RESULTS OF PERFORMANCE TESTS PERFORMED ON THE JOHN WATTS CASING CONNECTION ON 7" PIPE

Prepared For
JOHN WATTS
Houston, Texas

Project Funded By
Grant Award DE-FG01-95EE-15608
U.S. Department of Energy
In Support of the Energy Related Inventions Program

AUGUST, 1999

STRESS ENGINEERING SERVICES, INC.
Houston, Texas

DISCLAIMER

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PROJECT OVERVIEW : FUNDED BY DOE GRANT DE-FG01-95EE-15608

After an NIST evaluation of Watts' Full-Strength Flush-Joint Pipe Connection and it's recommendation, The U.S. Department of Energy Awarded funds to Watts to make four coupled specimens per Claim 1 of Watts' Patent 4,813,717 and to test them per modified ISO 13679 Level III requirements. Also included was hydrostatic and tension testing of two Integral Pipe Connections per Claim 18, rated at 80%.

Watts' threaded pipe connection was developed in the mid-eighties for use primarily to connect joints of Oilfield Casing and Tubing, and was successfully tested numerous times under both tension and internal hydraulic working pressure to pipe rupture which occurred away from the connection. In the vernacular of that day, it rated as a Full Strength Connection. The connection threads had a 90 degree load (tension) flank and a 45 degree stab (compression) flank which was then sufficient because only 50% axial compressive strength was required. The objective of this project was to qualify a 7" O.D. 32# P110 pipe connection as 100% under the ISO standard which is much more definitive, exacting and stringent than prior Performance Standards for Oil Country Tubular Goods. (OCTG)

Due to the advent of deeper wells, higher well fluid pressures and directional drilling which requires high degrees of bending on pipe strings, compressive connection strength has now become more than a passing interest and in fact for many wells, is a prime consideration. ISO 13679 requires various tests under combination loads including tension, compression, bending, internal gas pressure, external water pressure, and thermal cycles with the stress limit being at 95% VME Shear Stress. To withstand these higher compressive strength requirements, Watts changed the stab flank angle from 45 to 20 degrees.

An environmentally friendly thread dope containing 30% Teflon that met API specifications, was first used to assemble all coupled specimens but late in the project after several specimens leaked, it seemed evident that Teflon buildup between the threads caused excessive thread interference which in turn, overstressed the box and pin, to cause the leaks. To confirm that as fact, the last two tests were run on capped-end specimen #2 having re-cut threads and assembled with API Modified thread dope having no Teflon. The specimen was gas pressured to 90% VME yield stress with no leaks, and then a 90% VME yield tension load was applied with 1000 psi internal gas pressure to detect leaks. The test was limited to 90% VME to be sure that both tests could be run, in case we had not correctly diagnosed the problem. Thus it appears the Connection may qualify under the ISO Standard if re-tested. For complete test data, see the Project Report written by Tom Asbill, V.P. of Stress Engineering Services.

Had the Teflon problem been known, the project would not have been attempted within the time available which required that all activities occur on a broad front, but tests would have been run on a step-by-step basis before accepting a grant. However, the project did uncover a New Invention which I intend to Patent under 10CFR600.33(b)(1) shown as Paragraph (b) on page 1 of the contract replacement pages that Contracting Officer Berta Schreiber faxed to me on Dec 07, 1995 as Amendment M001. A copy of the application will be sent this year, to the "Patent Counsel" in accord with (c)(1) of M001. Therefore, I hereby request approval to prove the New Invention in simple step-by-step proof testing later this year with the funds remaining in this project and then hopefully, find funding to retest per ISO 13679. If successful, I will also offer Worldwide Royalty Free Rights for use by the U.S. Government for all of my prior Tubular Connection Patents that are complimentary to the New Invention. This project has cost DOE a considerable amount and has cost Watts about the same in time and expense, but I believe enough has been learned such that the Connection will qualify under ISO 13679.

I sincerely appreciate the opportunity given to me by the U.S. Department of Energy, the direction given by Douglas L. Baptist, the Contract modification by Berta Schreiber, the fine guidance by David Crouch, the timely support by Steven Jones and the expert advice and cooperation from Tom Asbill.

John D Watts

John D. Watts, P.E. (281)463-2312 phone or fax, 5054 Stanhope, Houston, Tx 77084-3033

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Prepared By W. T. Asbill
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PN 5806

STRESS ENGINEERING SERVICES
Houston, TX

August, 1999

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1.0 INTRODUCTION & SUMMARY

INTRODUCTION - Stress Engineering Services (SES) was contracted by Mr. John Watts to test his threaded connection developed for oilfield oil and gas service. Stress Engineering offers a test facility that specializes in testing OCTG and marine pipe and associated connections. This particular test required the application of a variety of loads including axial tension and compression, internal pressure (gas), external pressure (water), bending and both low and elevated temperature. These loads were used to determine the sealing and structural limits of the connection.

CONNECTION DESIGN – The connection design tested had tapered threads with 10 threads per inch. A square thread form and a round thread form were tested. The square thread form had a 2° load flank and 15° stab flank. The round thread had a 0° load flank and 20° stab flank. Most of the testing was performed on the round thread form. Both a coupled connection design and an integral connection design were tested. The coupling was a pin by pin (male) thread with the pipe having a box (female) thread. Both designs have outside and inside diameters that are flush with the pipe body. Both designs also contain a small external shoulder. This shoulder can (not necessarily required) engage during assembly.

TEST PROCEDURE - The test procedure selected for this evaluation was the newly written ISO 13679 procedure for full scale testing of casing and tubing connections, which is currently going through the ISO acceptance process. The ISO procedure requires a variety of tests that includes makeup/breakout testing, internal gas sealability/external water sealability testing with axial tension, axial compression, bending, internal gas thermal cycle tests and limit load (failure) tests). This test was performed with four coupled samples and included most of these loads. Two integral samples were also included for limit load testing

ISO makeup/breakout tests are divided into three types – initial makeup, IMU, repeated makeup within the same sample, MBL, and repeated makeup using several samples called round robin, RR. IMU and MBL were performed in this project.

The ISO sealing and structural procedure is divided into four primary tests and identified as Series A, B, C and Limit Load (failure). Series A and B test to 95% actual yield of the pipe and Series C uses 90% of actual yield. Samples 1 and 3 were tested to Series A and the loads are shown in Figure 1. For these samples, the axial compression was limited to 75% pipe body yield, which was set by Mr. Watts at the beginning of the test. Samples 2 and 4 were tested to Series B with loads shown in Figure 2. This series included 20 degrees per 100 feet bending but no external pressure. Due to premature leaks, no samples were subjected to Series C which included mechanical and thermal cycles. Samples 5 and 6 were tested to failure.

SUMMARY OF TASKS PERFORMED AND RESULTS - Table 1 contains a summary of the tasks performed by SES. The project started with the selection and purchase of a popular size of oilfield pipe, which was 7" OD, 32 pound per foot, P-110 casing. While the connections were being threaded by Mr. John Watts, material tensile tests were performed to get the actual strength of the 7" pipe.

The first samples contained a square thread form. Excessive galling was experienced during the first series of makeup/breakout tests and Mr. Watts decided to change the thread form and remachine the samples.

The second samples had a round thread form and performed very well in the makeup/breakout tests. Basically no galling occurred of any consequence.

Samples 1 and 3 were to be tested with external water (ISO Series A) while samples 2 and 4 were to be tested with bending (ISO Series B, no external pressure). Testing of all four samples started with tension and internal gas pressure. During this initial pressure testing, samples 1, 3 and 4 developed leaks and the test was stopped before any external pressure or bending was applied. Sample 2 successfully tested to ISO Load Point 5 which included bending before developing a leak. Figure 3 shows the loads at which the samples leaked and the relative pipe body performance capability. Sample 1 and end A of sample 2 held a high pressure while samples 3, 4 and end B of sample 2 leaked at relatively low pressures. All of these leaks were with nitrogen gas pressure.

After reviewing the results, it was believed that several conditions may have contributed to the premature leaks-

- The BOL 2000 thread lubricant contains solid particles (mainly PTFE flakes) that are larger than the solid particles in API 5A2 compound. Possibly the large particles prevented tight thread contact necessary for gas leak tightness.
- The BOL 2000 lubricant may have caused or at least contributed to the yielding of the pin end during makeup. Pin inward deformation was found in some pins subsequent to testing and breakout. Excessive yielding of the pin or box will contribute to poor thread contact and leakage.
- The connections were madeup to full or near full shoulder contact. This causes the end of the pin to be stressed near the yield strength. This along with the interference caused by the thread compound may cause excessive pin hoop stresses and yielding which in turn gives relatively loose thread contact. This behavior is particularly present when repeated makeup and breakout occurs.

In an effort to show that the above damaging conditions may have occurred, Mr. Watts remachined samples 1 and 2. When this was completed, time allowed only one sample to be retested and sample 2 was selected because it already had welded end caps whereas one cap was cut from sample 1. Mr. Watts also had 0.001" removed from the crests of the box and pin threads of sample 1. This was to allow the lubricant a place to migrate to as the thread flanks engaged and became tight during assembly. The sample was madeup with API lubricant and to a lesser thread interference (0.032" gap at the external shoulder compared to 0.0" to 0.0035" for previous assemblies) than previous makeups. Two loads were applied – (1) capped end gas pressure to 90% pipe body yield, 14,620 psi, and (2) tension to 90% pipe body yield, 1,026 kips, plus a low pressure of 1,000 psi to check gross sealability. The sample successfully held the loads with no leaks. This successful test indicates that the above damaging conditions likely did occur with the test samples. These conditions can be corrected and sealability improved.

Samples 5 and 6 were failure tested with water (project scope did not include gas sealability testing of these samples. Sample 5 failed by fracture in the pin critical section of the threads with no leaks observed before failure. Sample 6 failed by thread jumpout with no leakage before failure. The resulting joint efficiencies relative to the pipe body were-

- Sample 5 = 79% on yield and 73% on ultimate strength
- Sample 6 = 92% on yield and 86% on ultimate strength

TABLE 1
SUMMARY OF TASKS PERFORMED BY STRESS ENGINEERING

DATE	TASK PERFORMED	RESULTS	NEXT PLAN OF ACTION
May 25	Purchased 7" pipe for making samples		Sent to threading shop for machining
June 2	Material tensile tests performed on pipe		
June 7	Makeup/breakout test of square thread form connections	Excessive galling	Changed thread form and remachined samples
July 7& 8	Preliminary makeup/breakout test of round thread form connections	Set torque requirements	Determined recommended makeup torque
July 8	Makeup samples 1, 2, 3, 4, 5 & 6	Assembled for testing	Install end caps for combined load tests
July 9 - 18	Welded end caps to ends of samples		
July 13	Baked sample 2		
July 14	Baked samples 1, 3, 4, 5 & 6		
July 15	Tested sample 2	Leaked - internal gas End A = 13,260 psi	Retest with different thread lubricant
July 19	Breakout and remake sample 2		
July 19	Baked sample 2		
July 20	Tested sample 1	Leaked - internal gas 11,930 psi	Retest with different thread lubricant
	Tested sample 2	Leaked - internal gas End A = 13,800 psi, End B = 3,110 psi	
July 21	Breakout samples 1 and 2		Threads remachined
	Breakout and remake samples 3 & 4		Changed thread lubricant
	Baked samples 3 & 4		
July 22	Tested sample 6 - Capped end burst	Thread jumpout at 15,400 psi - no leak prior to failure	
July 23	Tested sample 4	Leaked - internal gas 2,750 psi	
July 23	Tested sample 5 - Tension to failure with pressure	Tension failure at 968 kips & 5,400 psi - no leak prior to failure	
July 28	Tested sample 3	Leaked - internal gas 4,650 psi	
July 29	Breakout samples 3, 4		
Aug 11	Makeup sample 2	Fewer turns	
Aug 12	Tested sample 2	No leaks	
Aug 13	Report preparation completed		

