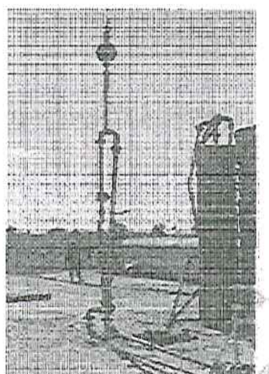
Rehearsal for Steady-State Conversion Test with Simulated FC (Typical Equipment Setup)



Photograph 27

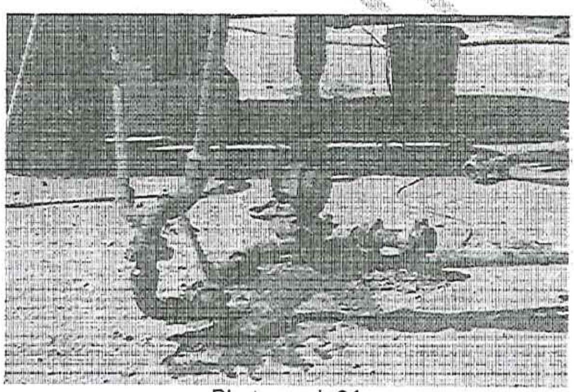


Photograph 28

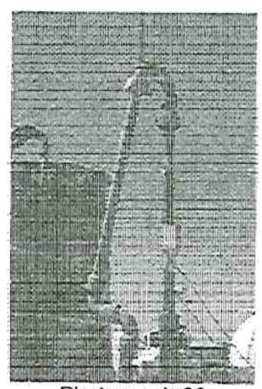


Photograph 29

Photograph 30



Photograph 31



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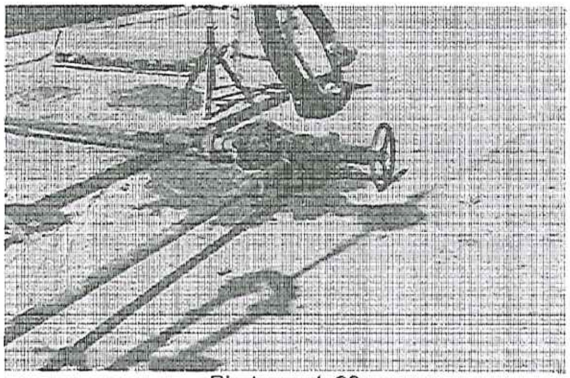
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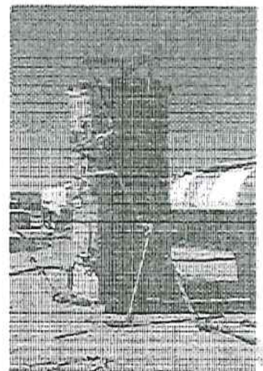
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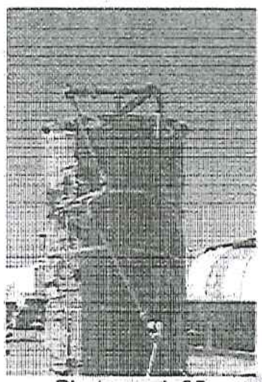
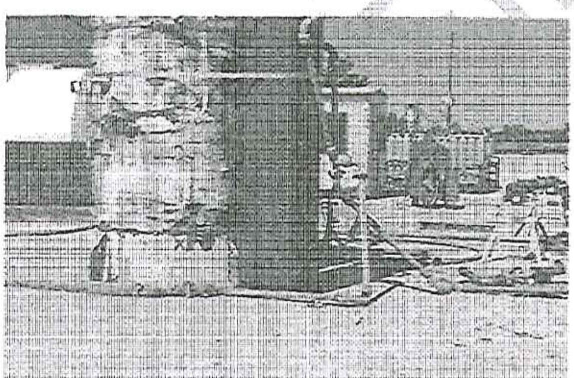

Photograph 35


Photograph 36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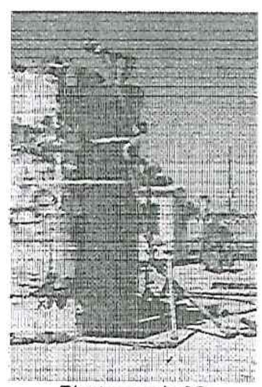
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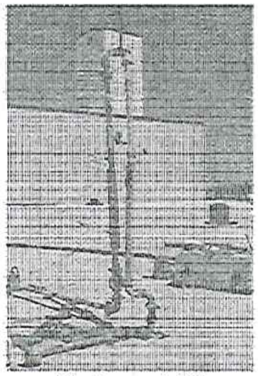

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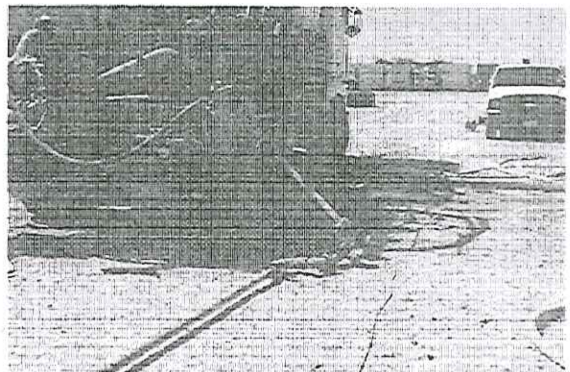

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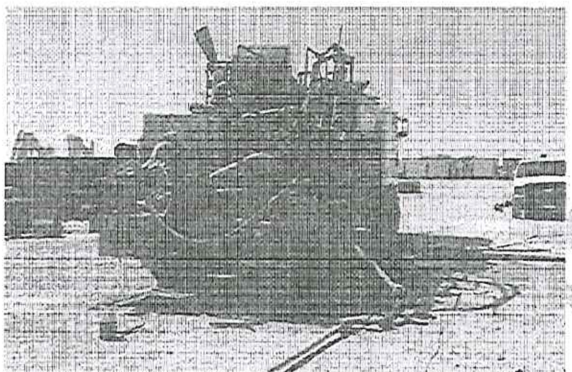
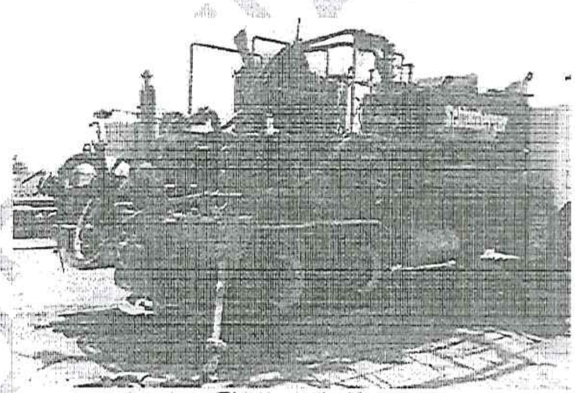
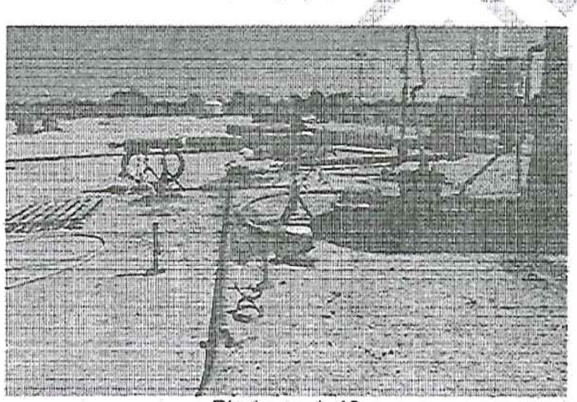


Photograph 41



Photograph 42



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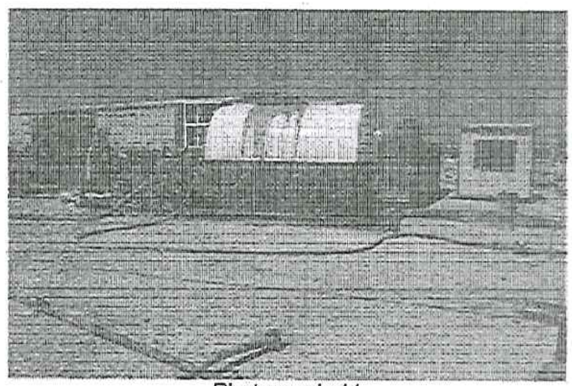

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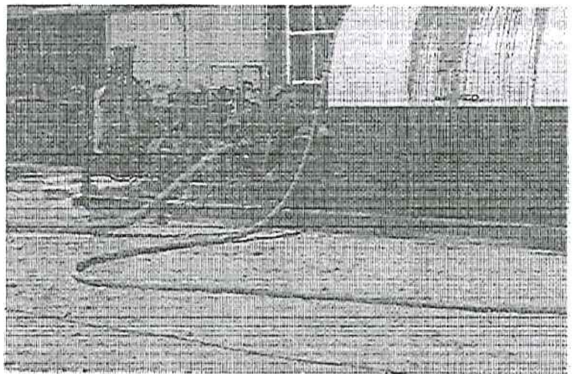
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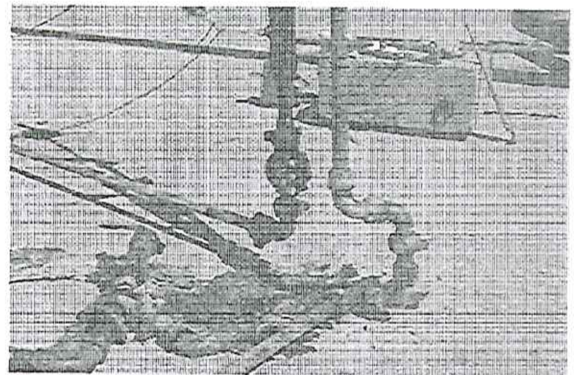
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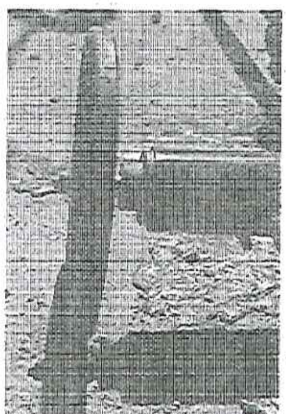
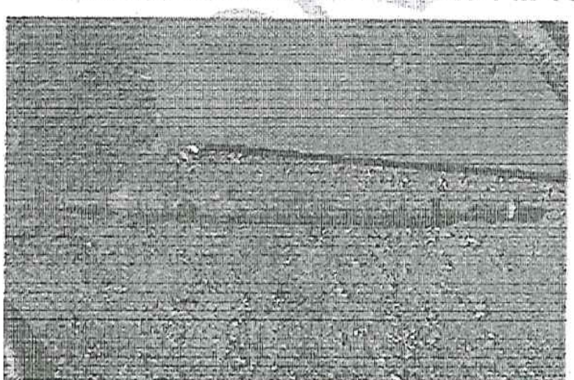
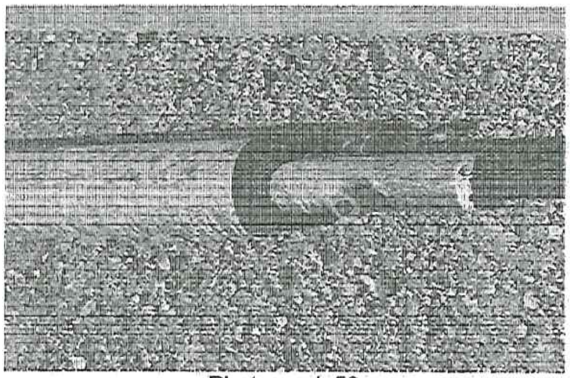

Photograph 47

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

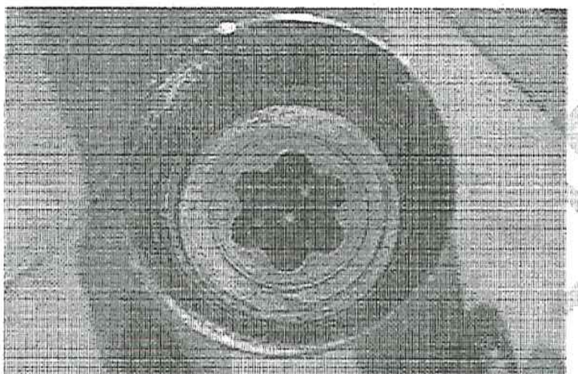

Photograph 48


Photograph 49

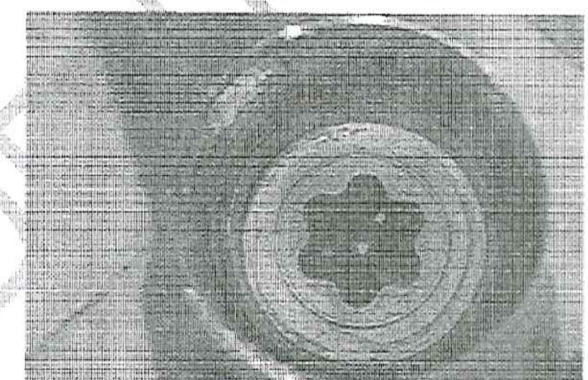


Photograph 50

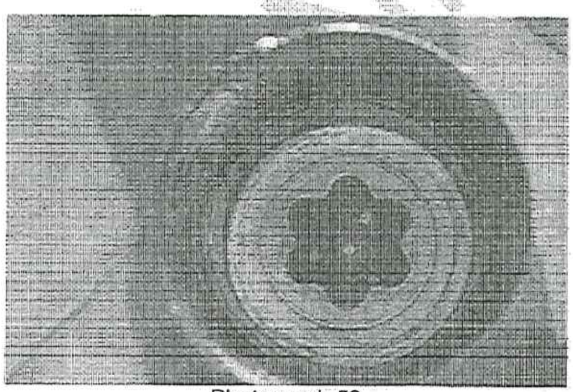
Allamon Ball after Conversion Test of FC SN 29679918-05