FIGURE 1
JOHN WATTS 7" PIPE COUPLED CONNECTION
ISO SERIES A TEST LOADS
SAMPLES #1 & #3

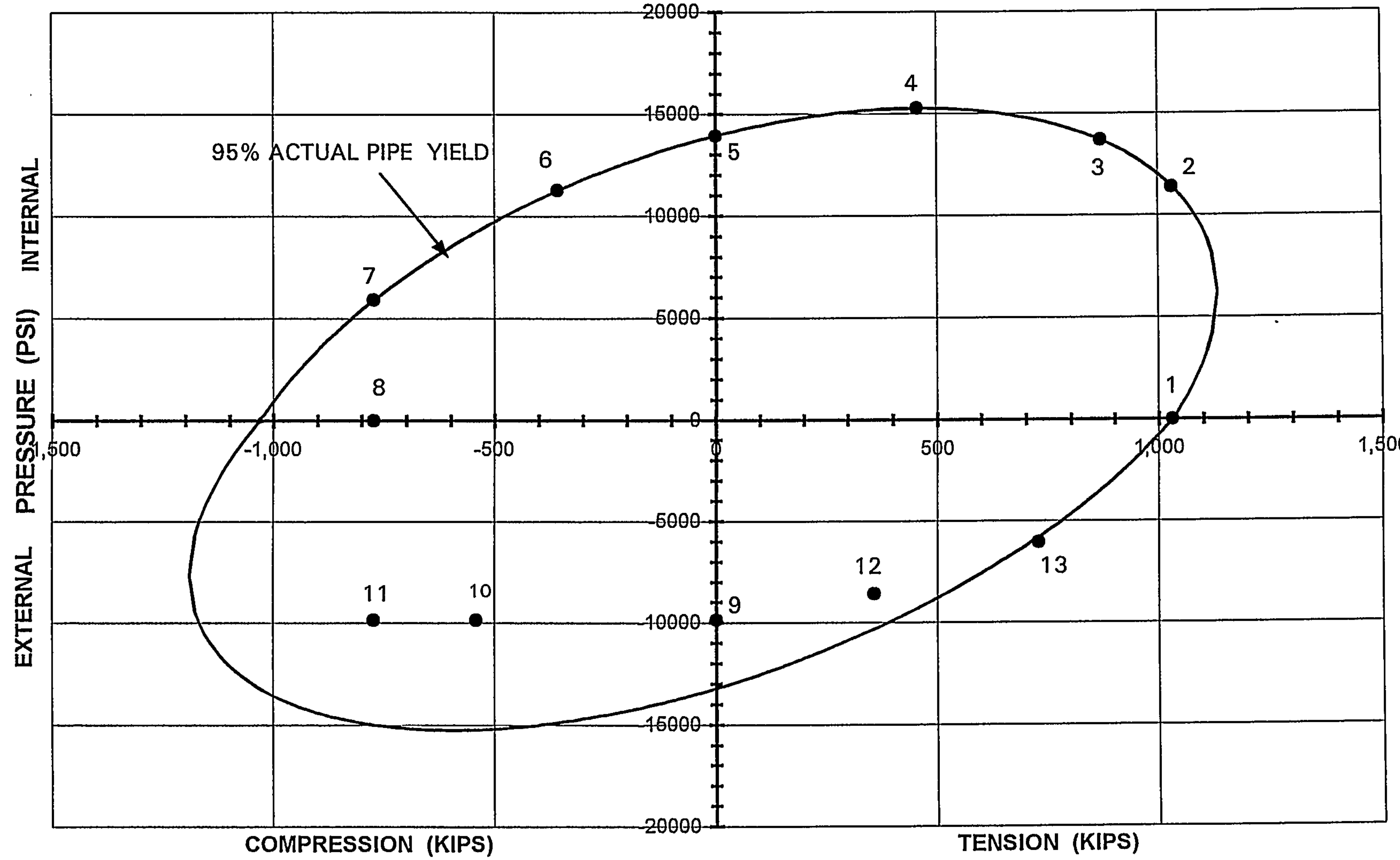


FIGURE 2
JOHN WATTS 7" PIPE COUPLED CONNECTION
ISO SERIES B TEST LOADS
SAMPLES #2 & #4

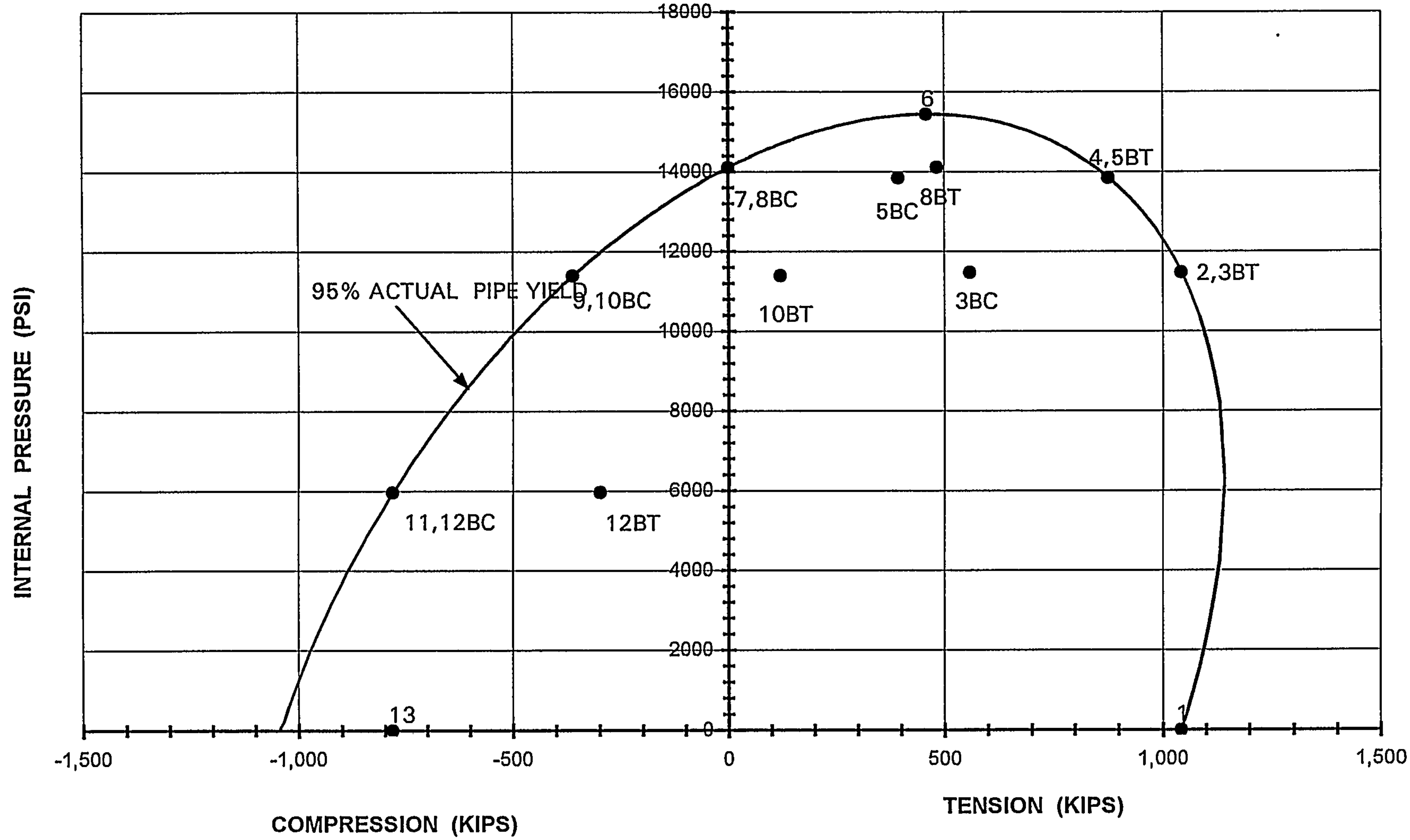


FIGURE 3
JOHN WATTS SAMPLES 1, 2, 3 & 4 LEAKS
COMPARED TO PIPE BODY PERFORMANCE

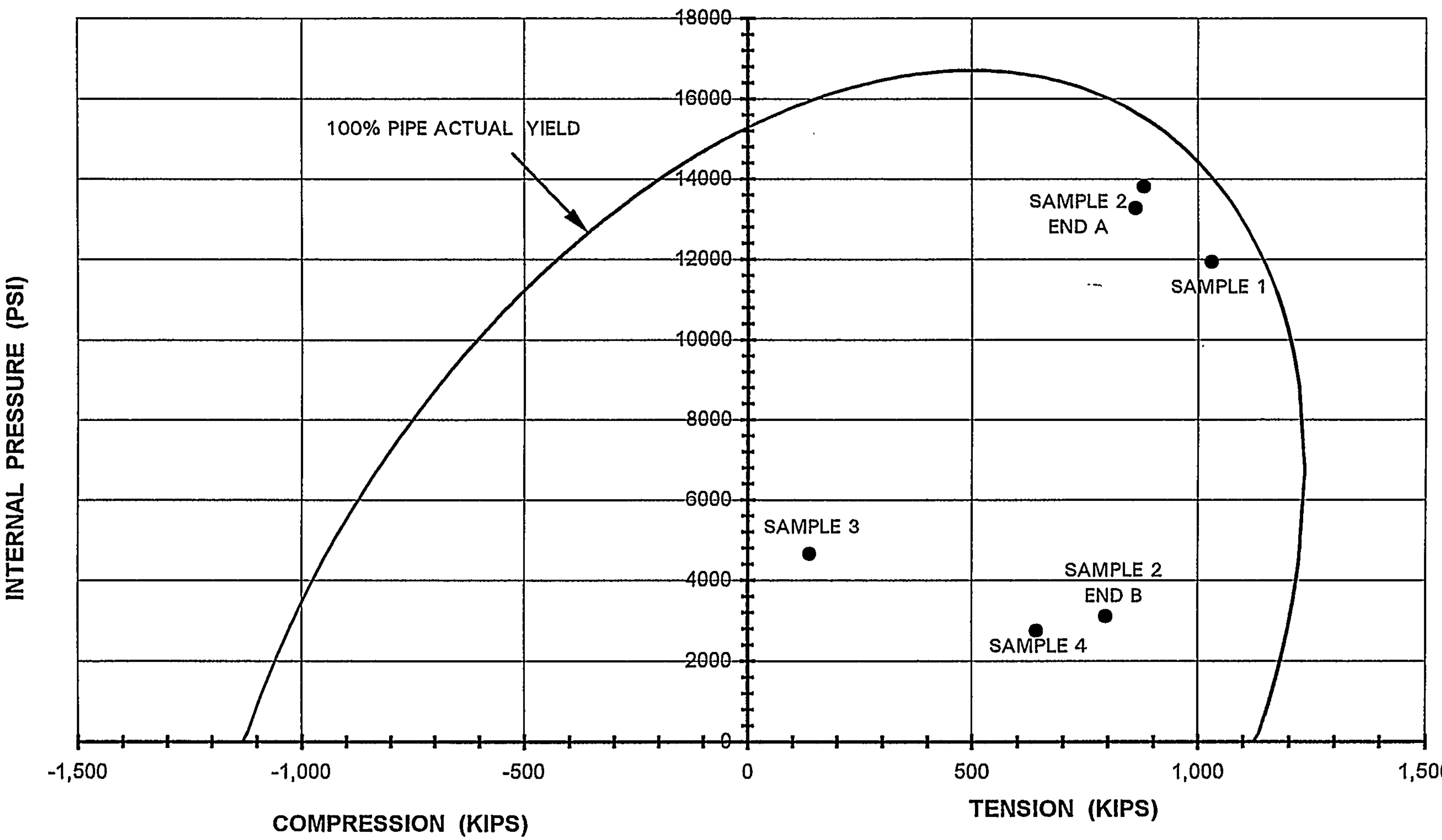
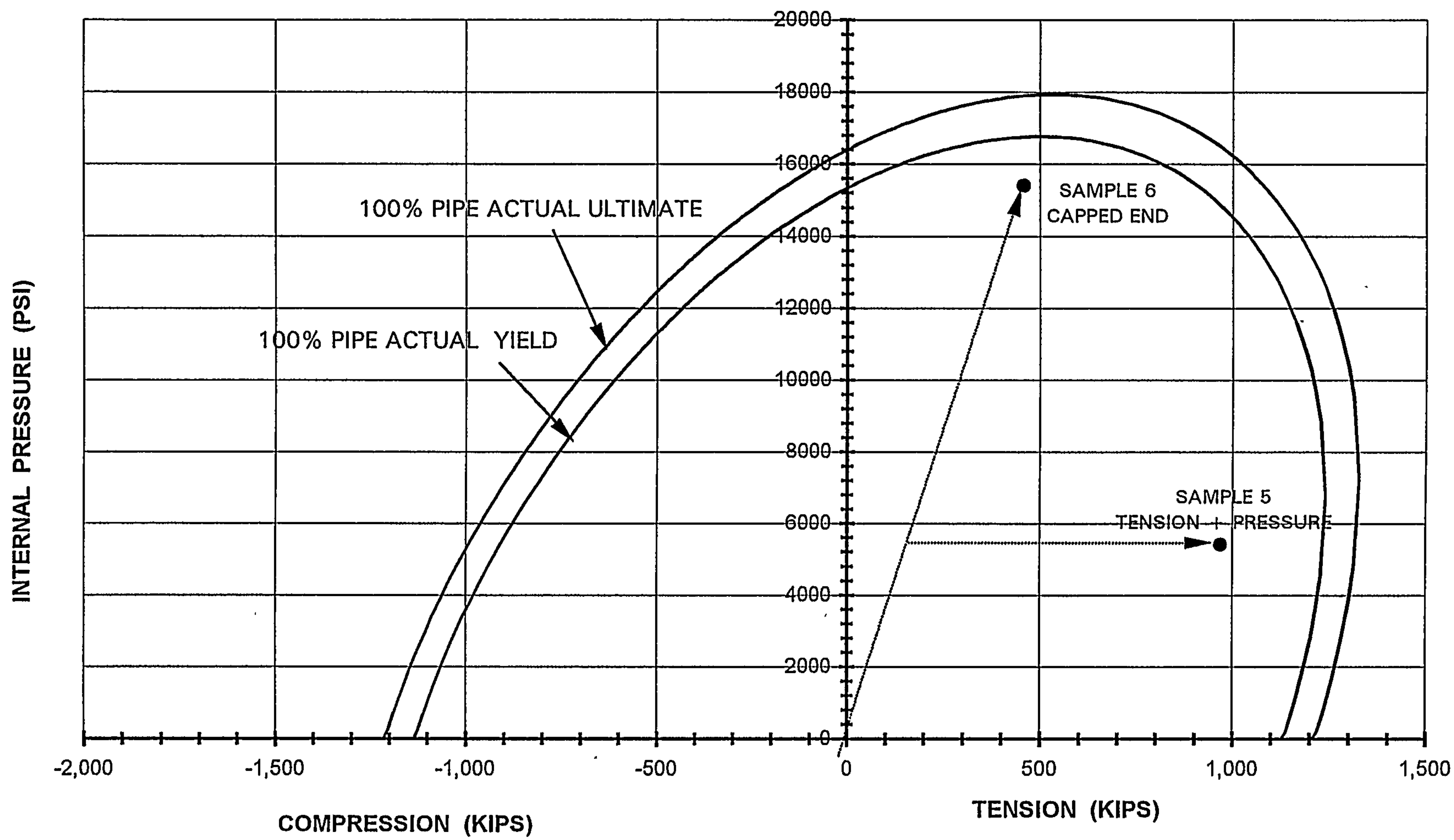


FIGURE 4
JOHN WATTS SAMPLES 5 & 6 FAILURES
COMPARED TO PIPE BODY PERFORMANCE



2.0 TEST SAMPLES & PREPARATION

2.1 PIPE SIZE

The pipe size selected for this project was as follows:

- 7" nominal outside diameter
- 32 pounds per foot weight (0.453" wall)
- 6.094" nominal inside diameter

This pipe size is commonly used as a production casing string in oil and gas wells and is often used for testing of casing connections. A slightly thicker pipe was needed for the coupling stock and 7" 41 pound per foot pipe was used for this.

2.2 PIPE MATERIAL

The pipe material grade was API 5CT grade P-110. Tensile tests were performed for the pipe purchased for this test and the reports are given in Appendix A. One 40' long joint of pipe was purchased for the 32 pound per foot pup samples. One 12' long piece of 41 pound per foot was purchased for the couplings. The two ends of the 7" 32 pound joint of pipe and one end of the 7" 41 pound pipe were material tested. The API specified and actual strengths were as follows:

- API Specified Yield Strength = 110,000 – 140,000 psi
- API Specified Ultimate Strength = 125,000 psi minimum
- Coupling Stock = 132,000 psi yield strength, 142,000 psi ultimate strength
- Pipe (pup) Stock = 124,000 psi yield strength, 131,000 psi ultimate strength
  = 121,000 psi yield strength, 131,000 psi ultimate strength

This gave an average pipe yield strength of 122,500 psi which was used to determine the test loads. Mr. Watts had requested that the coupling stock be 10 ksi stronger in yield than the pup stock. The materials purchased gave 9.5 ksi stronger which was acceptable.

The two pieces of pipe were cut into 30" and 18" long pieces as shown in Figure 5. This gave the required number of pin and box members.

2.3 MACHINED CONNECTIONS

Two thread forms were tested. The first samples had a square thread form and the thread dimensions and gaging procedure are given in Appendix B. The second thread form was a round thread and threading information is given in Appendix C. All machined pins and boxes were coated with zinc phosphate for added galling resistance which is a common OCTG practice. Both thread forms included an external shoulder.

A total of nine samples were machined – six coupled samples and 3 integral samples. The primary feature of the connection design that controlled sealability was thread interference. Therefore the samples were machined to have the minimum and maximum thread interference per the machine drawings and specifications. Table 2 gives the sample numbers and thread interferences. The coupled samples had three minimum interference samples and three maximum interference samples. The integral samples had two minimum and one maximum.

3.0 TEST PROCEDURES

3.1 ISO CD 13679 PROCEDURE

The Organization for International Standards (ISO) is currently developing a number of new documents for use in the petroleum and natural gas industry. ISO CD 13679 is a new test procedure that was recently completed by workgroup ISO/TC 67/SC5/WG2 and dated October 1, 1998. The title of the document is "**Petroleum and natural gas industries – Testing procedures for casing and tubing connections – Recommended practice**". The recommended practice is presently a Committee Draft (CD) and is going through the ISO acceptance process. Therefore, at this time it is not a finalized ISO document. However, the document is currently being used for tubing and casing connection testing.

Table 3 is a copy of Table 5-1 in ISO CD13679. It summarizes the requirements of the procedure. There are four Application Levels (AL), with AL IV being the most severe and AL I the least. There are three test series directed towards connection sealability identified as A, B and C, with the following requirements-

- Series A requires testing to 95% of the pipe yield strength using the von Mises yield criteria or 95% of the connection service rating (whichever is limiting). The Watts connection was rated equal to the pipe in tension, internal pressure and external pressure, with a limit of 75% pipe yield in compression. The connection must be tested in all four quadrants of axial load and pressure: Q1 = tension and internal pressure, Q2 = compression and internal pressure, Q3 = compression and external pressure and Q4 = tension and external pressure. Test temperature is ambient temperature.
- Series B also requires testing to 95% of the pipe yield or connection service rating (same as Series A, whichever is limiting). The connection must be tested in two quadrants of axial load and pressure: Q1 = tension and internal pressure and Q2 = compression and internal pressure. Bending equal to the lessor of (1)20 degrees/100 feet, (2)40% pipe body yield or (3)40% connection yield is required in

Application Level IV and optional in the other three levels. Test temperature is ambient temperature.

- Series C requires thermal cycling with tension and internal pressure to 80% the pipe body yield or 80% the connection service envelope, whichever is less. For application levels II and III the sequence of loads is as follows-

  5 mechanical cycles at ambient temperature

  5 thermal cycles at specified maximum and minimum temperatures

  5 mechanical cycles at maximum temperature

  5 thermal cycles at specified maximum and minimum temperatures

  5 mechanical cycles at ambient temperature

Figure 6 is a copy of Figure 5-1 of the ISO procedure. It shows the sequence of testing for AL IV. A total of eight samples is required (for this project four samples were tested rather than eight). Initial testing is for the makeup and breakout of the connections. Three types of make/break tests are specified, initial makeup (IMU), round robin galling (RRG) and make/break galling (MBG). Following makeup tests, the samples are baked to dry out the thread lubricant. Sealability test Series A, B and C are then performed. The last test is a Limit Load Test and the samples are taken to failure, where failure is connection leakage or structural failure, whichever occurs first.

The planned procedure for this project was: Makeup/breakout – IMU and MBG; sealability - Series A, Series B and Series C and Limit Load tests. Connection leakage was determined with the bubble method illustrated in Figure 7. This figure was taken from the ISO procedure and is commonly used for gas testing. External pressure tests use an external pressure chamber illustrated in Figure 8, which was also taken from ISO 13679, and used by SES.

3.2 WATTS TEST PROCEDURE

Samples 1 and 3 were tested to ISO Series A. The load steps are shown for sample 1 on a von Mises yield ellipse plot of the pipe body in Figure 9. Thirteen load steps were required and included tension, compression, internal pressure and external pressure, with load values at 95% of the actual pipe body yield strength. Samples 2 and 4 were tested to ISO Series B. Sample 2 load steps are shown in Figure 10. This procedure also contained 13 load steps and included tension, compression, internal pressure and bending. Similar plots and load steps are shown in Figure 11 for sample 3 and Figure 12 for sample 4. Due to earlier leaks, sample 4 was limited to 80% of the pipe body and tested to 95% of this value. The individual load steps and values are given along with the test logs for each sample in the appendices.

Samples 5 and 6 were tested to failure and not sealability gas tested. Sample 5 was tested with internal water pressure applied and held constant while tension was applied to failure. Sample 6 was capped end pressure tested (no frame load).

With the exception of the last gas test performed on sample 2 after remachining, all samples were baked at 350° for either 12 or 24 hours.

4.0 RESULTS OF MAKEUP/BREAKOUT TESTS

Make/break tests were performed in the SES laboratory. A Weatherford casing power tong was used. The tong is rated at 25,000 ft-lbs torque and pipe size range of 4-1/2" through 16" and is computer controlled. A plot of torque vs turn was made for each makeup and breakout. Both Shell 72732 API High Pressure Thread compound and Bestolife 2000 (environmentally friendly) thread compound were used in the makeups. The Shell compound is an API 5A2 product which has been the industry standard for 30 years. Specification 1 is the API cover page for this product. The manufacturer's specification sheet for BOL 2000 is given in Specification 2 and is an API 5A3 product.

4.1 FIRST TEST SERIES – SQUARE THREADS

The first set of samples contained the Watts square thread form. Makeup/ breakout tests were started and galling was immediately encountered. The results of this effort are given in Table 4. After five make/breaks, Mr. Watts stopped the test and decided to remachine the samples with a different thread form. Additional data including torque/turn plots are given in Appendix D.

4.2 SECOND TEST SERIES – ROUND THREADS

4.2.1 PRELIMIINARY RESULTS

The two spare coupled samples and one spare integral sample were used to determine the connection torque requirements. Pins 15, 17 and 24 plus boxes 4, 5, 8, 10 and 21 were used as preliminary samples. The results are summarized in Table 5 and the details are in Appendix E. Minimum recommended torque was determined from coupling 15. The two makeups that yielded the shoulder were used to establish maximum torque. From this data the recommended torque was determined to be

Coupled Connection:	6,400 ft-lbs. Minimum
	7,400 ft-lbs. Maximum
Integral Connection:	4,800 ft-lbs. Minimum
	5,400 ft-lbs. Maximum

4.2.2 TEST SAMPLE RESULTS

Makeup/breakout data for the four ISO samples and two failure samples is summarized in Table 6 with detailed data in Appendix F. The makeups used Bestolife 2000 thread lubricant because it is a popular industry environmentally friendly product. Some of the later makeups switched to the API compound due to concerns that the BOL 2000 compound contained too large solid particles and may have caused leaking that was experienced during the gas sealability tests.

Minor galling in the threads was experienced. Out of 14 breakouts after baking, two had galling. Connections 3B and 4A had galling on one or two threads that was repaired with a file and emry paper. Both of these breakouts occurred after baking of the connections at 350° for 12 or 24 hours to dry out the lubricant as required by ISO. No galling was found during the repeated make/breaks. Most of the breakout torques after baking were considerably higher than the makeup torque and other nonbaked breakouts.

The reference torque at which the counting of turns was started was 200 ft-lbs. Beyond this point, turns to full makeup ranged between 1.62 to 4.24. Makeup torque varied between 4,358 and 9,159 ft-lbs., with this highest value having shoulder engagement.

5.0 RESULTS OF SEALABILITY TESTS

Unfortunately, all of the four samples leaked during the ISO tests when subjected to internal gas pressure. The ISO load point and load values at which leakage occurred are tabulated below, in the order in which the samples were tested.

TABLE 7 - SUMMARY OF LEAK POINTS AND LOADS

SAMPLE NO.	ISO VME LOAD POINT	TENSION Kips	PRESSURE Psi	BENDING Deg/100 ft.	THREAD LUBRICANT
2A	4	860	13,260	6.7	BOL
1	2	1,029	11,390	0	BOL
2A	4	878	13,800	0.7	API After BOL makeup
2B	2	794	3,110	0.4	API After BOL makeup
4	1a	643	2,750	0.7	API After BOL makeup
3	1b	138	4,650	0	API After BOL makeup

All leaks were substantial and not small bubble leaks.

The leak points are compared to the pipe body performance in Figure 13. This shows that connections 2A and 1 were about 95% of the pipe body capacity. The other leaks were very low which indicates that something unusual may have occurred to the samples and that they could have been in an excessively deformed condition.

After reviewing the results, it was believed that several conditions may have contributed to the premature leaks-

- The BOL 2000 thread lubricant contains solid particles (mainly PTFE flakes) that are larger than the solid particles in API 5A2 compound. Possibly the large particles prevented tight thread contact necessary for gas leak tightness.
- The BOL 2000 lubricant may have caused or at least contributed to the yielding of the pin end during makeup. Pin inward permanent deformation was found in some pins subsequent to testing and breakout. Excessive yielding of the pin or box will contribute to poor thread contact and leakage.
- The connections were madeup to full or near full shoulder contact. This causes the end of the pin to be stressed near the yield strength. This along with the interference caused by the thread compound may cause excessive pin hoop stresses and yielding which in turn gives relatively loose thread contact. This behavior is particularly present when repeated makeup and breakout occurs.

In an effort to show that the above damaging conditions may have occurred, Mr. Watts remachined samples 1 and 2. When this was completed, time allowed only one sample to be retested and sample 2 was selected because it already had welded end caps whereas one cap was cut from sample 1. Mr. Watts also had 0.001" removed from the crests of the box and pin threads of sample 1. This was to allow the lubricant a place to migrate to as the thread flanks engaged and became tight during assembly. The sample was madeup with API lubricant and to a lesser thread interference (0.032" gap at the external shoulder compared to 0.0" to 0.0035" for previous assemblies) than previous makeups. Two loads were applied – (1) capped end gas pressure to 90% pipe body yield, 14,620 psi, and (2) tension to 90% pipe body yield, 1,026 kips, plus a low pressure of 1,000 psi to check gross sealability. The sample successfully held the load with no leaks. The two points are shown in Figure 14 on a 90% yield VME plot of the pipe body. This successful test indicates that the above damaging conditions likely did occur with the test samples. These conditions can be corrected and sealability improved.

6.0 RESULTS OF LIMIT LOAD TESTS

The failure loads are summarized in Table 8 below. The combined failure loads are plotted in Figure 15 along with the von Mises yield ellipse of the pipe body. Test logs and strip chart recordings are given in Appendix M for sample 5 and Appendix N for sample 6. Neither sample leaked before failure.

TABLE 8 – SAMPLES 5 AND 6 FAILURE LOADS

SAMPLE NO.	TENSION, KIPS	HYDROSTATIC PRESSURE, PSI	FAILURE MODE
5	458	15,400	Thread jumpout
6	968	5,400	Fracture in the pin threads

The joint strengths relative to the pipe body were determined from Figure 15 by scaling the failure points from the origin to the yield and ultimate strength curves, with values as follows:

- Sample 5 = 79% on yield and 73% on ultimate strength
- Sample 6 = 92% on yield and 86% on ultimate strength

WTA

SPECIFICATION 1

Bulletin on Thread Compounds for Casing, Tubing, and Line Pipe

API BULLETIN 5A2 (BUL 5A2)
SIXTH EDITION, MAY 31, 1988

American Petroleum Institute
1220 L Street, Northwest
Washington, DC 20005

BESTOLIFE CORPORATION

SPECIFICATION 2

SPECIFICATION SHEET

BESTOLIFE "2000"®

High-Pressure / High-Temperature Thread Compound for Casing, Tubing, and Line Pipe

COLOR:	Black - Copper
BASE GREASE:	Lithium
PENETRATION:	310-330 (unworked per ASTM D-217)
DENSITY:	10.2 #/gal
DROPPING POINT:	350°F/177°C (typ.)
FLASH POINT:	385°F/196°C (min.)
BRUSHABLE TO:	10°F/-12°C
SERVICE RATING:	600°F/316°C
TORQUE FACTOR:	0.90 (relative to API Modified)*

Bestolife "2000"® is the non-lead, non-zinc alternative to API Modified. Extensive controlled testing, including full-scale make and breaks and sustained gas pressure tests, has demonstrated that "2000"® will meet or exceed the listed performance objectives in API RP 5A3. The major solid components are a proprietary blend of nonmetallic materials that are inert to chemical attack, such as occurs in sour gas environments and with CO_2 injection, and stable to temperatures in excess of 600 °F. Bestolife "2000"® also addresses one of the major concerns in pipe yards and threading operations today: rejects due to pitting and corrosion. In a 700 hour salt fog spray test, "2000"® has demonstrated corrosion protection that exceeds the performance of the leading storage compound in the industry. The results of these tests show that Bestolife "2000"® is not only an excellent "running" compound but can also provide superior protection during long term storage (contact manufacturer for application requirements).

*The proper field torque for all API casing and tubing connections should be determined by following the procedures outlined in API RP 5C1: "Recommended Practice for Care and Use of Casing and Tubing".

A MATERIAL SAFETY DATA SHEET IS AVAILABLE FROM THE MANUFACTURER.
DO NOT USE ON OXYGEN LINES OR IN OXYGEN ENRICHED ATMOSPHERES.

Rev 11/9/98 MSDS 294G

Corporate Offices: 2777 Stemmons Freeway/Suite 1800/Dallas, Texas 75207
Telephone: (214) 631-8070; Fax: (214) 631-3047; http://www.bestolife.com

TABLE 2
JOHN WATTS TEST SAMPLES
NUMBERS AND INTERFERENCES

COUPLED SAMPLES

SAMPLE NO.	THEAD INTERENCE	BOX NO.	COUPLING NO. A - NO. - B	BOX NO.
1	MAX.	1	13	6
2	MAX.	2	14	3
3	MIN.	7	16	11
4	MIN.	9	18	12
M/B PREL.	MAX.	4	15	5
M/B PREL.	MIN.	8	17	10

INTEGRAL SAMPLES

SAMPLE NO.	THEAD INTERENCE	BOX NO.	PIN NO.
5	MAX.	19	22
6	MIN.	20	23
M/B PREL.	MIN.	21	24

TABLE 5-1
ISO 13679 TEST MATRIX SUMMARY

Application Level	Test Series and Specimen Numbers			Bake & Thermal Cycle Temperature	Test Pressure Medium
	A	B	C		
IV	4 Quadrants with Cycles At Ambient Temperature	Bending / Axial Load Internal Pressure At Ambient Temperature	Thermal Mechanical / Cycling 5 Mechanical 50 Thermal 5 Mechanical 5 Mechanical at Elevated Temperature 50 Thermal 5 Mechanical at Ambient Temperature	180 C	Gas
Total Specimens 8	Specimens 2,4,5,7	Specimens 1,3,6,8	Specimens 1,2,3,4		
	A	B*	C*		
III	4 Quadrants with Cycles At Ambient Temperature	Test Series B with Bending Optional At Ambient Temperature	Thermal Mechanical / Cycling 5 Mechanical 5 Thermal 5 Mechanical 5 Mechanical at Elevated Temperature 5 Thermal 5 Mechanical at Ambient Temperature	135 C	Gas
Total Specimens 6	Specimens 2,4,5	Specimens 1,3,6	Specimens 1,2,3,4		
		B*	C*		
II		Test Series B with Bending Optional At Ambient Temperature	Thermal Mechanical / Cycling 5 Mechanical 5 Thermal 5 Mechanical 5 Mechanical at Elevated Temperature 5 Thermal 5 Mechanical at Ambient Temperature	135 C	Gas
Total Specimens 4		Specimens 1,2,3,4	Specimens 1,2,3,4		
		B*			
I		Test Series B with Bending Optional At Ambient Temperature		Ambient	Liquid
Total Specimens 3		Specimens 1,2,3			

TABLE 3

TABLE 4
SQUARE THREAD SAMPLES MAKEUP/BREAKOUT SUMMARY
JOHN WATTS 7" FLUSH JOINT CONNECTION

PIN NO.	BOX NO.	MAKEUP NO.	LUBR. GRAMS	PLANNED TORQUE	SHOULDER		FULL MAKEUP		SPEED RPM	BREAKOUT TORQUE	REFURBISHING & GALLING OBSERVATIONS
					TORQUE	TURNS	TORQUE	TURNS			
15A	3	MU 1	API 63	4.2 turns	N/A	N/A	6,261	2.165	7	3,004	SLIGHT GALLING BACK OF BOX
											DREMEL REPAIR
		MU 2	API 54	3.7 turns	7,104	3.499	12,426	3.523	7	13,100	MORE SEVERE GALLING & REPAIR
		MU3	BOL 37	8500	5,394	2.632	9,575	2.633	7	8,820	MINOR GALLING
15B	4	MU1	API 41	8,500	6,812	2.791	8705.2.	2.789	7	7,737	MODERATE TO SEVERE GALL & REPAIR
16A	9	MU 1	API 40	6,000	4,726	2.459	7,229	2.459	7	7,929	SLIGHT GALLING

TABLE 5
ROUND THREAD SAMPLES - PRELIMINARY MAKEUP/BREAKOUT SUMMARY
JOHN WATTS 7" FLUSH JOINT CONNECTION

PIN NO.	BOX NO.	MAKEUP NO.	LUBR. GRAMS	PLANNE TORQUE	SHOULDER TORQUE	SHOULDER TURNS	FULL MAKEUP TORQU	FULL MAKEUP TURNS	SPEED RPM	BREAKOUT TORQUE	COMMENTS
15A	4	1	API-30	3TURNS	N/A	N/A	7,424	2.912	3.5	NONE	
		2	SAME	8400	N/A	N/A	8,522	0.027	2.5	8,780	0.002" Gap at shoulder
		3	API-26	8500	7,454	2.085	8,478	2.133	3.500	12,585	0.002" Gap at shoulder
		4	API-23	10,500	N/A	N/A	10,691	2.021	3.500	11,957	Less than 0.002" gap at shoulder
		5	API-25	12,500	5,201	1.983	11,628	2.185	3.500	NONE	Shoulder yielded
15B	5	1	BOL-21	10,000	5,646	2.914	9,013	3.004	3.500	8,145	Shoulder yielded
		2	BOL-18	7000	N/A	N/A	6,941	1.82	3.5	7,564	
		3	BOL-20	7000	N/A	N/A	6,975	2.097	3.5	7,855	
		4	BOL-21	7000	N/A	N/A	7,003	2.066	3.5	6,681	
		5	BOL-22	7000	N/A	N/A	7,028	2.093	3.5	7,569	
17A	8	1	BOL-20	7000	6,019	2.74	7,143	2.739	3.5	7,608	
		2	BOL022	7400	4,863	1.97	7,553	1.986	3.5	7,154	
		3	BOL-23	7400	4,724	1.827	7,648	1.843	3.5	7,400	
		4	SAME	7400	4,545	1.748	7,583	1.764	3.5	8,121	
		5	BOL-19	6400	5,619	2.009	6,665	2.015	3.5	NONE	
17B	10	1	BOL-20	7400	5,956	2.816	7,521	2.834	3.5	8,141	
		2	SAME	7400	5,650	1.814	7,476	1.826	3.5	8,027	
		3	SAME	7400	6,355	1.956	7,526	1.967	3.5	8,295	
		4	SAME	7400	6,300	2.001	7,473	2.001	3.5	8,403	Field repair 4th box inside thread
		5	BOL-25	6400	5,437	2.352	6,586	2.362	3.5	NONE	
24	21	1	BOL-26	3.75 turns	N/A	N/A	4,771	3.757	3.5	5,171	
		2	BOL-20	4800	N/A	N/A	4,717	2.24	3.5	4,682	
		3	BOL-21	4800	N/A	N/A	4,721	2.306	3.5	4,999	
		4	BOL-19	4800	N/A	N/A	4,752	2.107	3.5	5,053	
		5	BOL-20	4800	N/A	N/A	4,737	2.081	3.5	NONE	

ONLY GALLING WAS FOURTH BREAKOUT OF PIN 17B AND BOX 10.

TABLE 6
ROUND THREAD SAMPLES MAKEUP/BREAKOUT SUMMARY
JOHN WATTS 7" FLUSH JOINT CONNECTION

SAMPLE NO.	PIN NO.	BOX NO.	MAKEUP NO.	LUBR. GRAMS	SHOULDER		FULL MAKEUP		SPEED RPM	BREAKOUT TORQUE	COMMENTS
					TORQUE	TURNS	TORQUE	TURNS			
1A	13A	1	1	BOL-21	6,722	3.180	7,435	3.226	6	11,383 B	Gas tested - Leaked *
	REMACHINED										
1B	13B	6	1	B0L-21	6,783	3.216	7,430	4.235	6	8,128	
			2	B0L-23	6,613	2.358	7,670	2.373	6	7,754	
			3	B0L-21	6,048	2.064	7,657	2.092	6	6,910 B	Gas tested - Leaked *
	REMACHINED										
2A	14A	2	1	BOL-19	NONE	NONE	6,353	2.653	4	2,233 B	.0035" Shoulder gap. Leaked.
			2	API-38	3,282	1.75	6,946	1.797	5	5,906 B	Gas tested - Leaked
	REMACHINED										
			3	API-22	NONE	NONE	5,861	1.955	4	NONE	Gas tested - No Leak
2B	14B	3	1	BOL-20	NONE	NONE	6,333	3.017	4	3,125 B	.0025" Shoulder gap
			2	API-33	1,452	1.27	4,794	1.712	5	16,500 B	Shoulder yielded. Leaked
	REMACHINED										
			3	API-22	NONE	NONE	5,224	2.045	4	NONE	Gas tested - No Leak
3A	16A	7	1	B0L-19	5,777	2.488	7,570	2.521	6	23,741 B	No test, changed lubricant.
			2	API-23	4,175	1.647	5,024	1.669	4	20,937+ B	Gas tested - Leaked *
3B	16B	11	1	B0L-20	6,115	2.803	7,570	2.82	6	7,845	
			2	B0L-19	4,476	2.042	7,693	2.063	6	8,163	
			3	B0L-23	5,191	2.131	7,800	2.151	6	22,501 B	No test, changed lubricant.
			4	API-19	6,192	2.065	6,327	2.085	5	20,937+ B	Gas tested - Leaked. Pin & box
											galling on crest of 16th thread all around.

TABLE 6 Continued

SAMPLE NO.	PIN NO.	BOX NO.	MAKEUP NO.	LUBR. GRAMS	SHOULDER		FULL MAKEUP		SPEED RPM	BREAKOUT TORQUE	COMMENTS
					TORQUE	TURNS	TORQUE	TURNS			
4A	18A	9	1	BOL-25	4,741	3.118	6,499	3.15	4	20,425 B	No test, changed lubricant.
			2	API-19	3,984	1.629	4,358	1.662	5	17,762 B	Gas tested - Leaked. Pin 4th thread crest from pipe & 14th thread crest from end galled all around. Matching threads on box also galled all around.
4B	18B	12	1	BOL-23	5,699	2.728	6,510	2.745	4	14,906 B	No test, changed lubricant.
			2	API-20	3,963	1.558	9,159	1.622	5	20,353 B	Initial shoulder yielding.
5	22	19	1	BOL-19	NONE	NONE	5,441	3.57	4	6,014	
			2	BOL-19	NONE	NONE	5,348	2.261	4	5,869	
			3	BOL-18	NONE	NONE	5,338	2.008	4	NONE	Failed by jumpout.
6	23	20	1	BOL-19	NONE	NONE	4,713	3.452	4	NONE	Failed by box fracture.

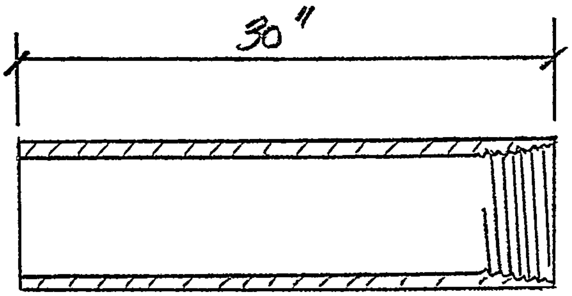
* INDICATES COUPLING WAS INSIDE COLLAPSE CHAMBER AND THEREFORE DO NOT KNOW WHICH END LEAKED.

B AFTER BREAKOUT TORQUE INDICATES CONNECTION HAD BEEN BAKED AT 350°F PRIOR TO BREAKOUT.

\+ INDICATES DUE TO TRANSDUCER LIMIT, BREAKOUTS 3A/BO#2 AND 3B/BO#4 WERE HIGHER THAN THE 20,937 FT-LBS REPORTED.

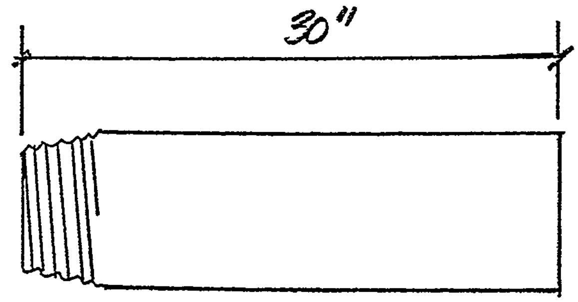
Client JW	Project No. 5806	Page No. of	By WTA	Date 4/14/99
Subject			Checked By	Date

JOHN WATTS SAMPLES — 4 COUPLED
2 INTEGRAL



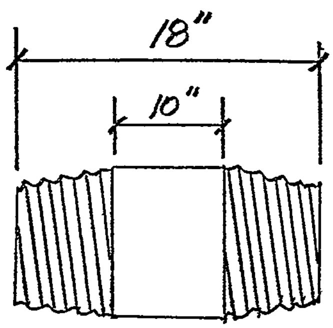
10 PUPS - BOX THREAD

7" 32# P-110



2 PUPS - PIN THREAD

7" 32# P-110

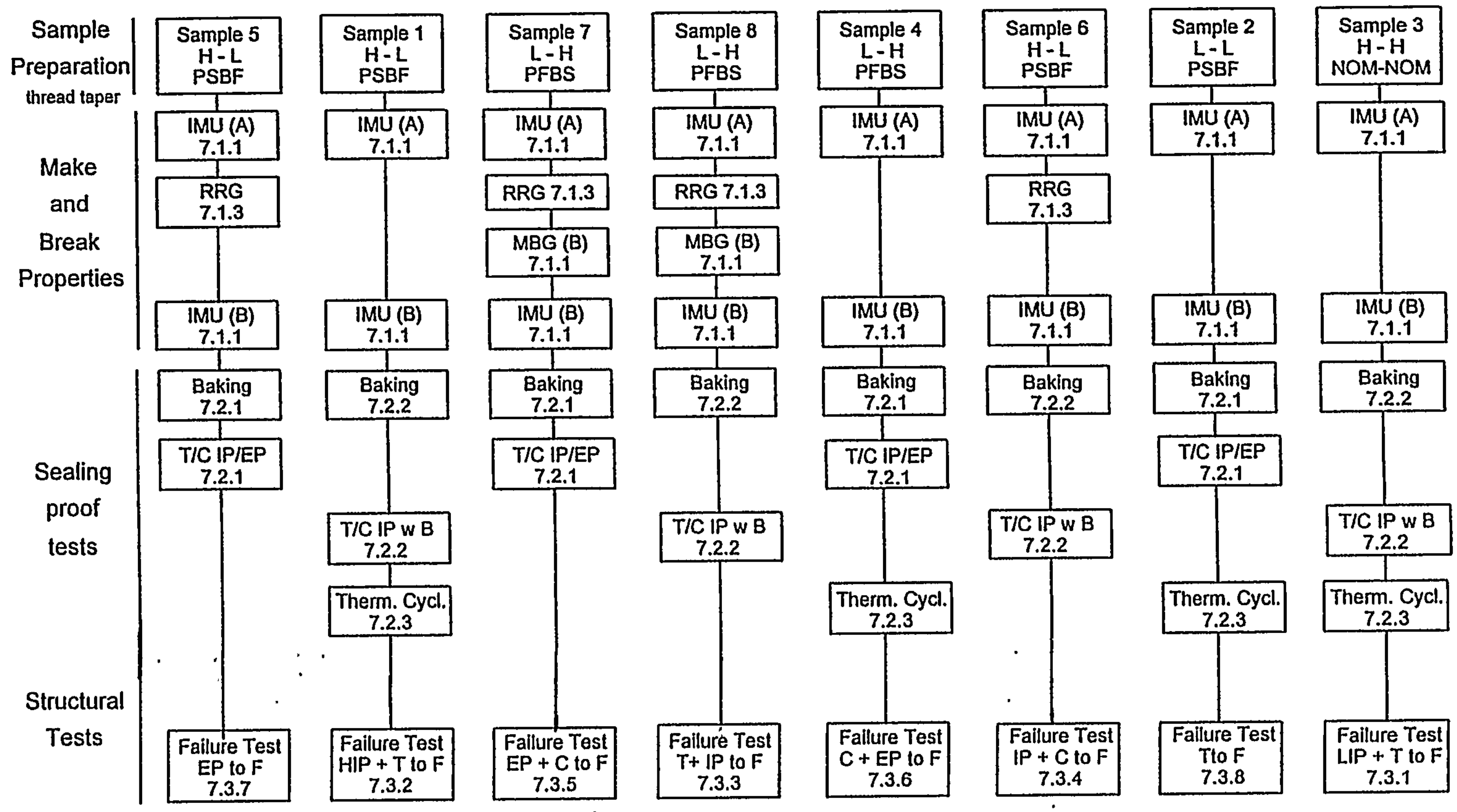


4 COUPLINGS

7" 35# (OR GREATER) P-110
YIELD STRENGTH MUST
BE AT LEAST 15 KSI
GREATER THAN PIPE YIELD.