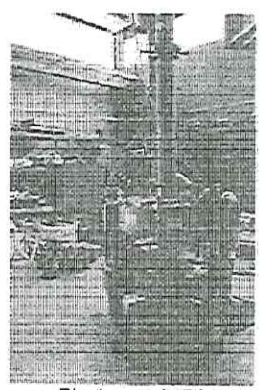
Photograph 51



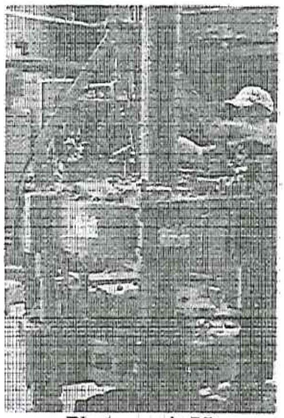
Photograph 52



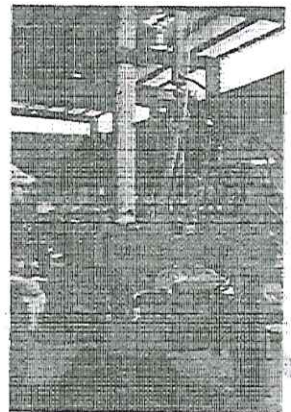
Photograph 53



Photograph 54



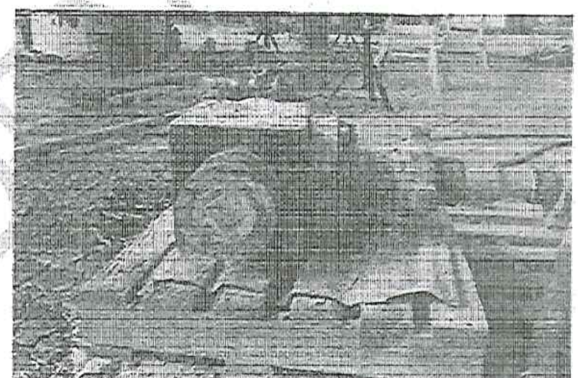
Photograph 55



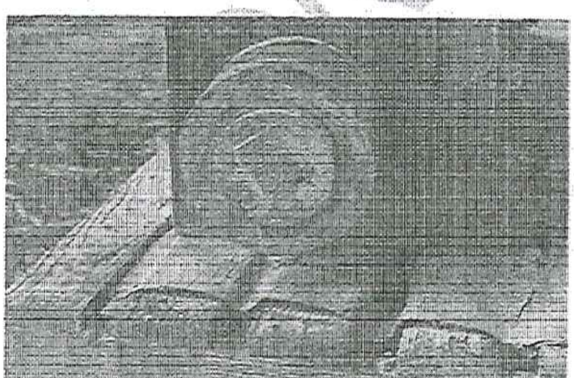
Photograph 56

Second Flow Surge Test of FC SN 29679918-04

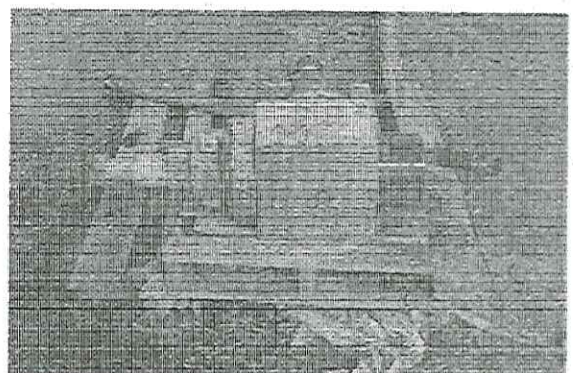
Photograph 57



Photograph 58



Photograph 59



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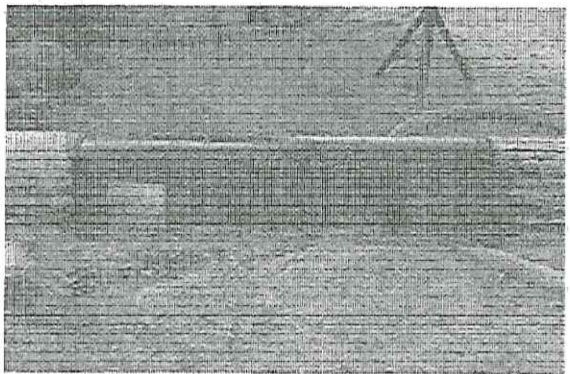

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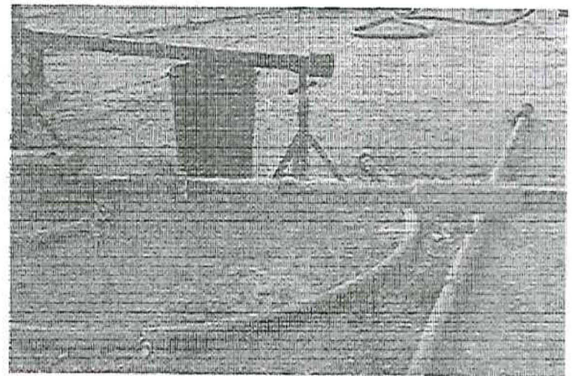
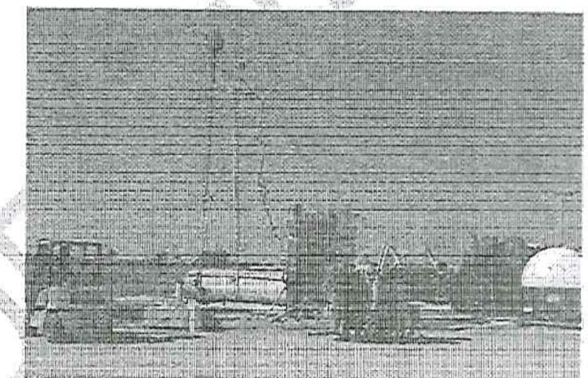


Photograph 62

Photograph 63



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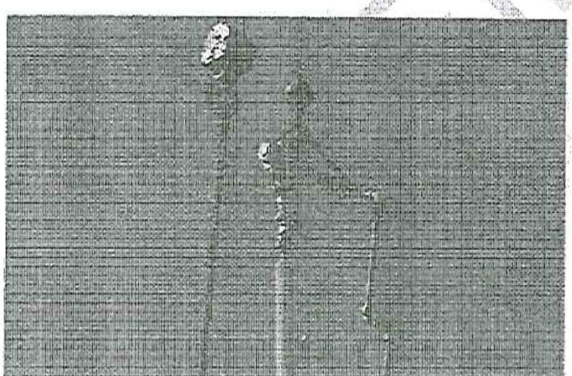