FIGURE 5

$$D + 6\sqrt{Dt} = 7 + 6\sqrt{(7 \times .453)} = 18"$$



(A) = CONNECTION "A" END
(B) = CONNECTION "B" END

IMU: INITIAL MAKE UP
MBG: MAKE BREAK GALLING
RRG: ROUND ROBIN GALLING

Figure 5-1 (proposed)
ISO 13679 - Application level IV testing programme

FIGURE 6

FIGURE 7

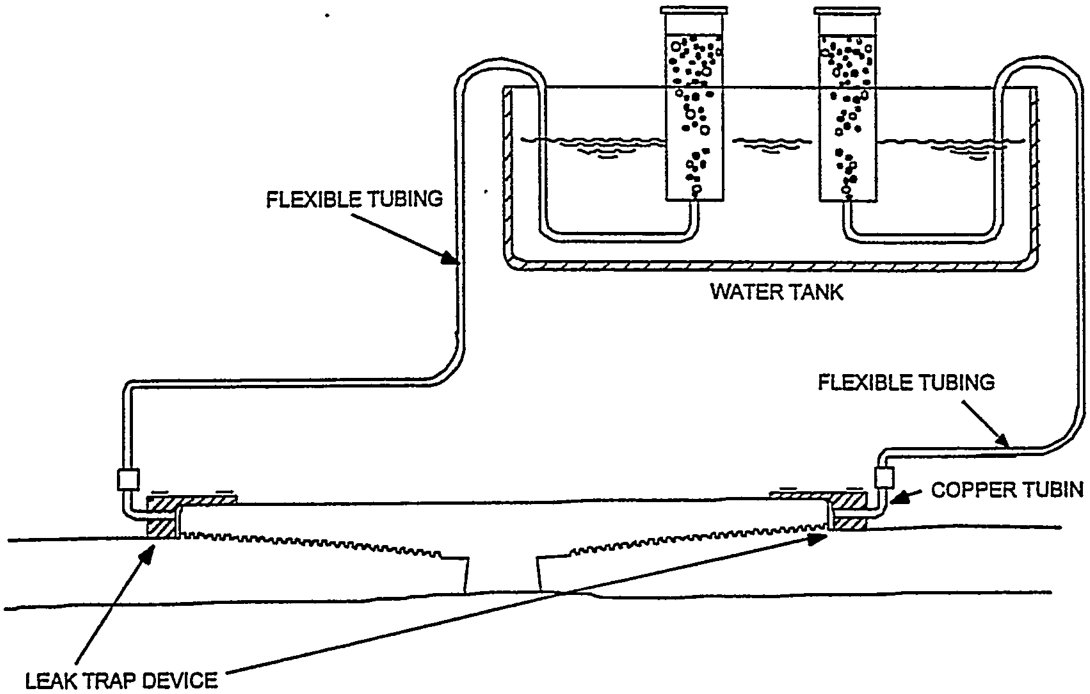


Figure 5-5
Leak detection by bubble method

5.5.5.1 System check

All leak detection systems shall be checked for leaks and sensitivity prior to a test program:

a) Check the system for leaks by applying .007 to .014 MPa (1-2 psi) air or nitrogen gas pressure. When the pressure stabilizes, close off the gas supply. Observe the pressure gauge for 2 min for stability. A drop in pressure indicates a system leak that must be located and fixed. Repeat this step until the gas pressure remains steady for a minimum 2 min hold period.

b) A sensitivity efficiency of the bubble leak dectection system shall be determined by introducing air and measuring the output air in the bubble tube. Inject the air in 1 cm^3 increments up to at least 10 cm^3. Determine the average relationship of output volume to input volume by plotting the data as shown in figure 6. The initial amount of input air required to start output air in the bubble tube (precharge) shall be recorded, but should not affect the calculated leak rate and is therefore not considered in this sensitivity efficiency. The sensitivity efficiency shall be at least 70 %. If less than 70 %, the system shall be reconfigured to increase sensitivity. This sensitivity efficiency shall be accounted for to normalize all observed leak rates and volumes during test execution according to the following equation:

$$LR_A = \frac{LR_o}{\eta_{LDS}}$$

where

LR_A = actual leak rate to be reported

LR_O = observed leak rate

η_{Lds} = leak detection system efficiency

FIGURE 8

bleed hole shall be at the opposite end of the specimen from the water inlet hole. The bleed hold shall be located in the end cap so as to allow all of the air to be removed from the inside of the specimen. The ports shall also be located in such a manner as to allow all of the water to be removed from the specimen for subsequent internal gas tests.

5.6.3 Setup for test series A

An example setup for test series A is shown in figure 5-8. During test series A, pressure loading changes from internal pressure to external pressure and back several times. To minimize test time, the tests may be conducted with an external pressure vessel in place for the entire series A. The external vessal may be used as part of the internal pressure leak detection system provided :

a) The objective of a leak detection sensitivity of 10-3 cc/sec is sought by all resonable means, recognizing that absolute demonstration may not be possible.

b) The external vessel is liquid filled and precharged.

c) To validate suspected leaks, additional tests should be performed to confirm the rate and source.

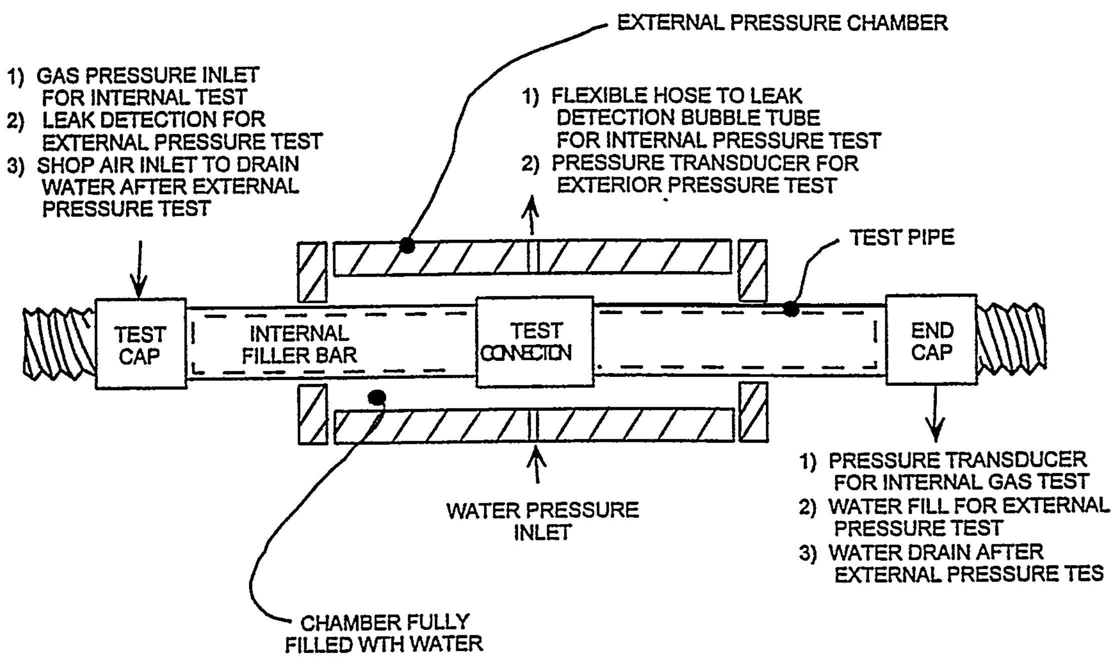


Figure 5-8

Example setup for test series A

5.6.4 Leak detection by water level

The leak detection system is similar to that shown in figure 5-9 and described in clause 5.5.5, except the entire system is full of water. One ported end cap is connected to the bottom end of a graduated cylinder with a flexible hose. The top end of the cylinder is open to the atmosphere to prevent a change in pressure due to varying water level inside the cylinder.

Before starting the external pressure test, the inside of the specimen is filled with water. At the same time, the flexible hose and approximately half of the graduated cylinder are also water filled. A coloring agent should be added to the water inside the cylinder for ease of viewing the water level.