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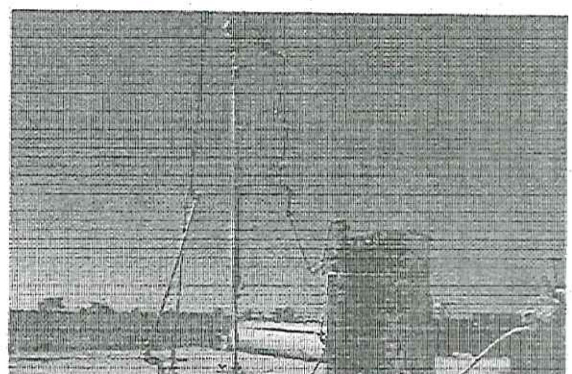
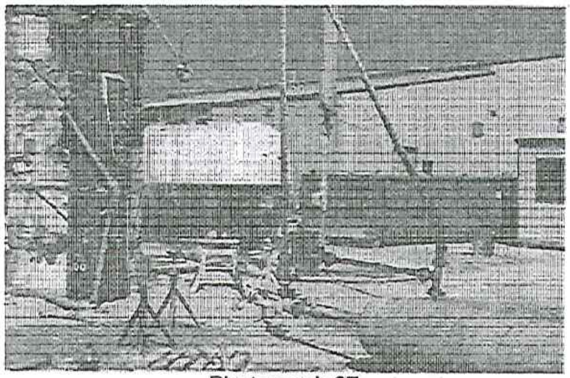


Photograph 66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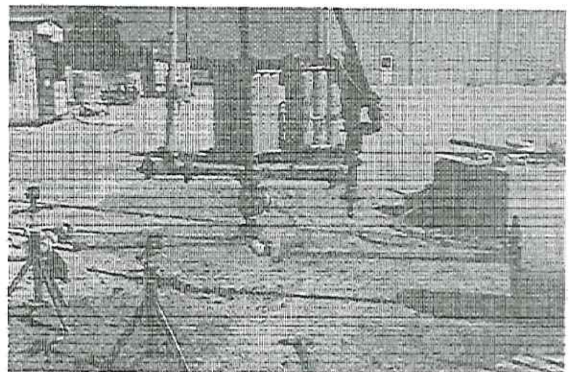
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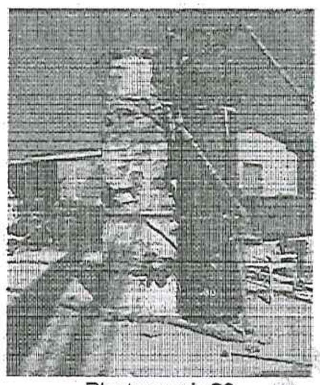
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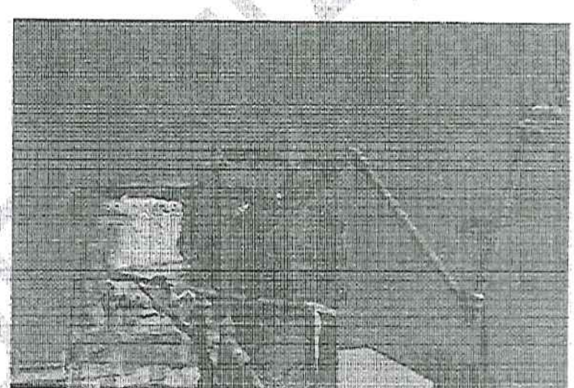
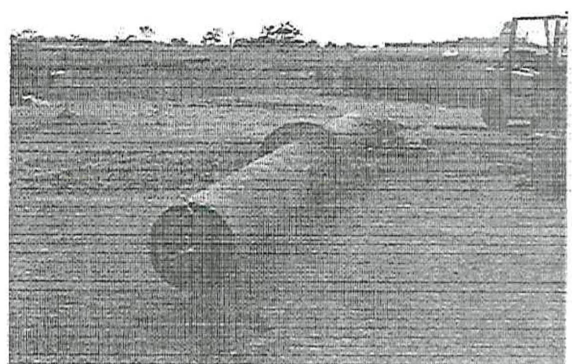