FIGURE 9
JOHN WATTS 7" PIPE COUPLED CONNECTION
ISO SERIES A TEST LOADS
SAMPLE #1

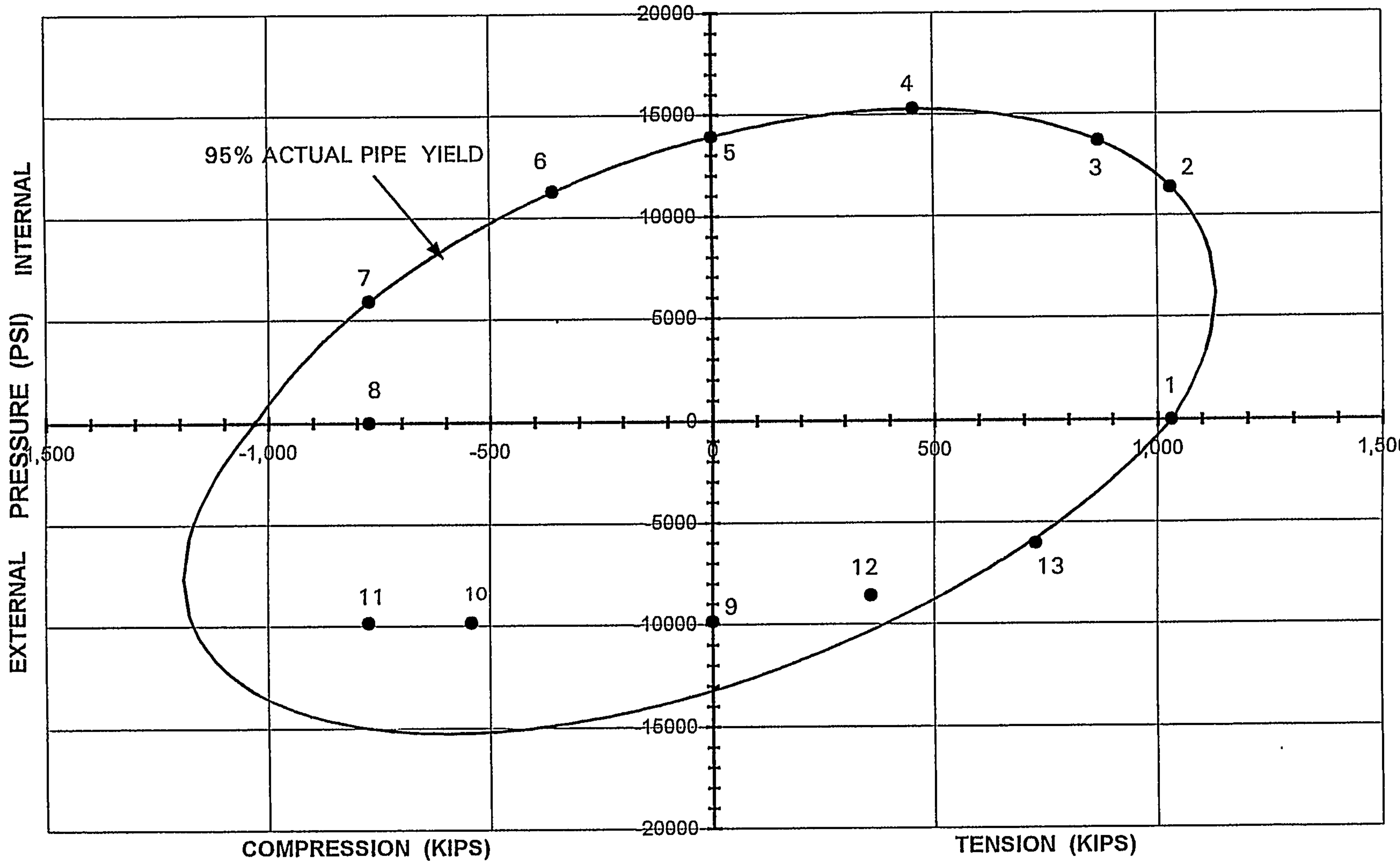


FIGURE 10
JOHN WATTS 7" PIPE COUPLED CONNECTION
ISO SERIES B TEST LOADS
SAMPLE #2

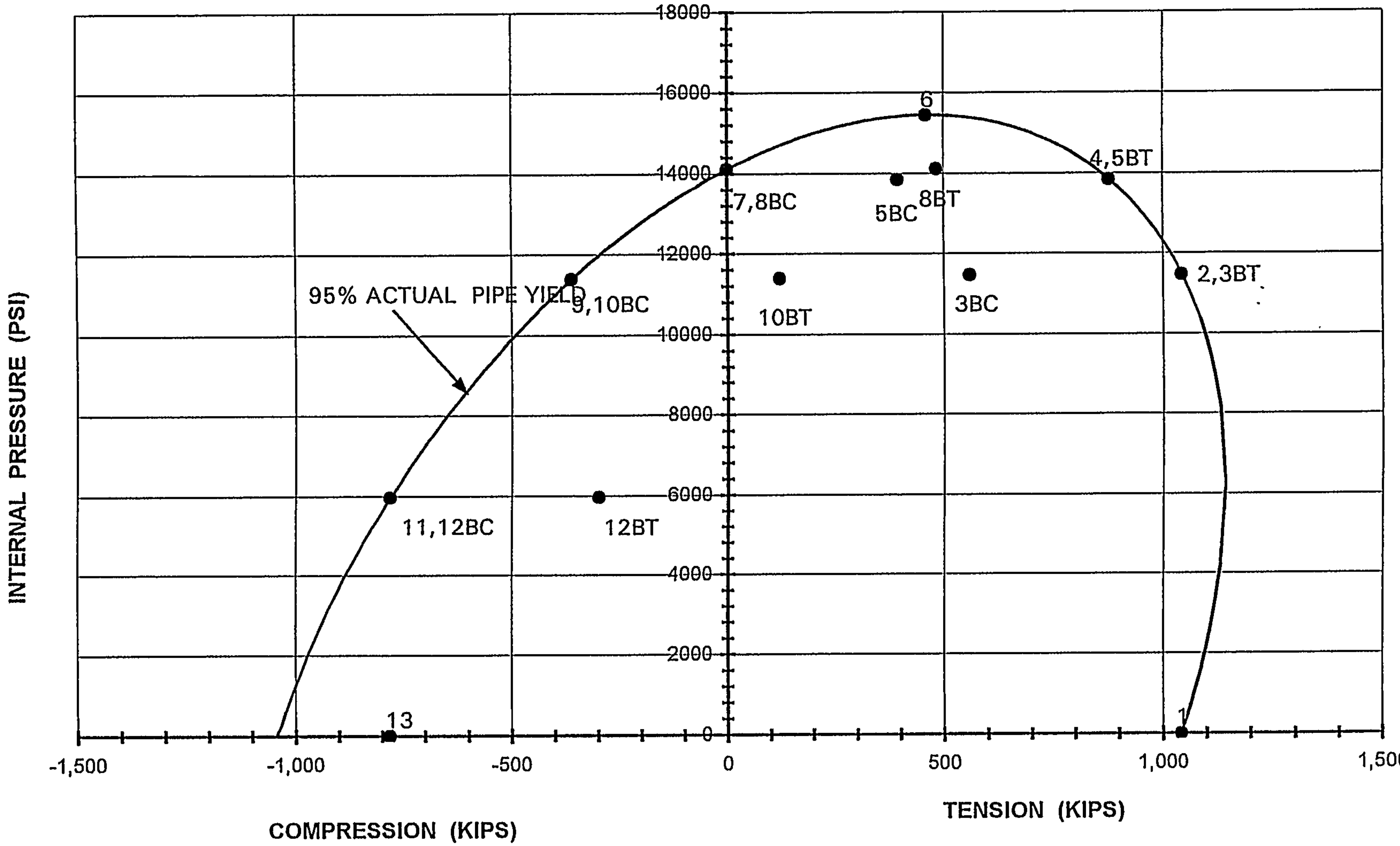


FIGURE 11
JOHN WATTS 7" PIPE COUPLED CONNECTION
ISO SERIES A TEST LOADS
SAMPLE #3

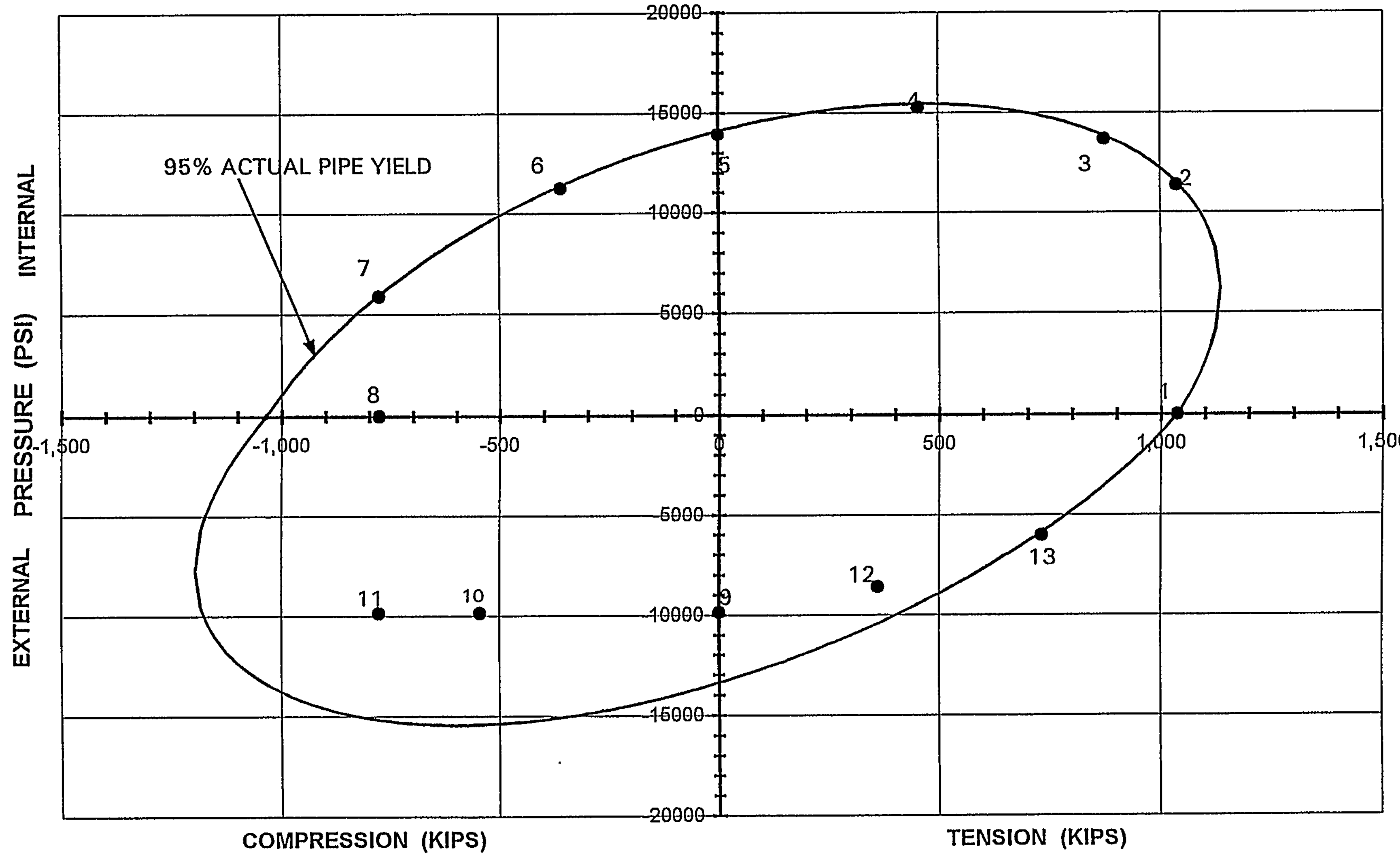


FIGURE 12
JOHN WATTS 7" PIPE COUPLED CONNECTION
ISO SERIES B TEST LOADS
SAMPLE #4

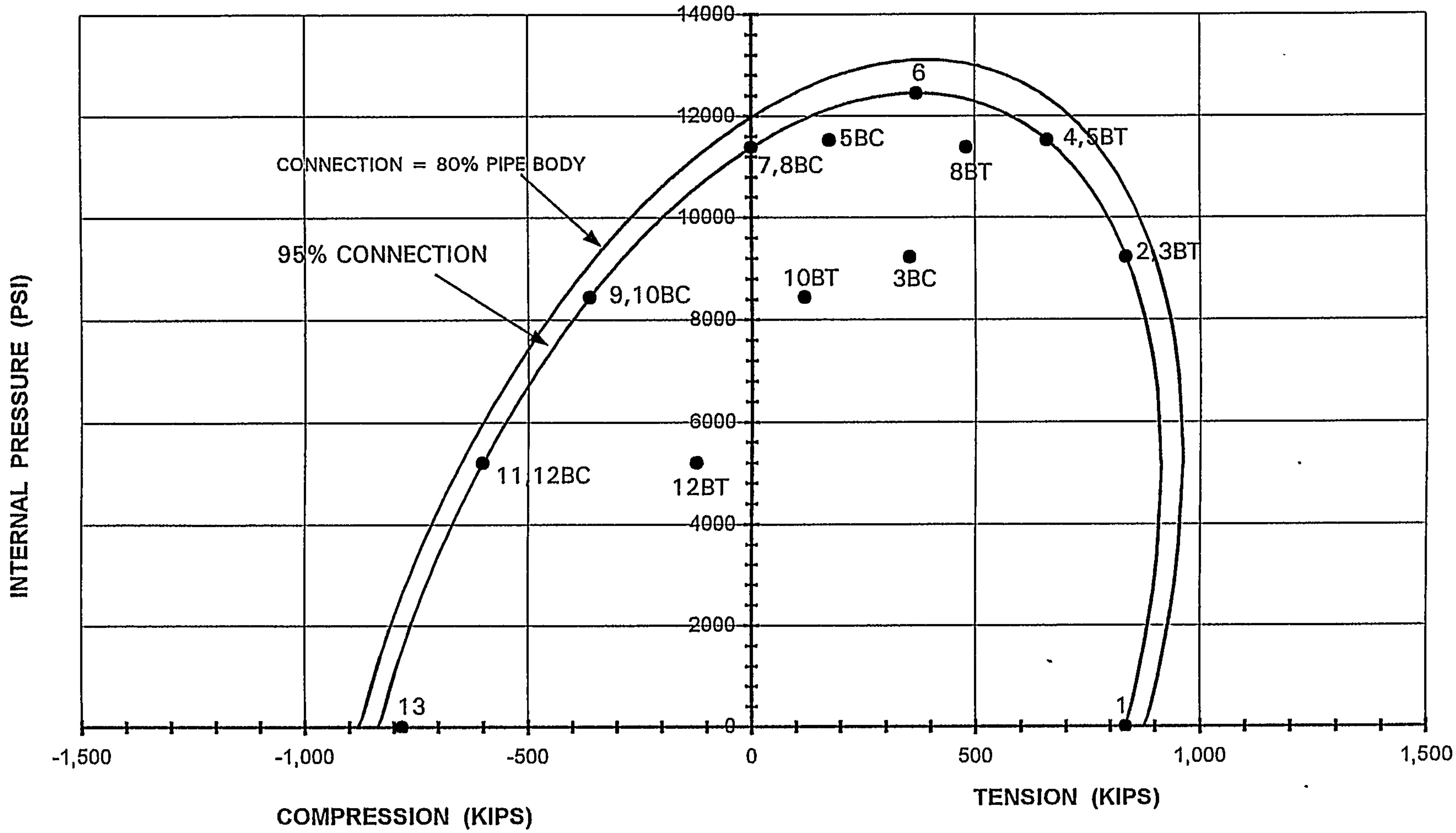


FIGURE 13
JOHN WATTS SAMPLES 1, 2, 3 & 4 LEAKS
COMPARED TO PIPE BODY PERFORMANCE

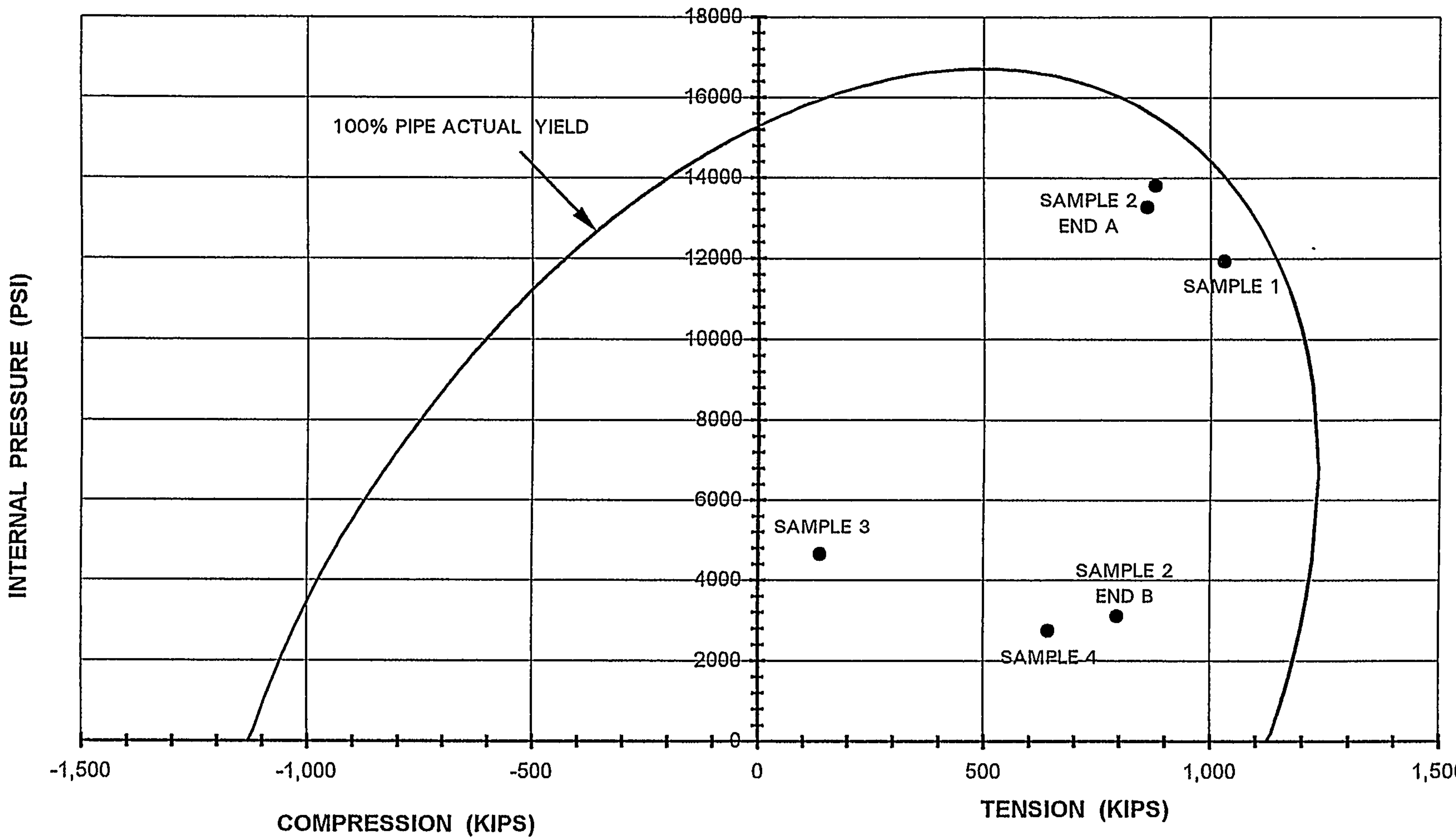


FIGURE 14
JOHN WATTS 7" PIPE COUPLED CONNECTION
SAMPLE #2 - LAST TEST AFTER REMACHINING

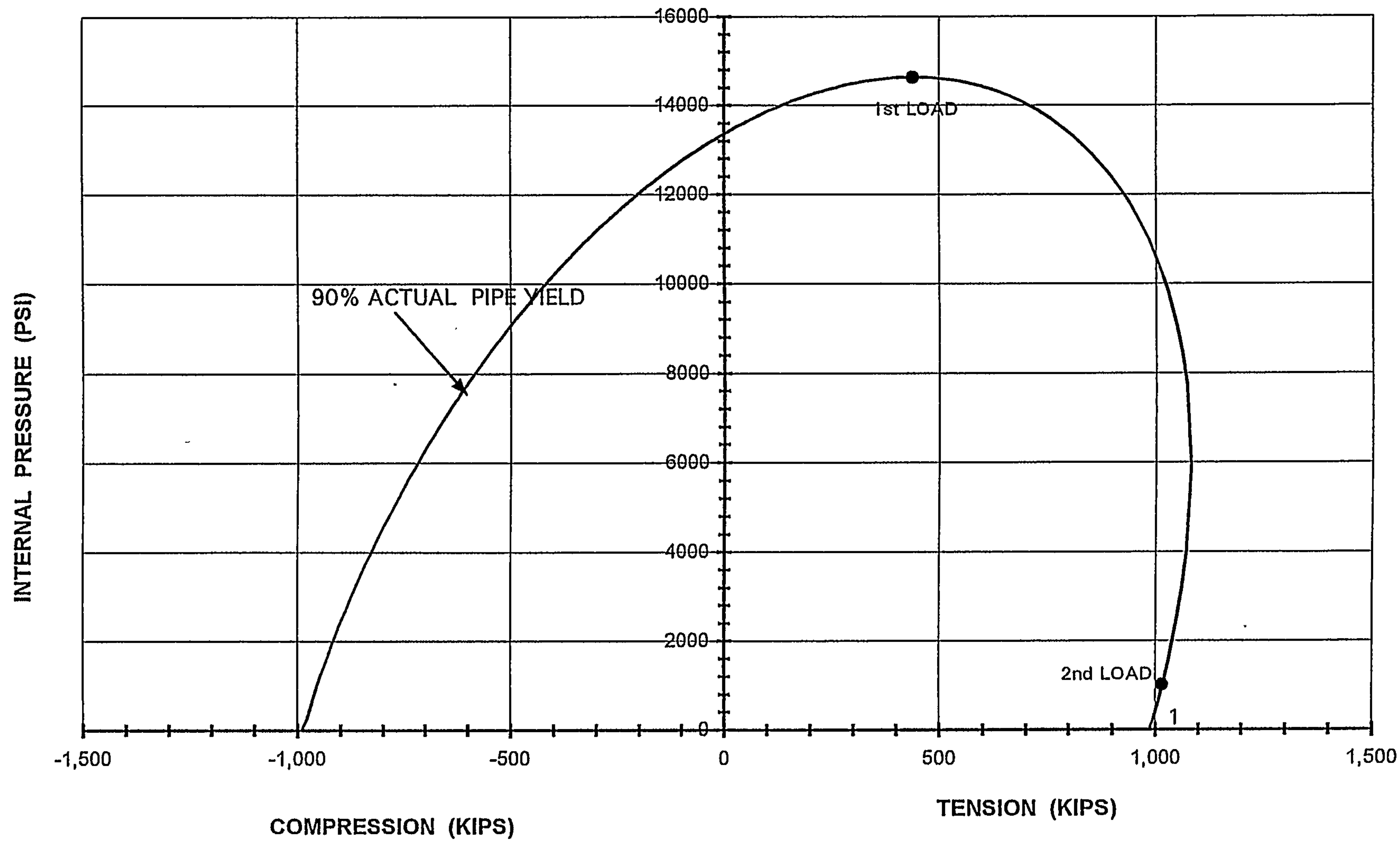
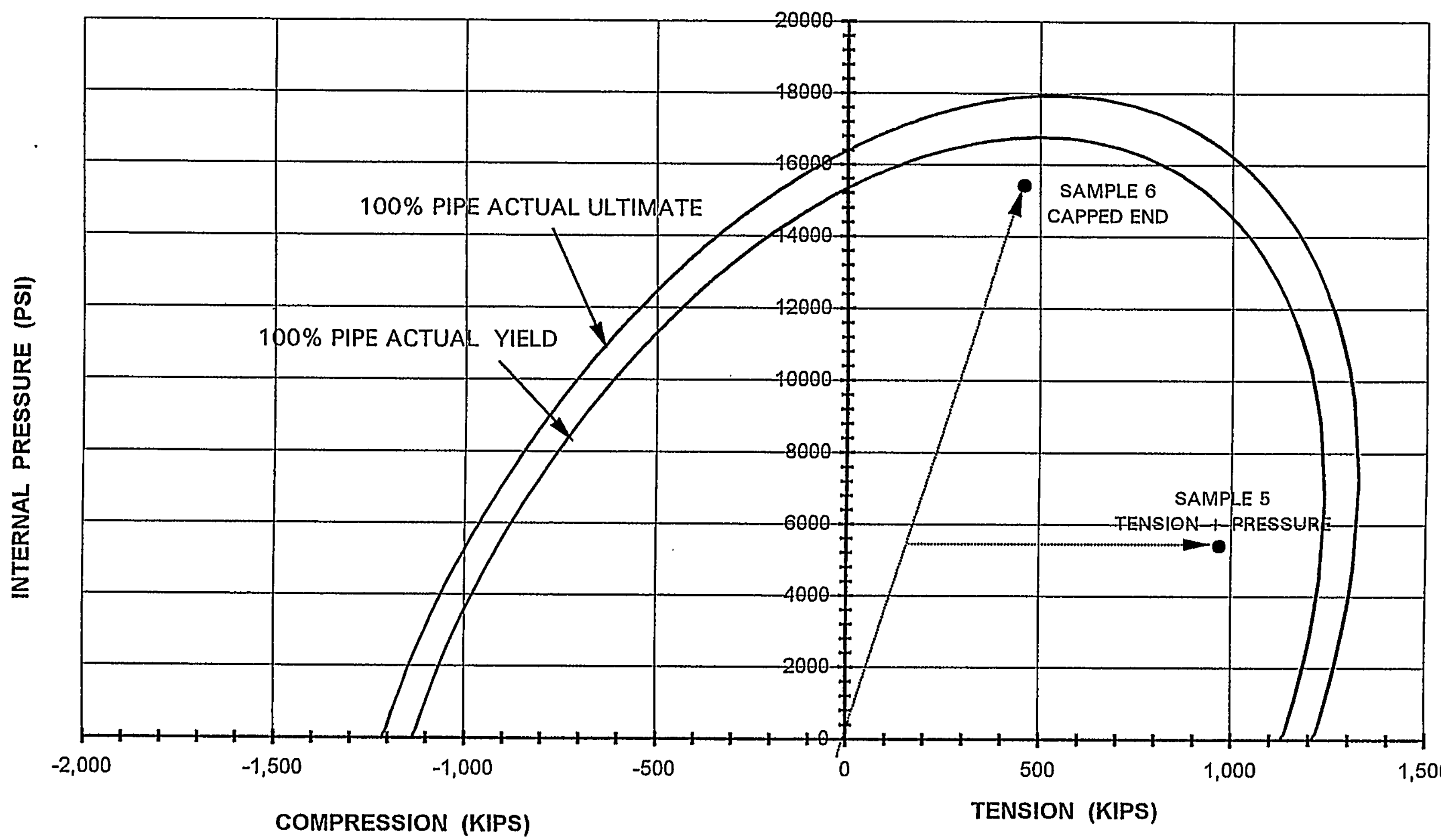


FIGURE 15
JOHN WATTS SAMPLES 5 & 6 FAILURES
COMPARED TO PIPE BODY PERFORMANCE



APPENDIX A
PIPE TENSILE TEST RESULTS

Bodycote MATERIALS TESTING

METAL TECHNOLOGY

Bodycote Omnitest Inc, Metallon Laboratory, 2524 Sutherland, Houston, Tx, 77023
Tel: 7139237761, Fax: 7139231679

Test Certificate

STRESS ENGINEERING SERVICES
13800 WESTFAIR EAST DR.
HOUSTON
TX

77041-1101

REF No M901946 : Issue 1
Ord No PN 5806 WTA

Date Tested 06/02/99
Date Reported 06/02/99

Attn: TOM ASBILL

Item - 7"O.D X 5 3/4"ID X 18 1/4" LONG PIPE
HEAT NO. U211843

Specification - API 5CT P-110

Tensile Test - ASTM E 8

	Dimensions [in]	Area [in^2]	GL [in]	0.60%YL [lbs]	0.60%YS [psi]	UTL [lbs]	UTS [psi]	%El	%RA	Comments
Longitudinal	0.9900x 0.5760	0.5702	2.00	75400.0	132000	80800.0	142000	28.5		Nil

Approved by James M. Mason

For and on authority of
Bodycote Omnitest Inc

Bodycote MATERIALS TESTING

METAL TECHNOLOGY

Bodycote Omnitest Inc, Metallon Laboratory, 2524 Sutherland, Houston, Tx, 77023
Tel: 7139237761, Fax: 7139231679

Test Certificate

STRESS ENGINEERING SERVICES
13800 WESTFAIR EAST DR.
HOUSTON
TX

77041-1101

REF No M901948 : Issue 1
Ord No PN 5806 WTA

Date Tested 06/02/99
Date Reported 06/02/99

Attn: TOM ASBILL

Item - 7"OD X 6 1/4" X 12" LONG
HEAT NO. SLN L30147 "A"

Specification - API 5CT P-110

Tensile Test - ASTM E 8

	Dimensions [in]	Area [in^2]	GL [in]	0.60%YL [lbs]	0.60%YS [psi]	UTL [lbs]	UTS [psi]	%El	%RA	Comments
Longitudinal	0.9900x 0.4170	0.4128	2.00	51000.0	124000	54140.0	131000	24.0		Nil

Approved by James M. Mason

For and on authority of
Bodycote Omnitest Inc

Bodycote MATERIALS TESTING
METAL TECHNOLOGY

Bodycote Omnitest Inc, Metallon Laboratory, 2524 Sutherland, Houston, Tx, 77023
Tel: 7139237761, Fax: 7139231679

Test Certificate

STRESS ENGINEERING SERVICES
13800 WESTFAIR EAST DR.
HOUSTON
TX

77041-1101

Attn: TOM ASBILL

REF No M901947 : Issue 1
Ord No PN 5806 WTA

Date Tested 06/02/99
Date Reported 06/02/99

Item - 7 [illegible]"OD X 6 1/4" X 11 3/4" LONG
HEAT NO. SLN L30147 "B"

Specification - API 5CT P-110

Tensile Test - ASTM E 8

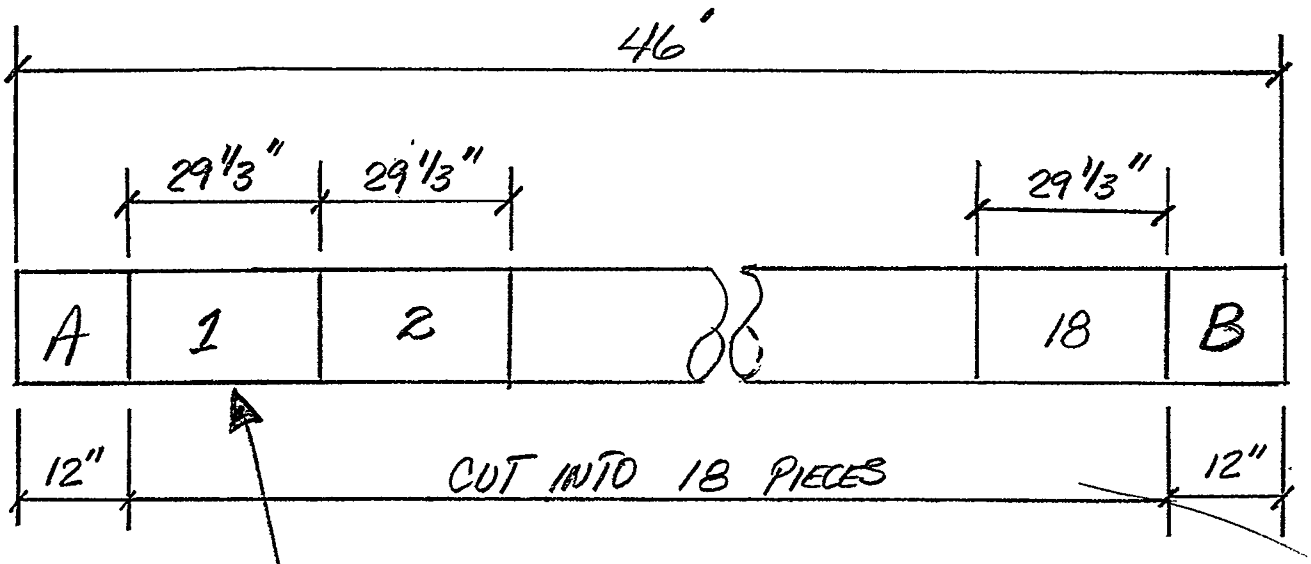
	Dimensions [in]	Area [in^2]	GL [in]	0.60%YL [lbs]	0.60%YS [psi]	UTL [lbs]	UTS [psi]	%El	%RA	Comments
Longitudinal	0.9900x 0.4450	0.4406	2.00	53300.0	121000	57500.0	131000	25.0		Nil

Approved by James M. Mason

For and on authority of
Bodycote Omnitest Inc

Client JW	Project No. 5806	Page No. of	By WTA	Date 5/25/99
Subject			Checked By	Date

7" 32# P-110 JOINT



NUMBER THE PIECES 1 → 18
STARTING AT END A

SHIP TO: CUSTOM THREADING
ATTN: KEN WEITZEL
5835 CHESWOOD
H/T 77087

BY FRIDAY, 5/28.

A division of USX Corporation

Post-it™ brand fax transmittal memo 7671

To JOHN PFEIFER	
Co.	Phone #
Dept.	Fax #
Fax #	

CONTRACT NO.

FAIRFIELD WORKS
P. O. BOX 599
FAIRFIELD, AL 35064

MAIL TO

THIS IS TO CERTIFY THAT THE PRODUCT DESCRIBED HEREIN WAS MFGD., SAMPLED, TESTED, AND OR INSPD. IN ACCORDANCE WITH THE SPECIFICATION AND FULFILLS REQUIREMENTS IN SUCH RESPECTS.

PREPARED BY THE OFFICE OF:
F.W. MOORE MGR Q.A.

DATE 08/22/91

PSAA PIPE ALLOY SMLS CASING TO THE REQUIREMENTS OF API SCT-90 3RD EDITION DTD 12/1/90 GRADE P-110 EXCEPT SIZE/END FINISH API MONOGRAM NOT PERMITTED UF PE SC CHARPY V-NOTCH TRANSVERSE IMPACT TESTS 20 FT/LBS AT +20 DEG F

INSP 04 MILL
CERTIFIED T/R

NO.	SIZE	WALL	SPECIFICATION & GRADE	MATL.	HEAT/LOT NO.	MIN. HYDRO PSI	YIELD STR. PSI	TENSILE STR. PSI	ELONG. % IN 2"	GAGE WIDTH IN.	FLAT
	7.0000	0.5900		SMLS	U21843		125,900	139,400	33.2	1.5	
					X05121		134,000	146,000	30.7	1.5	
					X25395		131,300	144,900	31.1	1.5	

END OF DATA

ALL TUBULAR PRODUCTS WERE ELECTROMAGNETICALLY N.D.E. INSPECTED FOR O.D. & I.D. DEFECTS BY FOERSTER DIVERTED FLUX EQUIPMENT IN ACCORDANCE WITH SEC. 10 A.P.I. SPECS 5A,5AC, & OR 5AX
PROD. WATER QUENCHED & TEMPERED AT DEG. TEMP. AND HELD FOR MIN.
CHARPY IMPACT TESTS FOR INFO ONLY

NO.	HEAT NO.	TYPE	C	MN	P	S	SI	CU	NI	CR	MO	SN	AL	N	V	B	TI	CB	CO
	U21843	HEAT	.29	.48	.009	.005	.22				.31				.03	.0023			
		PROD	.29	.48	.009	.006	.22				.31				.03	.0020			
		PROD	.30	.49	.009	.005	.22				.32				.03	.0029			
	X05121*	HEAT	.29	.50	.012	.009	.25				.03				.03	.0017			
	X25395	HEAT	.29	.40	.013	.004	.21				.31				.03	.0023			
		PROD	.29	.47	.012	.009	.22				.32				.03	.0019			
		PROD	.30	.47	.012	.005	.22				.32				.03	.0019			

END OF DATA

JF 5/99

0 - -3 CAZ L28274-64

NORTH STAR STEEL Seamless Tubular Products CERTIFIED TEST REPORT 04/30/98

HEAT NO.: SLN L30147	CUSTOMER :	NSSO MILL ORDER NO.: 0-0042236
PRODUCT DESCRIPTION : 7.000 OD 0.453 WALL 31.67LBS/FT PE R3	CUSTOMER ORDER NO.: 02-3495-D	NSSH W/O NO.: D31511
GRADE :API 5CT P-110/NSS-95	CUSTOMER SPEC.:	NSSH LOT NO.: 98-1807

CHANICAL PROPERTIES :

SPECIMEN CROSS SECTION			ACTUAL LOAD (KIPS)		STRENGTH (KSI)		ELONGATION		COMMENTS
DTH (IN)	THICK (IN)	AREA (SQIN)	YIELD	TENSILE	YIELD	TENSILE	GAGE LENGTH	% ELONG	
0.987	0.437	0.4330	51.0	55.9	117.8	129.1	2	23.0	

Chemical Analysis NS 57 MELTED AND MANUFACTURED IN THE USA

	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Sn	Cb	V	Al	Ca	B	Ti	N
HEAT	0.25	1.04	0.006	0.005	0.32	0.16	0.11	0.36	0.05	0.011	0.001	0.003	0.029	0.0030	0.0019	0.044	0.0072
PRODUCT #1	0.27	1.02	0.007	0.006	0.32	0.16	0.11	0.36	0.05	0.010	0.002	0.002	0.027	0.0031	0.0025	0.044	0.0085
PRODUCT #2	0.27	1.02	0.006	0.006	0.32	0.16	0.11	0.36	0.05	0.007	0.001	0.002	0.027	0.0031	0.0021	0.043	

)STATIC TEST (PSI) : 10000 DRIFT PLUG SIZE : 6.000 INCHES

SUPPLEMENTAL

EQUIREMENTS	YES	NO	REMARKS
IDNESS	X		269 BHN
\RPY IMPCT TS			
LAPSE TEST	X		TESTED
CROHARDNESS			
ATTENING TEST			
CE TEST			
MINY HARDEN			
AIN SIZE			
HER			

This material has been produced and tested in accordance with the requirements of applicable specifications unless otherwise listed below. We hereby certify that the above test results are representative of those contained in the records of the company. Any modification to this certification as provided by North Star Steel without the expressed written consent of North Star Steel negates the validity of this test report
North Star Steel is not responsible for the inability of this material to meet specific applications.

Signed: Date: 4/30/98
Approved:

SWORN AND SUBSCRIBED TO BEFORE ME
THIS_____________DAY__________

Notary Public

MY COMMISSION EXPIRES__________
THIS CERTIFICATE IS NOTORIZED ONLY WHEN REQUESTED

APPENDIX B
THREAD DATA FOR SQUARE THREAD FORM

GAGING PROCEDURE FOR JDW PIPE THREADS

1. The machine must have a repeatability within .0002 inch over the working stroke required.

2. Set-up gaging of first part, while still in chuck.
    2.1 Confirm that threading tip is at the machine centerline, is square and level.
    2.2 Check thread surface finish to be 32 RMS or less.
    2.3 Check thread diameter at GSET with MRP gage.
    2.4 Check thread diameter near other end and calculate the taper as an independent check.
    2.5 Check thread depth, lead and form with a 50:1 trace, or by plastic mould on a 50:1 comparator.
    2.6 Check thread depth with a dial gage, to match the depth per 1.5 above.
    2.7 Check thread form with a profile gage to confirm 1.5 above.
    2.8 Before production begins, the setup procedure must be observed and approved by Watts.

3. Production gaging.
    3.1 Check each thread diameter at GSET with MRP gage.
    3.2 Check each thread depth with a dial gage.
    3.3 Check each thread form with a profile gage.
    3.4 By sight and feel, confirm that the thread surface is 32 RMS or better.

------------------------ THREAD SURFACE FINISHING REQUIREMENTS -------------------------------

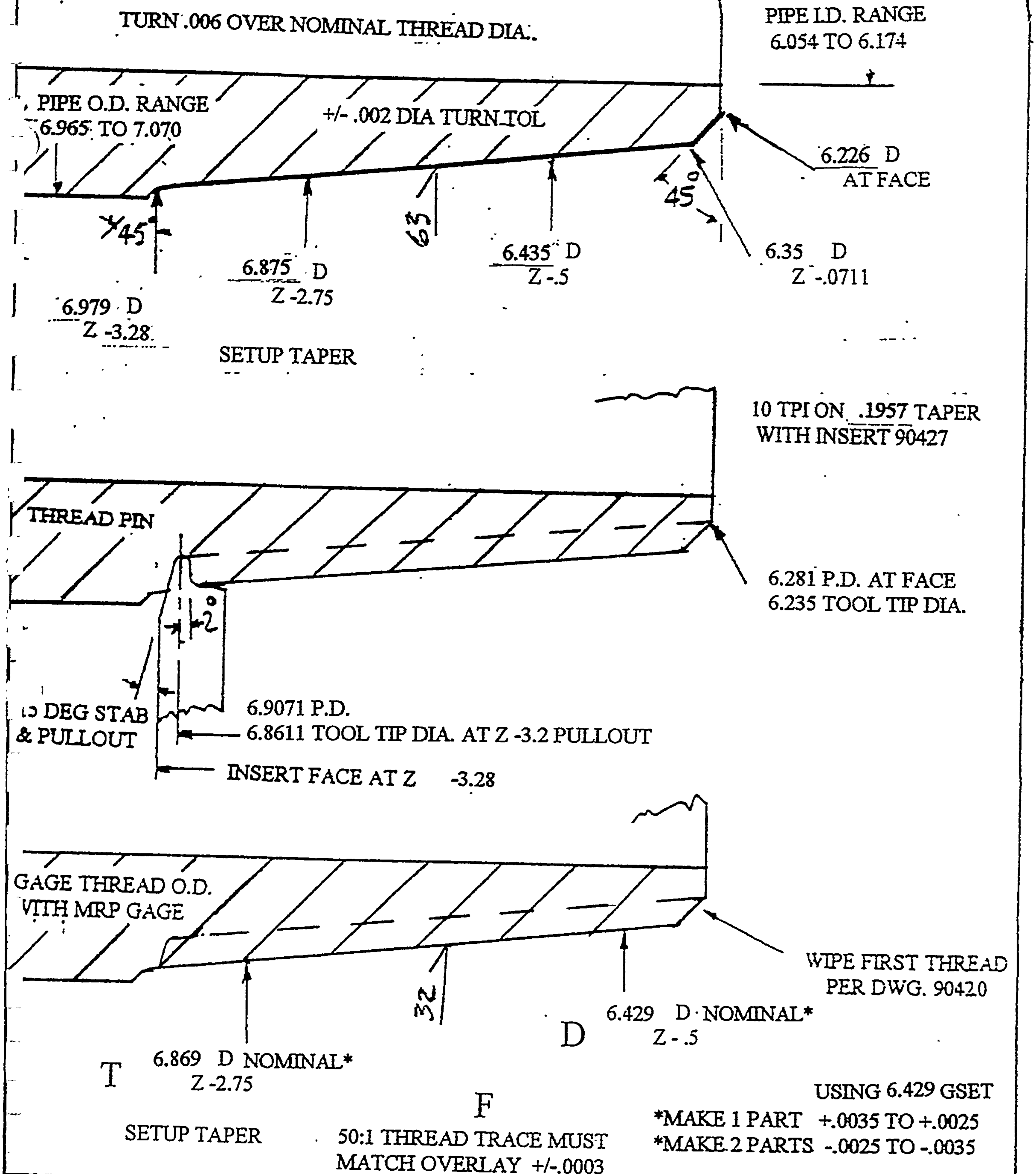
A. Surface finish as turned, shall be RMS or better.

B. Carbon and low alloy steel shall have a plain phosphate coating no more than 0.0002 inch thick, which is normally limited by aclean bath. No additives such as cadmium or zinc shall be in the bath.

C. CRA threads shall have all microscopic stringers removed.
    C.1 A wire brush softer than the CRA by at least 50 BHN may be used while the threads are being rotated in the machine.
    C.2 CRA threads may be blasted with Size 13 Glass Beads or smaller. The surface may take on Frosted Look but no base metal shall be removed and the surface FEEL shall not change.

D. No mechanical or chemical surface damage shall be allowed, and suitable protectors shall be installed by the manufacturer.

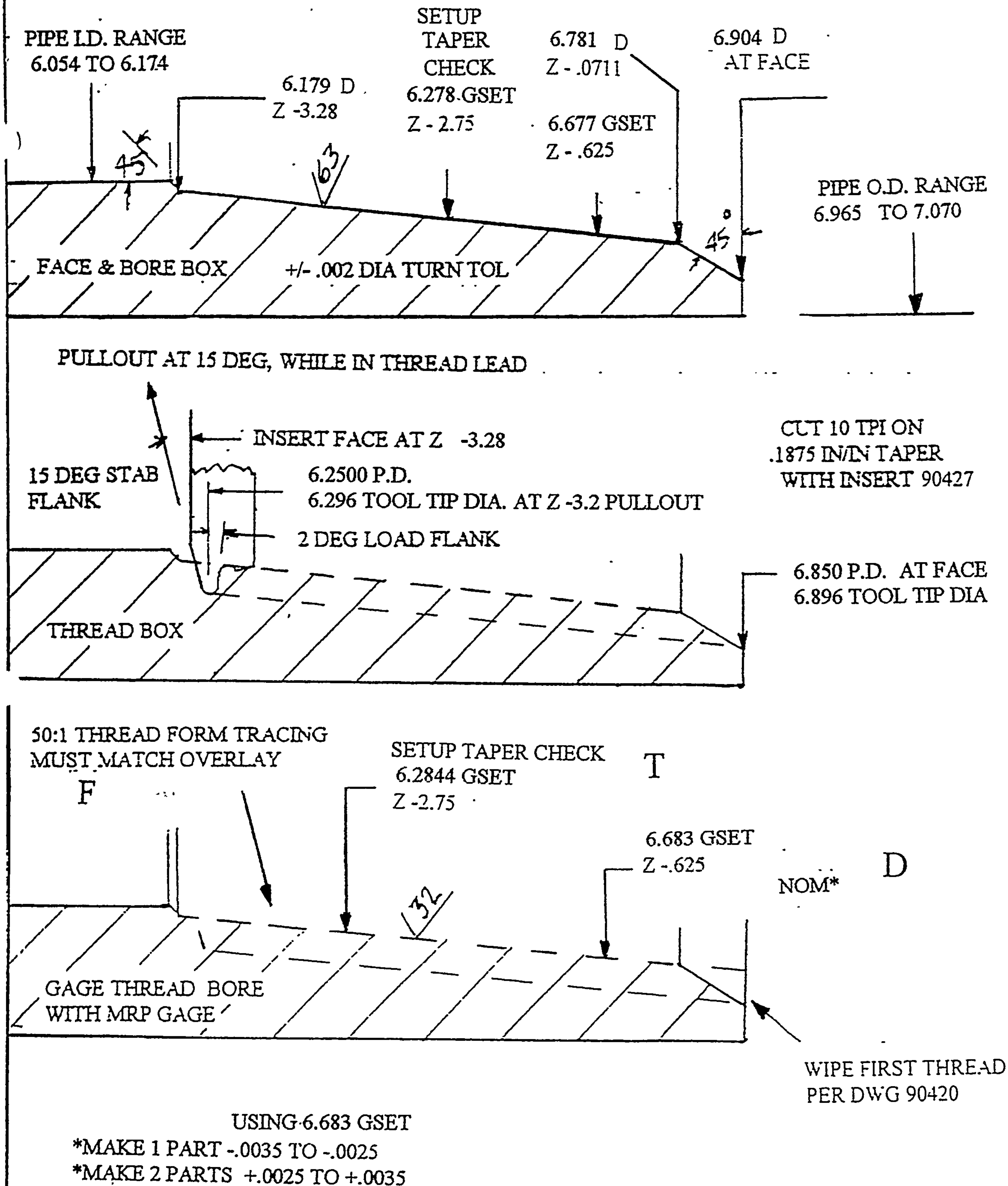
5-20-99



John D. Watts, P.E.
5054 Stanhope
Houston, Texas 77084-3033
Telephone (713) 463-2312 Fax (713) 463-2312