Photograph 70


Photograph 71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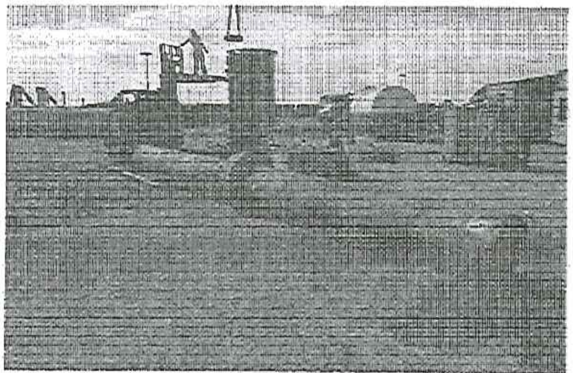
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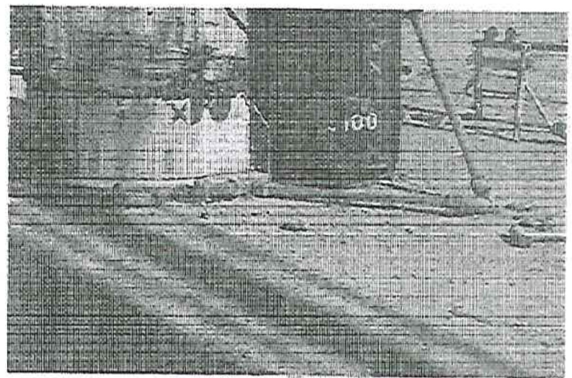
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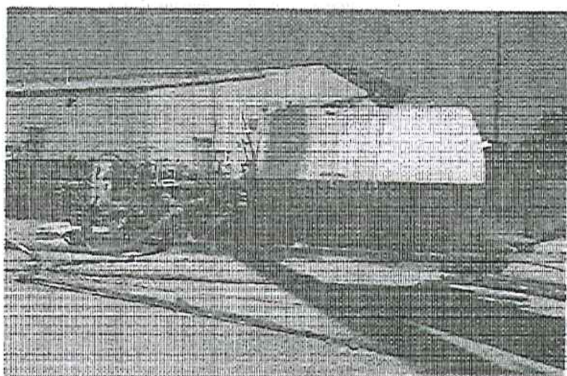
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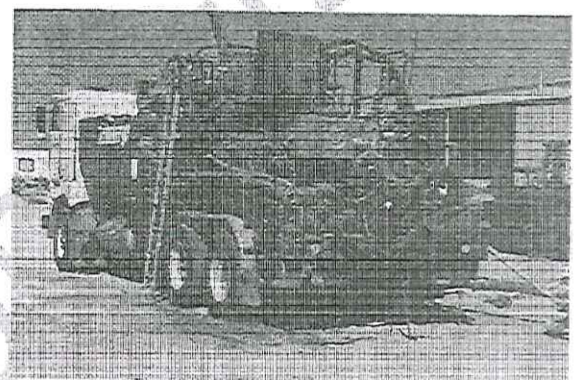
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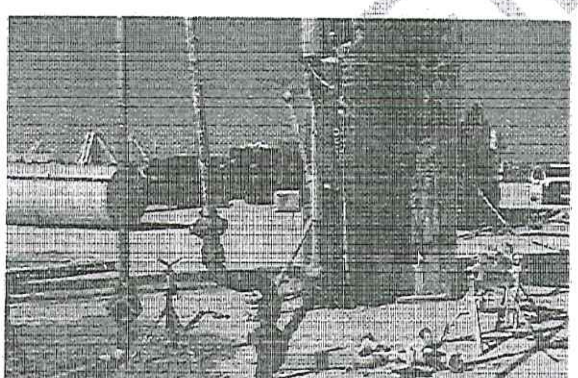
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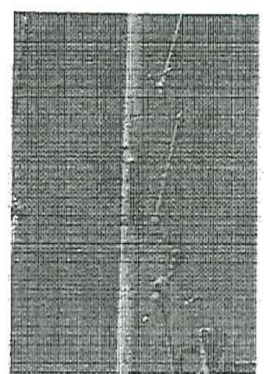
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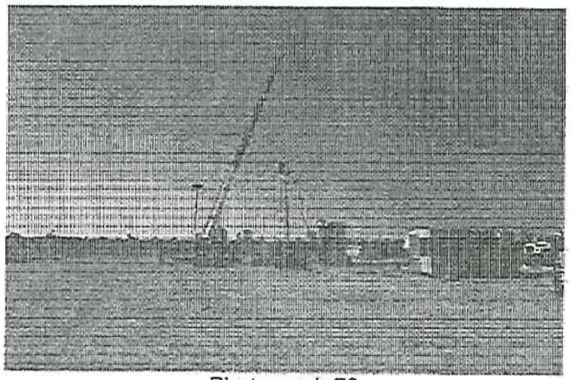
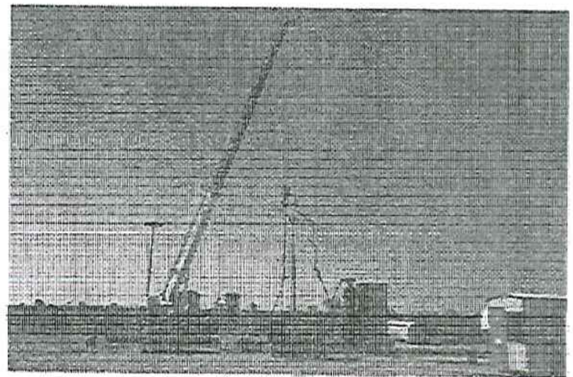
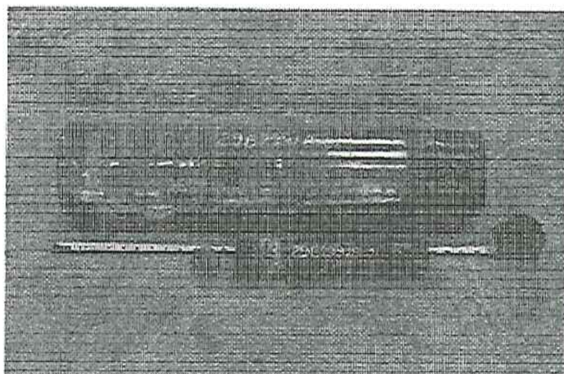
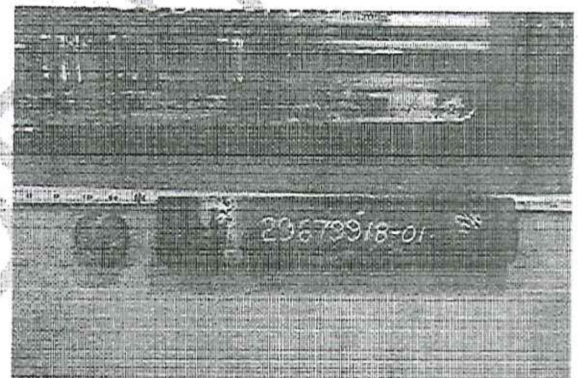

Photograph 79

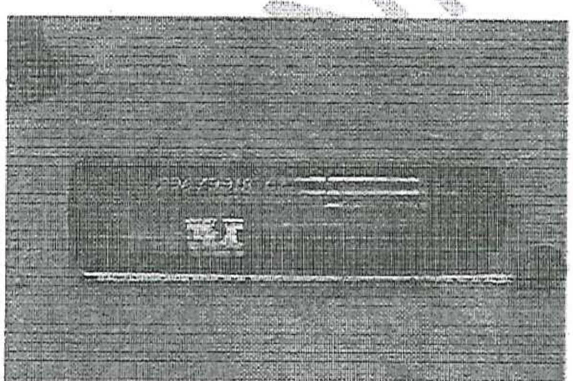

Photograph 80

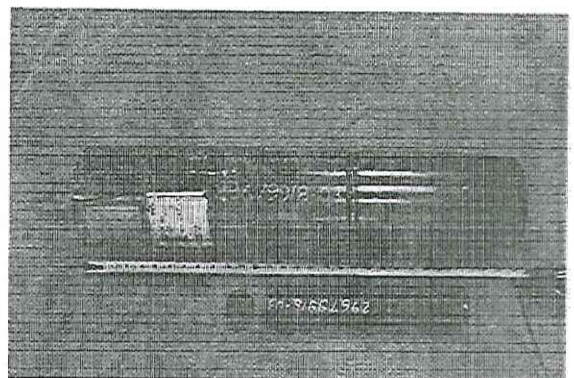
Post-Test Photographs of FC SN 29679918-01 through -05

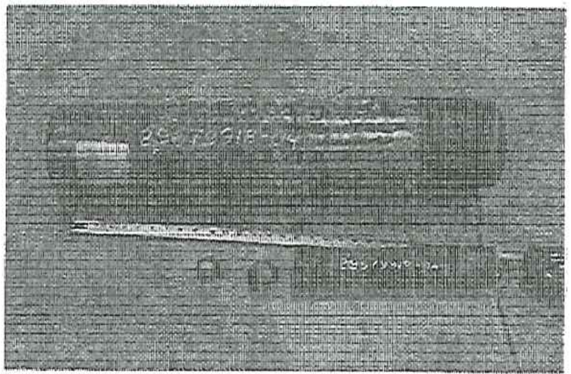

Photograph 81 (SN-01)



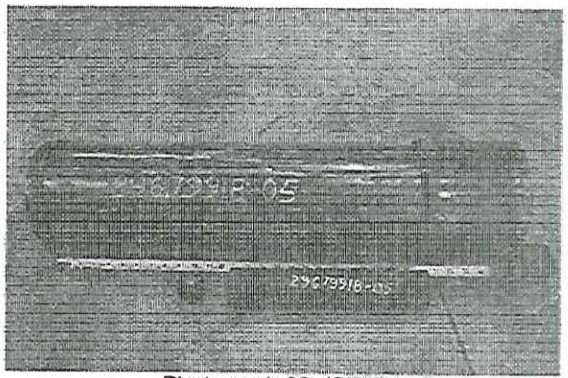
Photograph 82 (SN-01)