WATTS TYPE FJ80 PIN

DWN. BY:	DWG. NO. 90430
CKD. BY: JDW	REV. C



John D. Watts, P.E.
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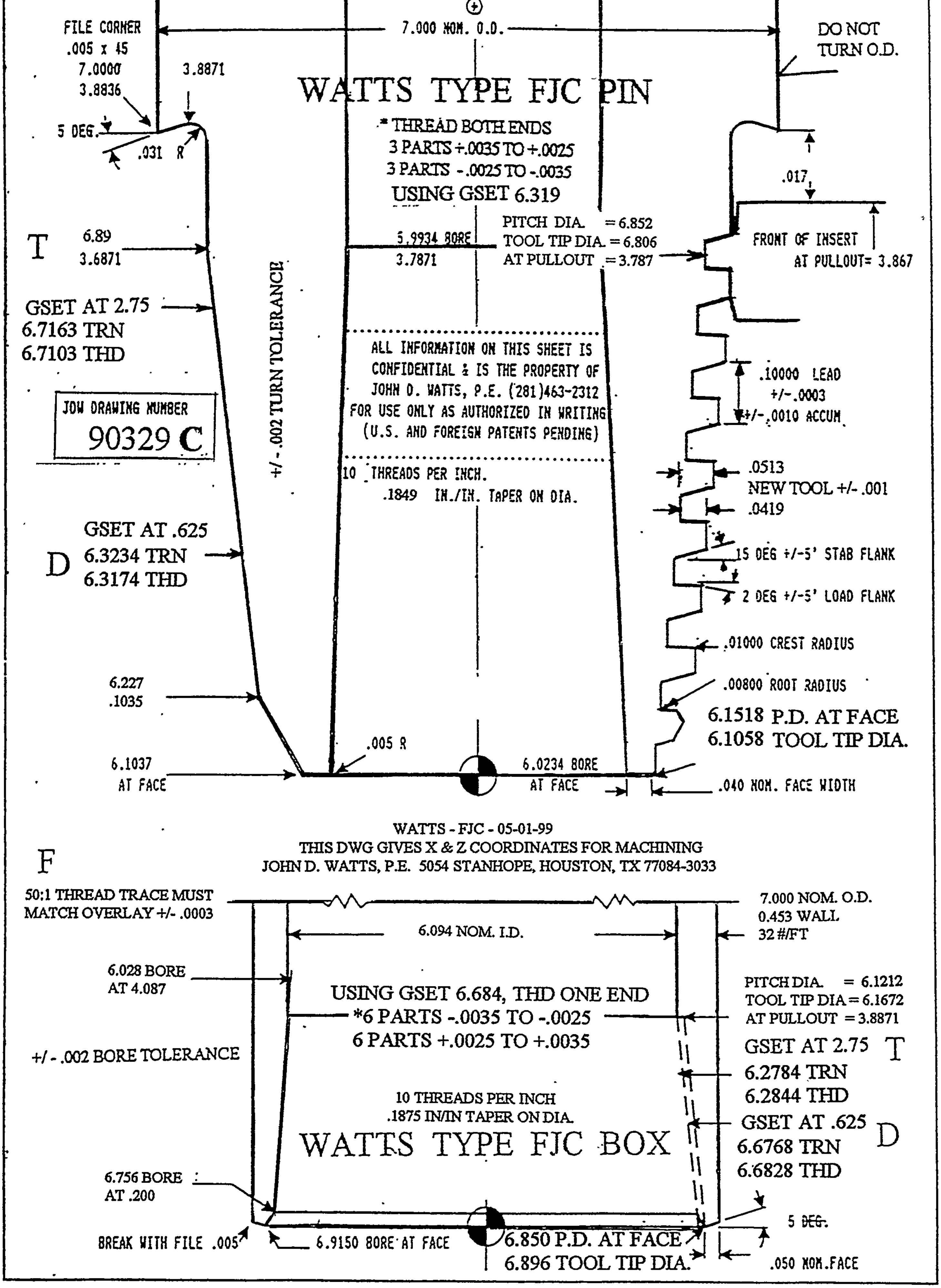
WATTS TYPE FJ80 BOX

DWN. BY:	DWG. NO. 90431	REV. C
CKD. BY: JDW		


WATTS TYPE FJC PIN
FILE CORNER .005 x 45
7.0000
3.8836
3.8871
5 DEG.
.031 R
7.000 NOM. O.D.
DO NOT TURN O.D.
* THREAD BOTH ENDS
3 PARTS +.0035 TO +.0025
3 PARTS -.0025 TO -.0035
USING GSET 6.319
.017
T
6.89
3.6871
5.9934 BORE
3.7871
PITCH DIA. = 6.852
TOOL TIP DIA. = 6.806
AT PULLOUT = 3.787
FRONT OF INSERT
AT PULLOUT= 3.867
GSET AT 2.75
6.7163 TRN
6.7103 THD
+/- .002 TURN TOLERANCE
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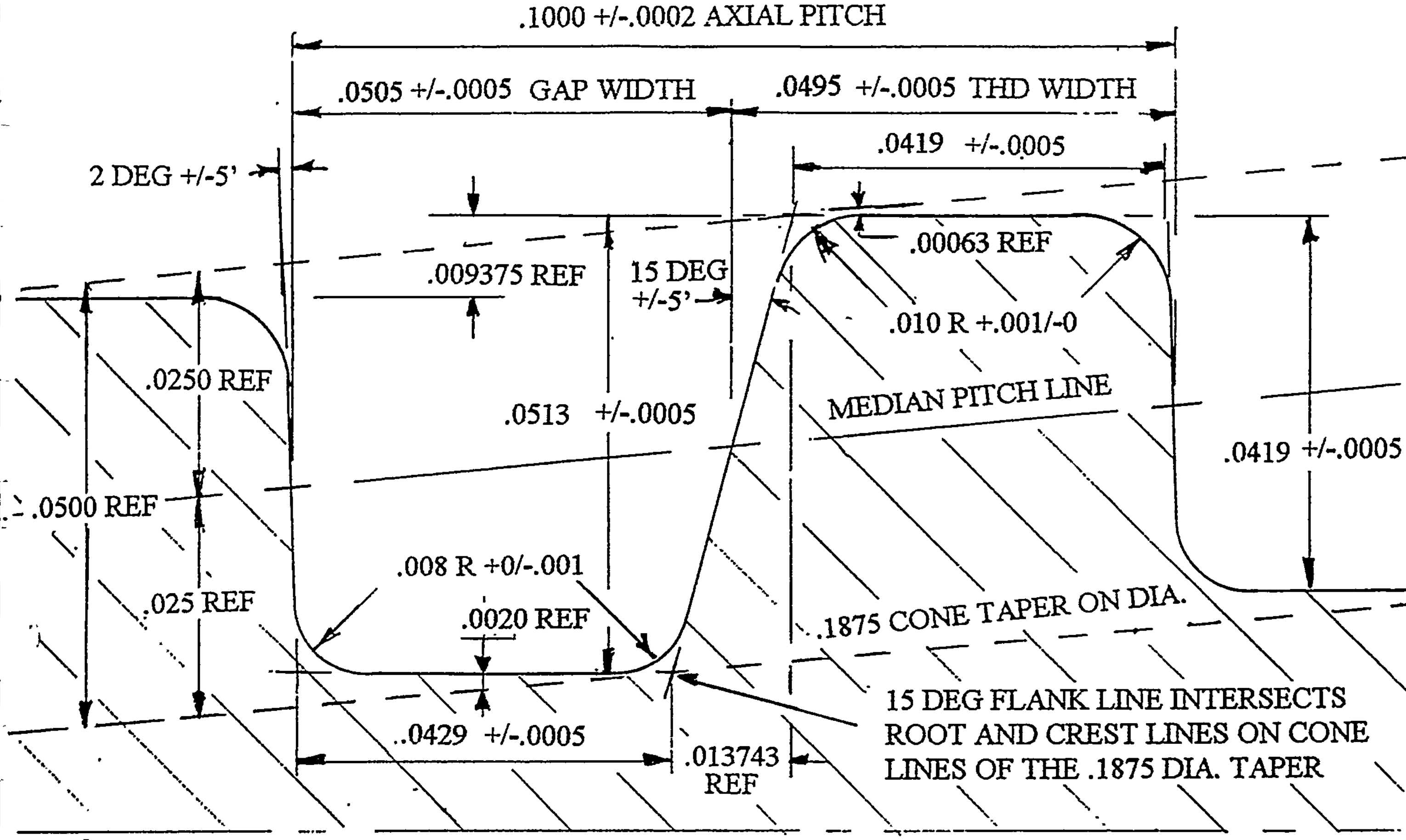
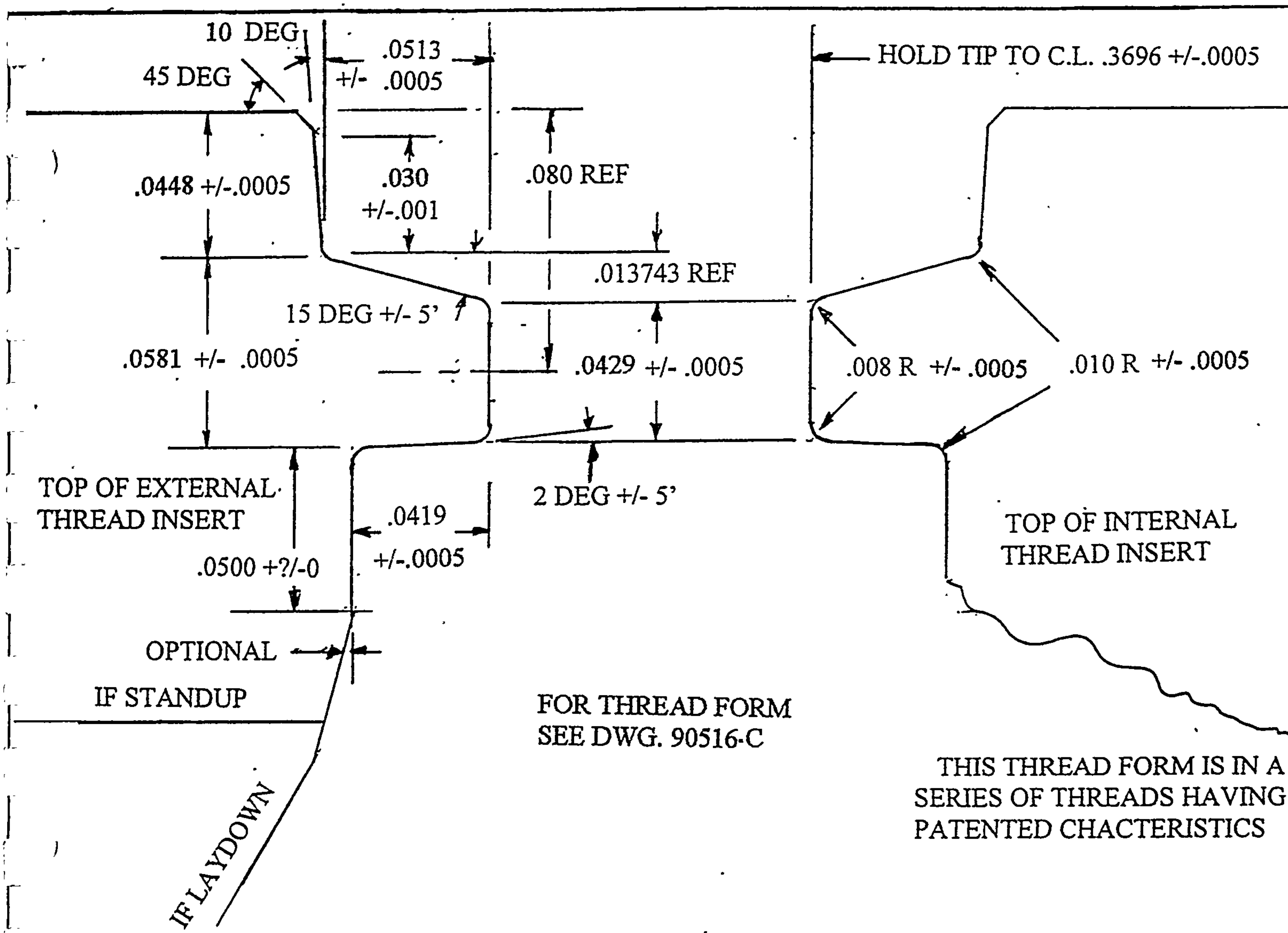
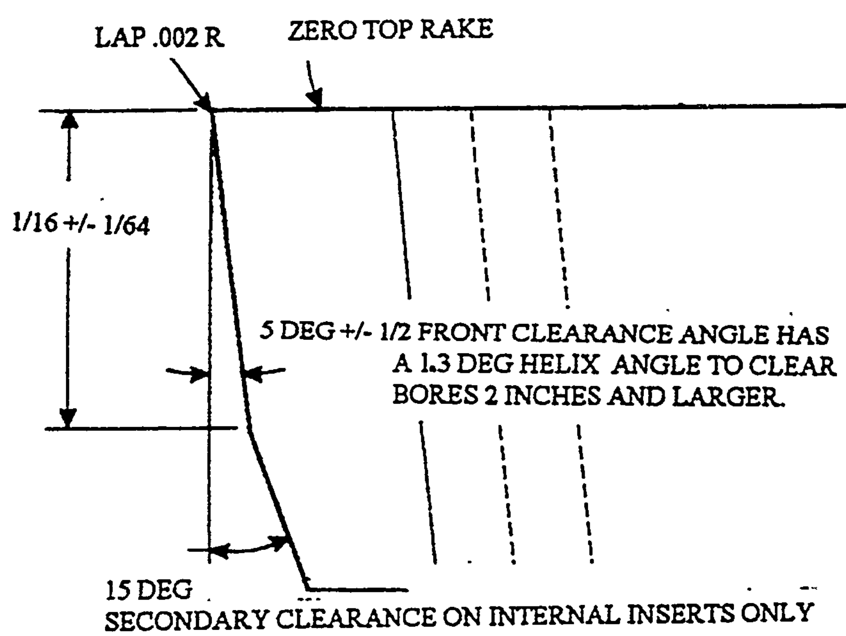
.10000 LEAD
+/-.0003
+/-.0010 ACCUM
JDW DRAWING NUMBER
90329 C
10 THREADS PER INCH.
.1849 IN./IN. TAPER ON DIA.
.0513
NEW TOOL +/- .001
.0419
GSET AT .625
D
6.3234 TRN
6.3174 THD
15 DEG +/-5' STAB FLANK
2 DEG +/-5' LOAD FLANK
.01000 CREST RADIUS
6.227
.1035
.00800 ROOT RADIUS
6.1518 P.D. AT FACE
6.1058 TOOL TIP DIA.
.005 R
6.1037
AT FACE
6.0234 BORE
AT FACE
.040 NOM. FACE WIDTH
WATTS - FJC - 05-01-99
THIS DWG GIVES X & Z COORDINATES FOR MACHINING
JOHN D. WATTS, P.E. 5054 STANHOPE, HOUSTON, TX 77084-3033
F
50:1 THREAD TRACE MUST MATCH OVERLAY +/- .0003
6.094 NOM. I.D.
7.000 NOM. O.D.
0.453 WALL
32 #/FT
6.028 BORE
AT 4.087
USING GSET 6.684, THD ONE END
*6 PARTS -.0035 TO -.0025
6 PARTS +.0025 TO +.0035
PITCH DIA. = 6.1212
TOOL TIP DIA = 6.1672
AT PULLOUT = 3.8871
+/- .002 BORE TOLERANCE
GSET AT 2.75
T
6.2784 TRN
6.2844 THD
10 THREADS PER INCH
.1875 IN/IN TAPER ON DIA.
GSET AT .625
D
6.6768 TRN
6.6828 THD
WATTS TYPE FJC BOX
6.756 BORE
AT .200
5 DEG.
BREAK WITH FILE .005
6.9150 BORE AT FACE
6.850 P.D. AT FACE
6.896 TOOL TIP DIA.
.050 NOM. FACE

SURFACE FINISH AS TURNED, 32 RMS OR BETTER



All information on this sheet is confidential and is for use only as authorized in writing and may be protected by U.S. & Foriegn Patents and Patents Pending. For further data and for License information, contact: John D. Watts, P.E. 5054 Stanhope Houston, Texas 77084-3033 Telephone (281) 463-2312 Fax (281) 463-2312	This drawing is property of John D. Watts, P.E. For use only as authorized in writing
	10 TPI WATTS TYPE C THREAD DETAIL
	DWN. BY:
	CKD. BY:
	DWG. NO. 90516
	REV. C





NOTES:

1. FURNISH A 50:1 TRANSPARENT OVERLAY WITH THE FIRST INSERT, TO CHECK INSERTS AND TRACINGS OF PRODUCTION THREADS.
2. USE TNMC 43 SANDVIC GC225 OR EQUAL, AS HARD AND AS TOUGH. SPECIFY ON QUOTE.

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Houston, Texas 77084-3033
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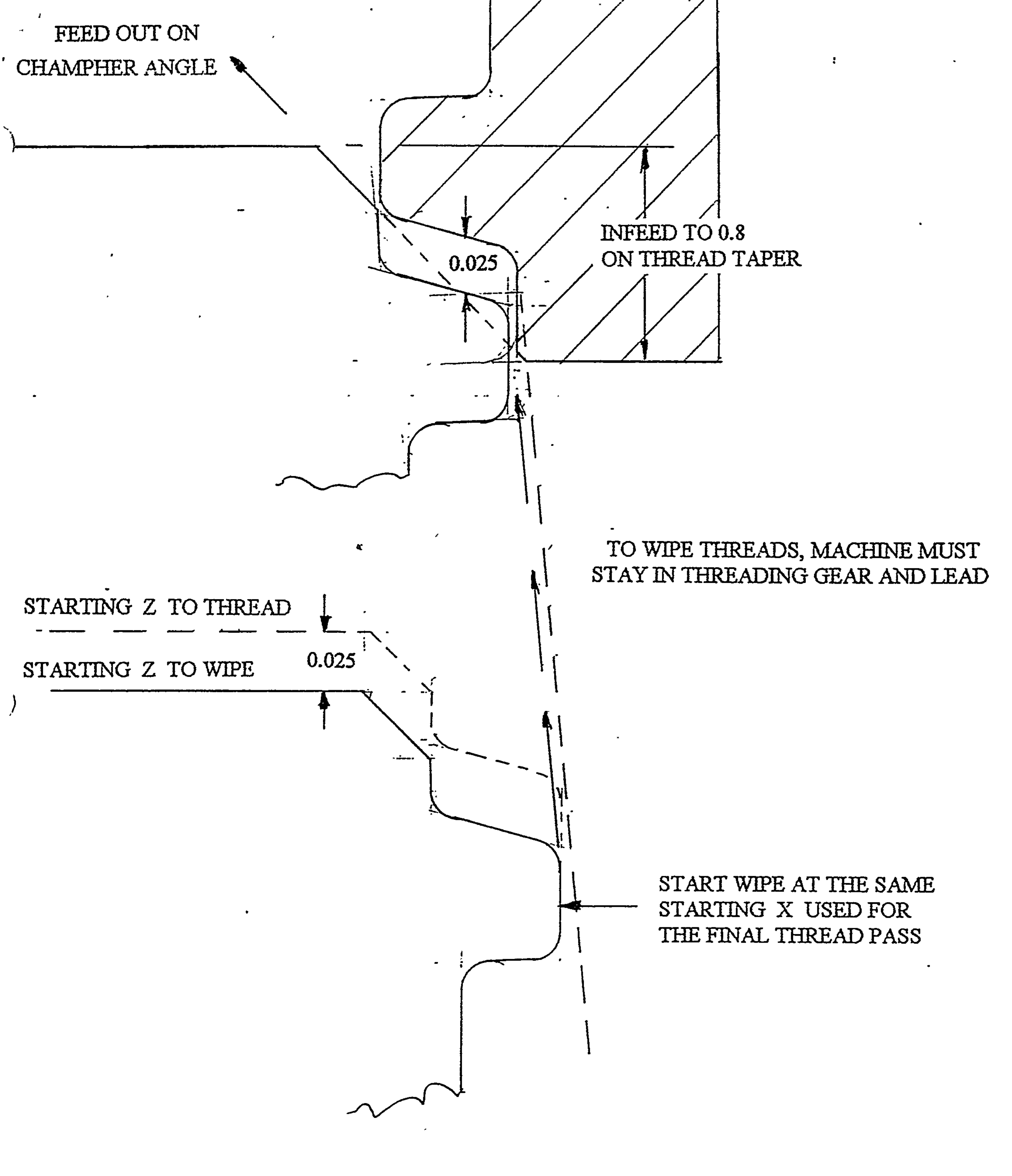
THREAD INSERTS FOR 10 TPI - .1875 T - 2 DEG X 15 DEG FLANKS

DWN. BY:	DWG. NO. 90427	REV. C
CKD. BY: JDW		



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HOW TO WIPE FIRST THREAD

DWN. BY:	DWG. NO. 90420	REV.
CKD. BY: JDW		

18442

Description	No.	PIPE O.D. 6.965 to 7.07	PIPE I.D. 6.045 to 6.174	TURN MRP +/-.001	THREAD MRP	TAPER MRP	F	NOTE
MAX BOX 30 IN. LONG	1 *	7.045	6.160	6.675	6.680 +/-.001 6.680	D -.3984 .1875		.048
	2				6.681			.048
GSET - .003	3 P				6.680			.0482
	4 P				6.681			.048
	5				6.680			.048
	6				6.680			.048
MIN BOX 30 IN. LONG	7	7.045	6.161	6.681	6.686 +/-.001 6.686	.187		.0482
	8				6.6855			.048
GSET + .003	9 P				6.685			.0485
	10 P				6.6855			.0482
	11				6.6865			.048
	12				6.686			.048
MAX PIN BOTH ENDS	13A *	PIN BORE 6.965 to 7.07 7.050	5.99 to 6.000	6.325	6.320 +/-.001 6.320	D +393 .185		.048
	13B				6.320			.0482
18 IN. LONG	14A				6.3205			.0482
	14B				6.320			.0482
GSET +.003 P	15A				6.320			.0482
	15B				6.3205			.0485
MIN PIN BOTH ENDS P	16A	7.050		6.319	6.314 +/-.001 6.3135	.185		.0485
	16B				6.315			.0485
18 IN. LONG	17A				6.313			.0482
	17B				6.3135			.0482
GSET - .003	18A				6.314			.0485
	18B				6.314			.0485

TARGET DIAMETERS SHOWN, ARE + OR - .003 FROM THE GSET: TOLERANCE = +/- .001

Inspected and recorded by S Carter Date 6-9-99

2/3

INSPECTION RECORD SHEET FOR DRAWINGS 90431-C & 90430-C

(All of these parts are 30 inches long.)