Photograph 83 (SN-02)


Photograph 84 (SN-03)

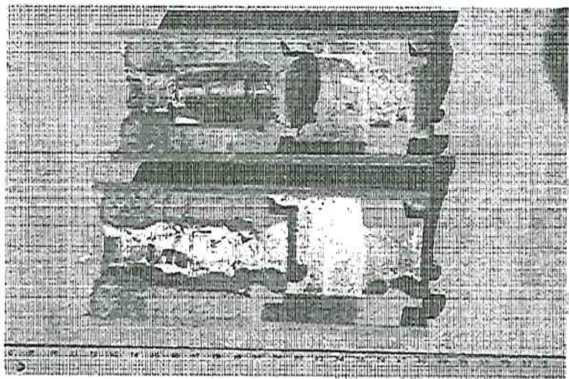


Photograph 85 (SN-04)

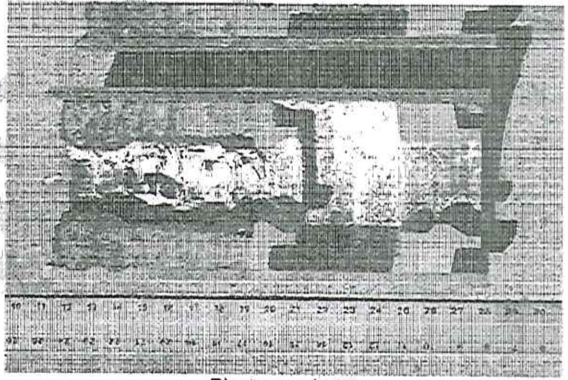


Photograph 86 (SN-05)

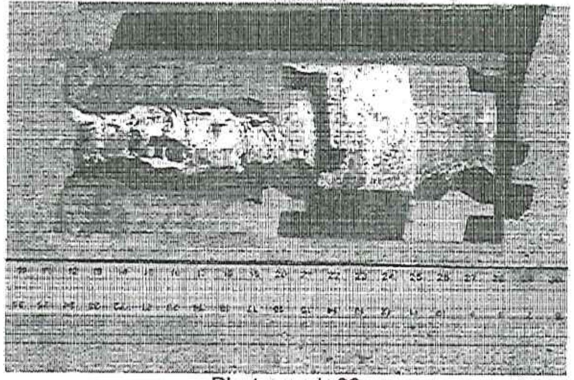
Inspection Photographs of FC SN 29679918-02 after Sectioning



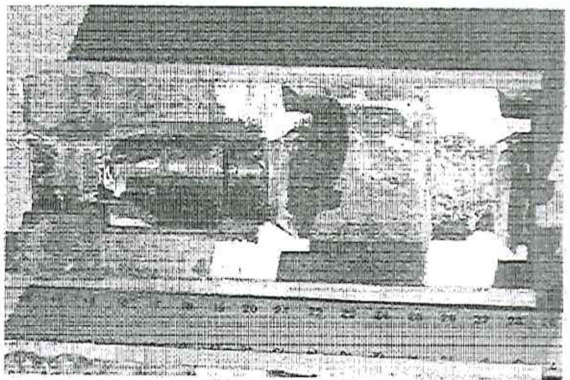
Photograph 87



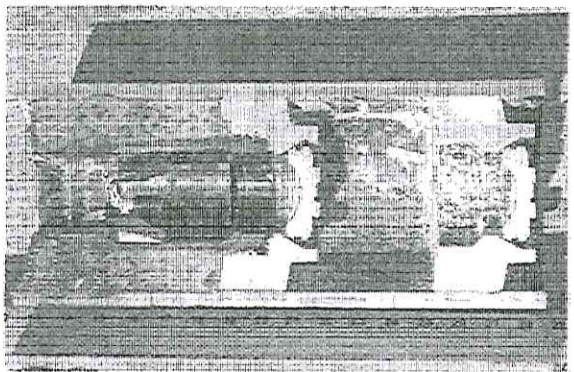
Photograph 88



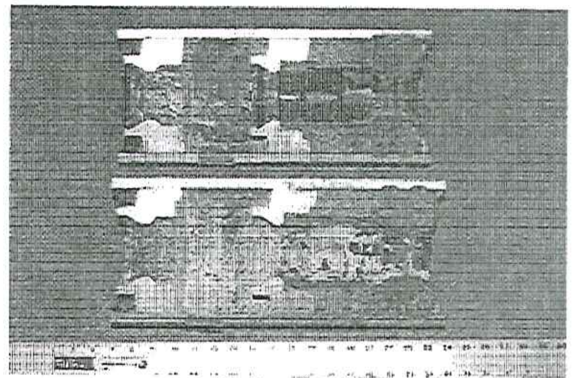
Photograph 89



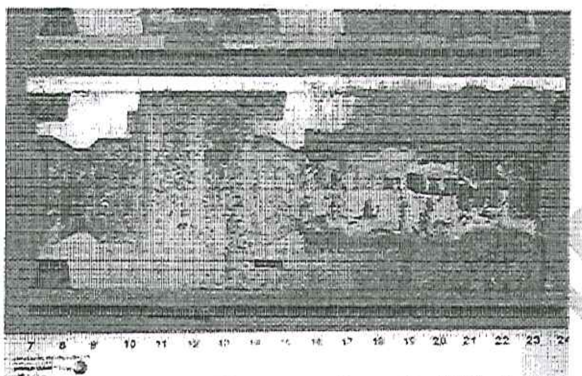
Photograph 90



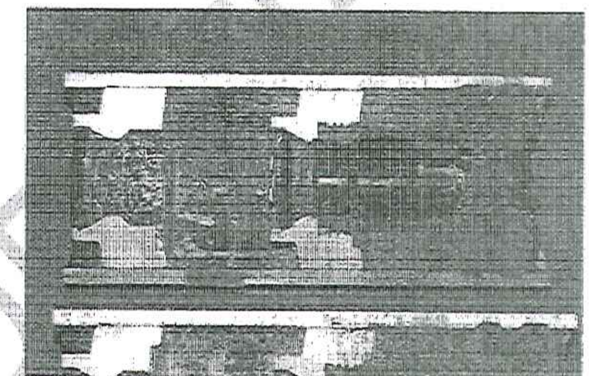
Photograph 91



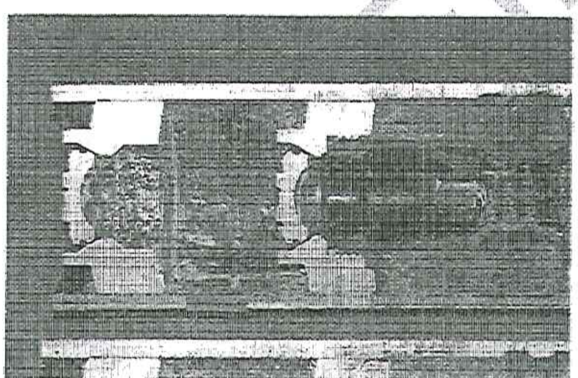
Photograph 92



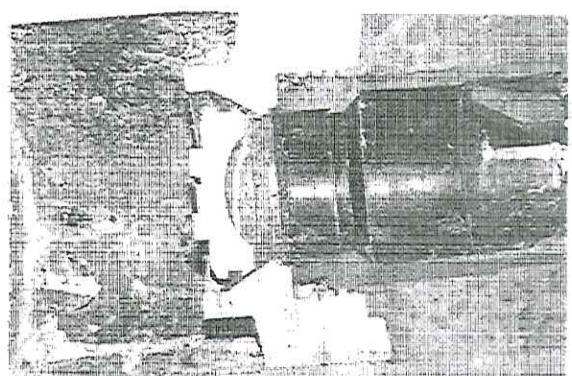
Photograph 93



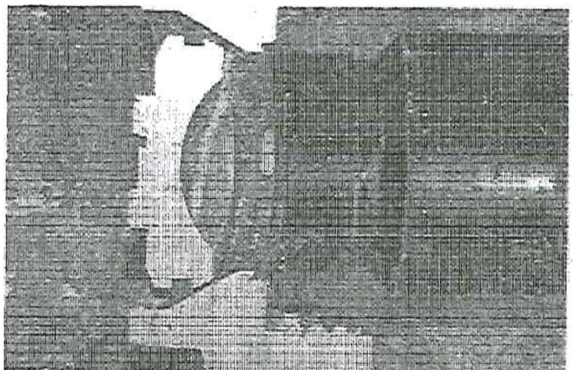
Photograph 94

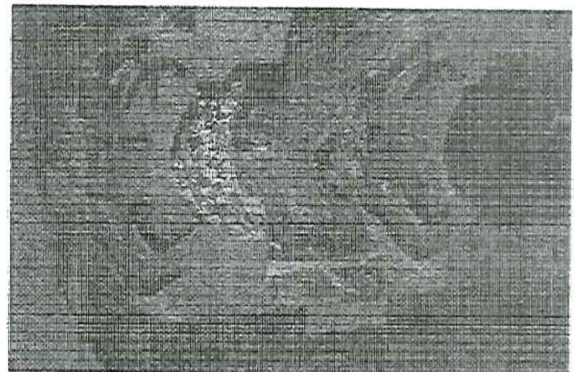


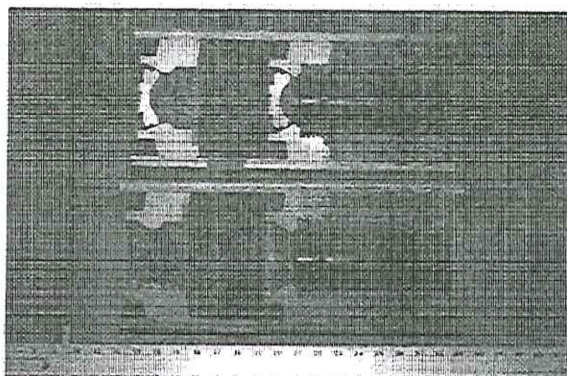
Photograph 95

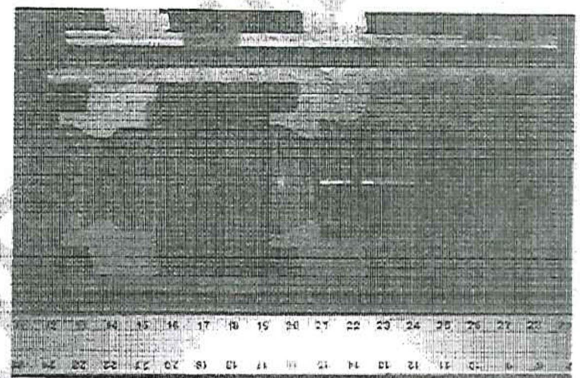


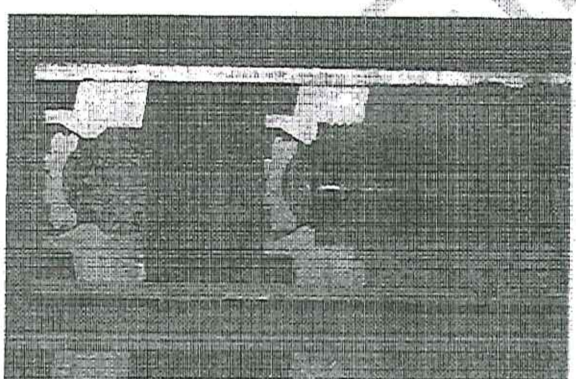
Photograph 96

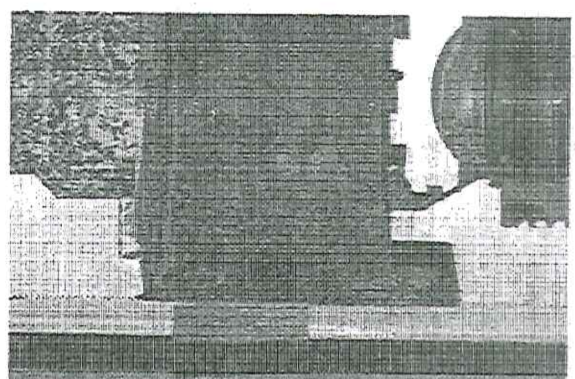

Photograph 97

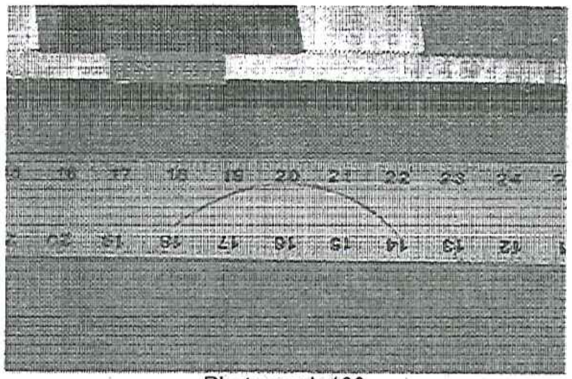

Photograph 98


Photograph 99

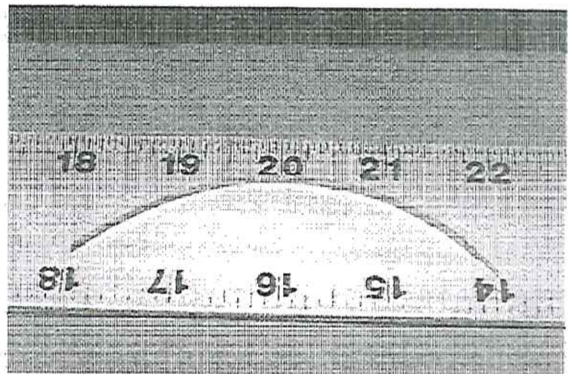

Photograph 100


Photograph 101

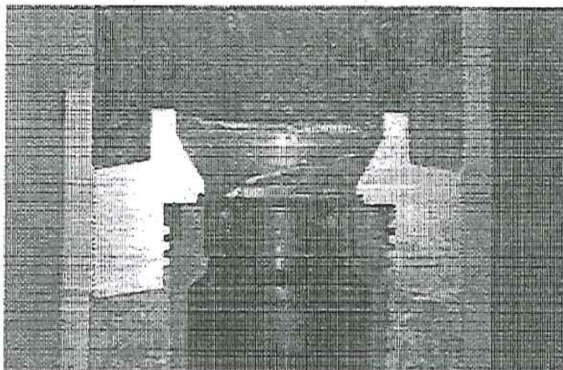

Photograph 102



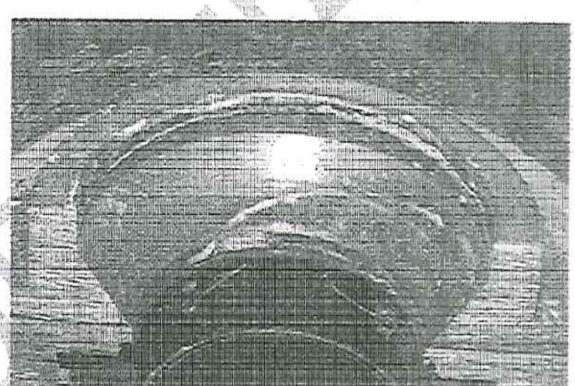
Photograph 103



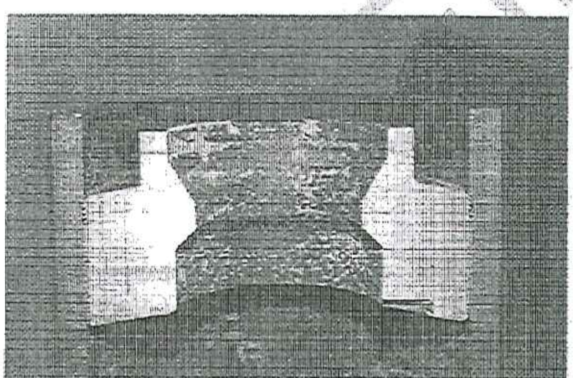
Photograph 104



Photograph 105



Photograph 106



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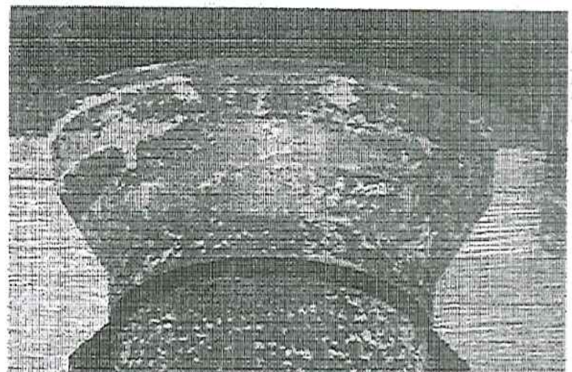

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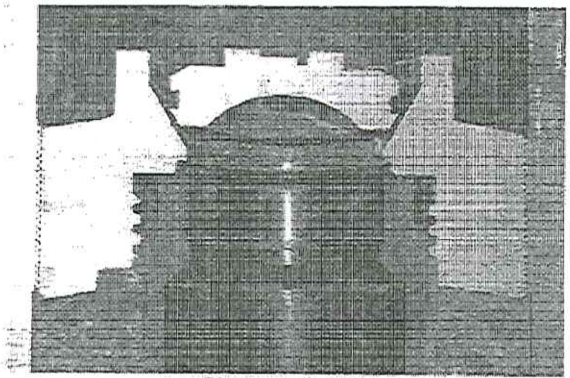
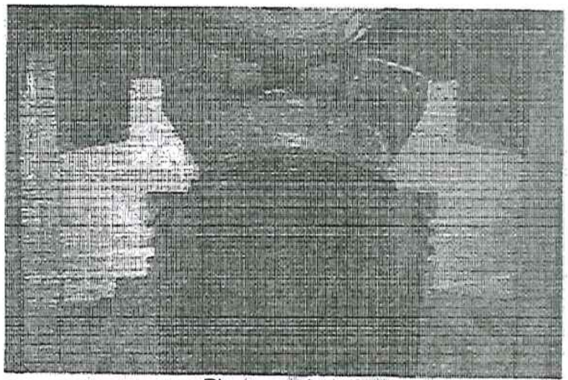


Photograph 109



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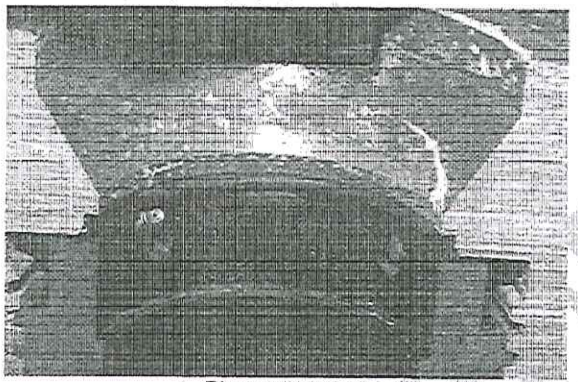
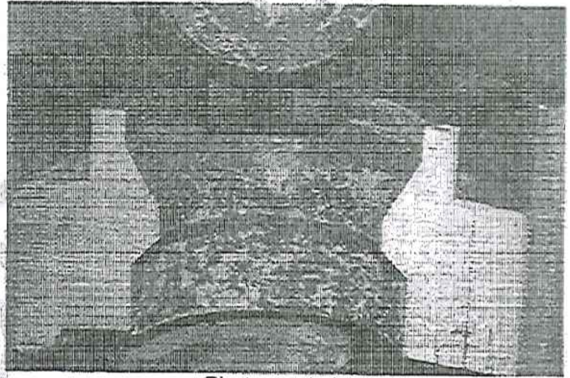
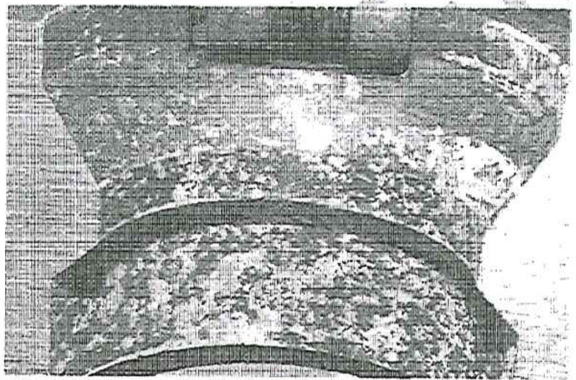


Photograph 111



Photograph 112



Photograph 113