	Description	No.	PIPE O.D. 6.965 to 7.07	PIPE I.D. 6.045 to 6.174	TURN MRP +/-.001	THREAD MRP	TAPER MRP	F	NOTE
F‾ - .003	MAX BOX	19 *	7.045	6.155	6.675	6.680 +/-.001 6.6805	D -.3984 .1865		.048
ET + .003	MIN BOX	20			6.681	6.686 +/-.001 6.6865	.1875		.0482
I + .003	MIN BOX	21			6.681	6.686 +/- .001 6.686			.048
SI T + .003	MAX PIN	22 *	6.965 to 7.07	6.045 to 6.174	6.437	~~6.453~~ +/-.001 6.456 6.4565	D +.4403 .195		.0485
SET - .003	MIN PIN	23	7.050	6.172	6.431	~~6.426~~ +/-.001 6.450 6.450	.1955		.0482
S_T - .003	MIN PIN	24			6.431	~~6.426~~ +/-.001 6.450 6.450			.0485

Note: Max means Maximum Metal; Min means Minimum metal.

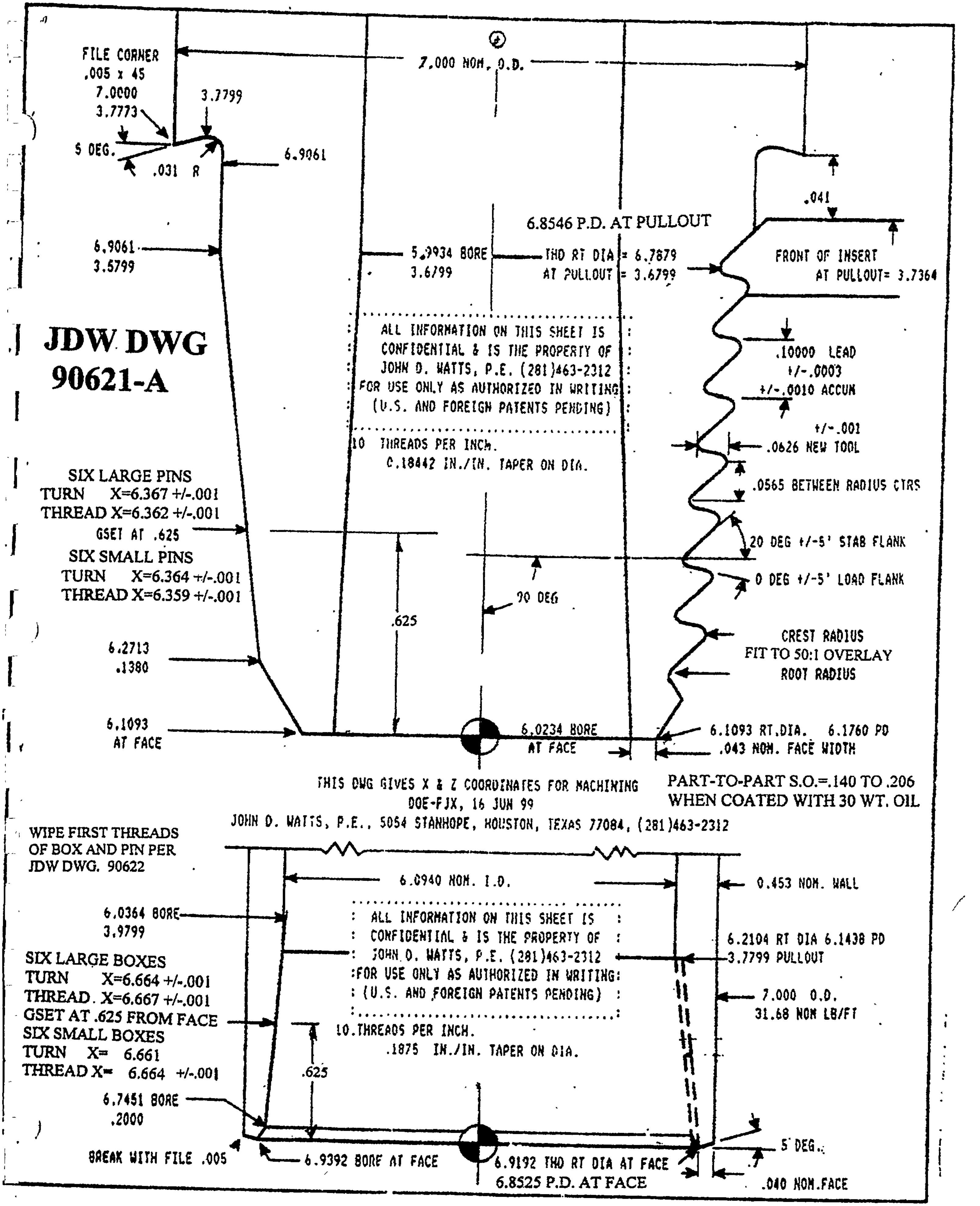
Inspected and recorded by S Carter Date 6-8-99

TARGET DIAMETERS SHOWN, ARE + OR - .003 FROM THE GSET: TOLERANCE = +/- .001

* ON FIRST PART AFTER EACH SET-UP, MEASURE ALL DIMENSIONS ON DRAWING

3/3

APPENDIX C
THREAD DATA FOR ROUND THREAD FORM



FILE CORNER
.005 x 45
7.0000
3.7773
3.7799
5 DEG.
.031 R
6.9061
7.000 NOM. O.D.
.041
6.8546 P.D. AT PULLOUT
FRONT OF INSERT
AT PULLOUT= 3.7364
6.9061
3.5799
5.9934 BORE
3.6799
THD RT DIA = 6.7879
AT PULLOUT = 3.6799
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FOR USE ONLY AS AUTHORIZED IN WRITING
(U.S. AND FOREIGN PATENTS PENDING)
JDW DWG
90621-A
.10000 LEAD
+/-.0003
+/-.0010 ACCUM
+/-.001
.0626 NEW TOOL
10 THREADS PER INCH.
0.18442 IN./IN. TAPER ON DIA.
SIX LARGE PINS
TURN X=6.367 +/-.001
THREAD X=6.362 +/-.001
GSET AT .625
SIX SMALL PINS
TURN X=6.364 +/-.001
THREAD X=6.359 +/-.001
.0565 BETWEEN RADIUS CTRS
20 DEG +/-5' STAB FLANK
0 DEG +/-5' LOAD FLANK
90 DEG
.625
CREST RADIUS
FIT TO 50:1 OVERLAY
ROOT RADIUS
6.2713
.1380
6.1093
AT FACE
6.0234 BORE
AT FACE
6.1093 RT.DIA. 6.1760 PD
.043 NOM. FACE WIDTH
THIS DWG GIVES X & Z COORDINATES FOR MACHINING
DOE-FJX, 16 JUN 99
JOHN D. WATTS, P.E., 5054 STANHOPE, HOUSTON, TEXAS 77084, (281)463-2312
PART-TO-PART S.O.=.140 TO .206
WHEN COATED WITH 30 WT. OIL
WIPE FIRST THREADS
OF BOX AND PIN PER
JDW DWG. 90622
6.0940 NOM. I.D.
0.453 NOM. WALL
6.0364 BORE
3.9799
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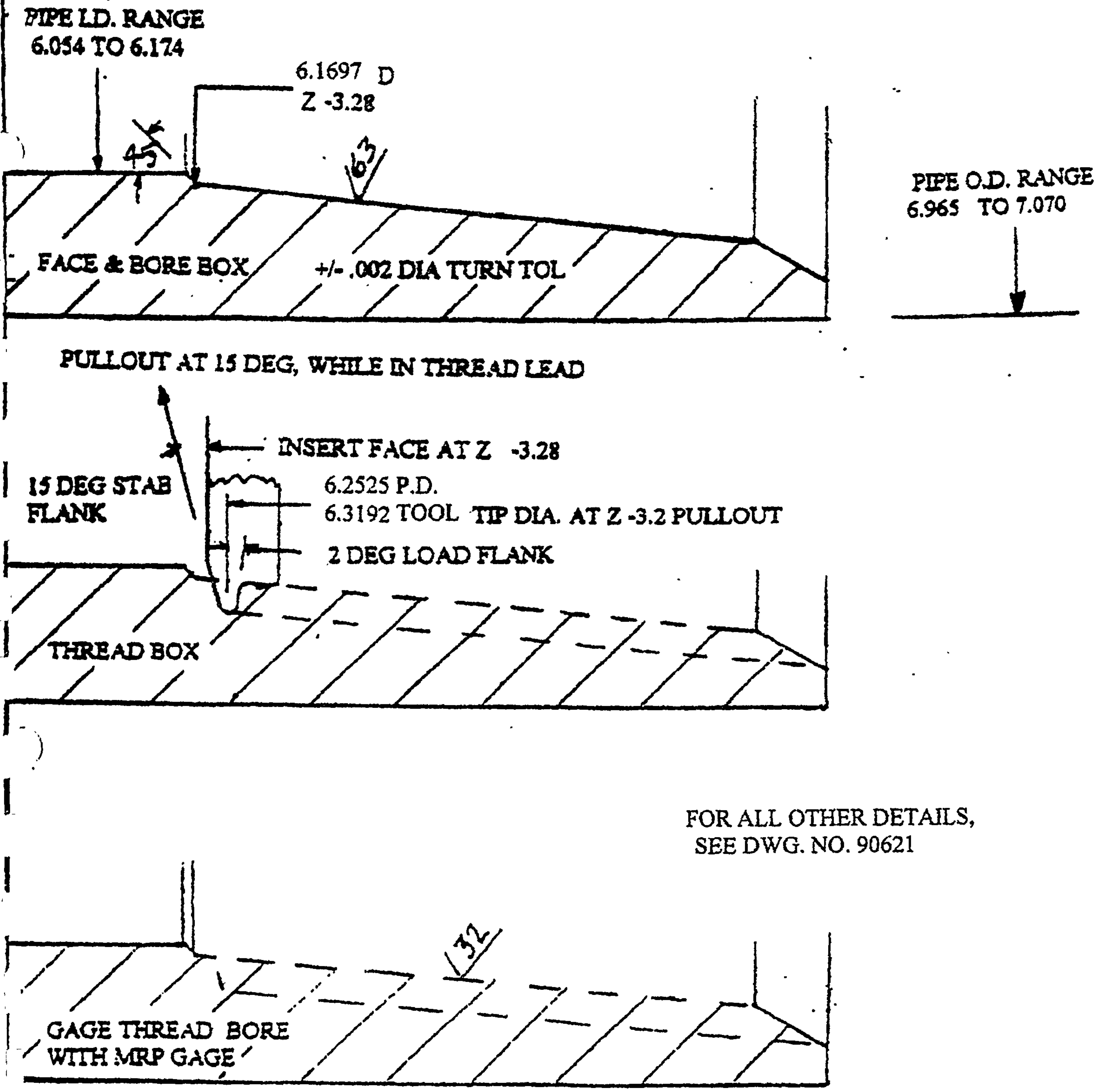
FOR USE ONLY AS AUTHORIZED IN WRITING
(U.S. AND FOREIGN PATENTS PENDING)
6.2104 RT DIA 6.1438 PD
3.7799 PULLOUT
SIX LARGE BOXES
TURN X=6.664 +/-.001
THREAD. X=6.667 +/-.001
GSET AT .625 FROM FACE
SIX SMALL BOXES
TURN X= 6.661
THREAD X= 6.664 +/-.001
7.000 O.D.
31.68 NOM LB/FT
10.THREADS PER INCH.
.1875 IN./IN. TAPER ON DIA.
.625
6.7451 BORE
.2000
BREAK WITH FILE .005
6.9392 BORE AT FACE
6.9192 THD RT DIA AT FACE
6.8525 P.D. AT FACE
5 DEG.
.040 NOM.FACE



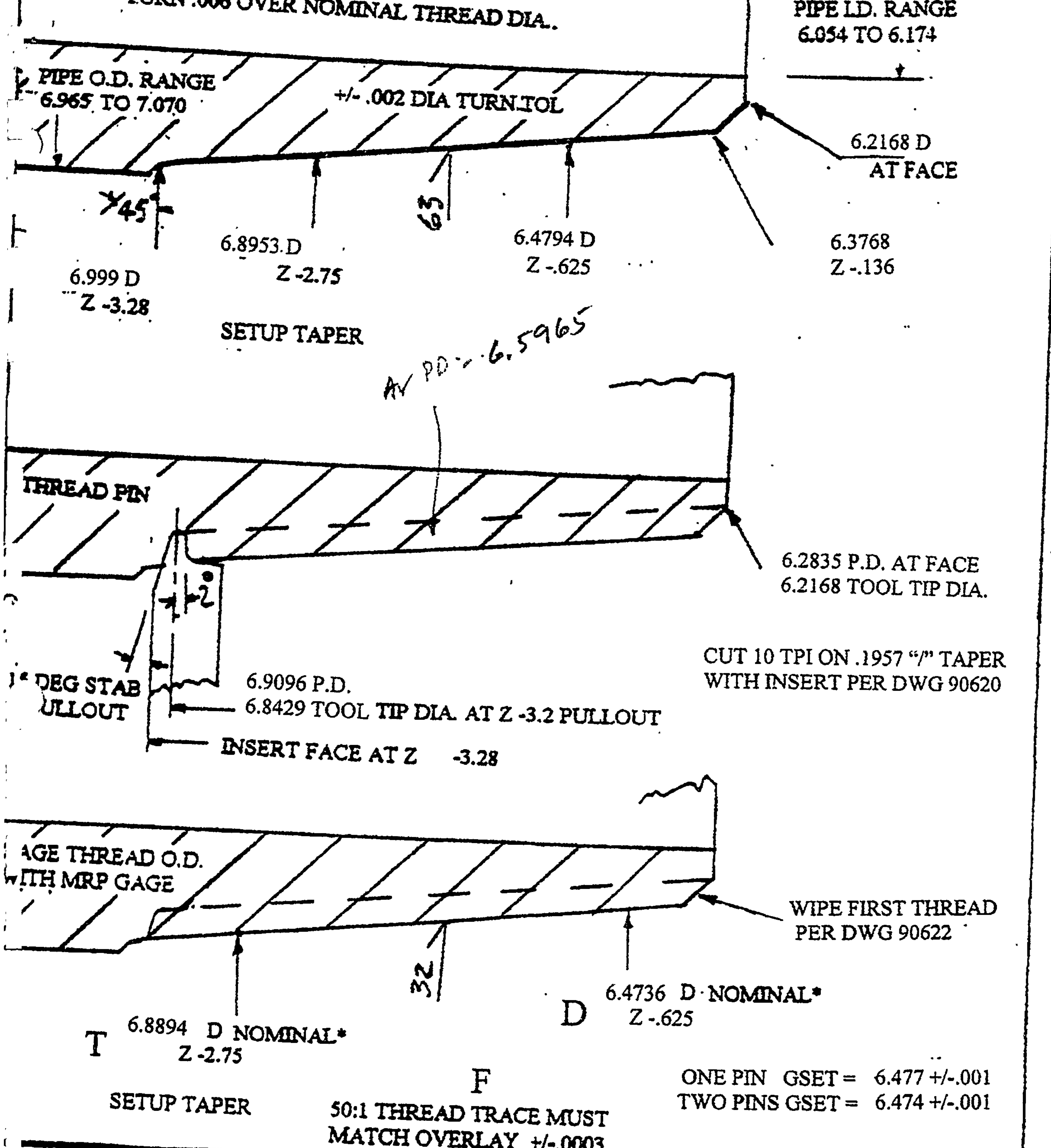
FOR ALL OTHER DETAILS,
SEE DWG. NO. 90621

MAKE: ONE SMALL BOX
TWO LARGE BOXES

John D. Watts, P.E.
5086 Stanhope
Houston, Texas 77084-3033
Telephone (713) 463-2312 Fax (713) 463-2312

WATTS TYPE FJ80 BOX

DWN. BY:	DWG. NO. 90624	REV.
CKD. BY: JDW		



John D. Watts, P.E.
5064 Stanhope
Houston, Texas 77084-3033
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WATTS TYPE FJ80 PIN

DWN. BY:	DWG. NO. 90623
CKD. BY: JDW	REV. A

06/25/1999 17:45 2814632312 JOHN D. WATTS PAGE 02

INSPECTION RECORD SHEET FOR DRAWING 90621.

Description	No.	.625 MRP	MOLD OK	SETUP ONLY READINGS	
MIN. ~~MAX~~ BOX ✓ 30 IN.	1	-.0005		THREAD I.D. AT PULLOUT	✓
LONG ✓	2	Ø		THREAD LENGTH TO PULLOUT	✓
✓	3	Ø		5 DEGREE AT FACE?	✓
6.664+/-.001 MAX. INT. P	4	Ø		THREAD TAPER, INCH/INCH	.1884
P	5	Ø		IS WIPE FREE OF SHARP EDGES	✓
✓	6	-.0005		SUR FIN 63 RMS OR BETTER?	✓
MAX. ~~MIN~~ BOX ✓ 30 IN.	7	+.001		COMMENTS	
LONG P	8	Ø			
✓	9	+.00025			
6.667+/-.001 P	10	-.00025			
MIN. INT. ✓	11	+.001			
✓	12	+.0005			
MAX PIN BOTH ENDS ✓	13A	+.001		TURNED NECK DIAMETER	✓
	13B	-.0005		THREAD LENGTH TO PULLOUT	✓
	14A	+.0005		THREAD LENGTH TO SHOULDER	✓
6.362+/-.001 ✓ MAX. INT. 18 IN.	14B	-.001		THREAD TAPER, IN/IN ON DIA.	✓
LONG	15A	Ø		IS WIPE FREE OF SHARP EDGES?	✓
P	15B	-.001		SUR FIN 63 RMS OR BETTER?	✓
MIN PIN ✓ BOTH ENDS	16A	-.001		COMMENTS	
	16B	Ø			
MIN. INT. P	17A	-.0005			
6.359+/-.001	17B	Ø			
18 IN. LONG ✓	18A	-.001			
	18B	Ø			

Inspected and recorded by S.E. Cates Date 7-6-99

2/3

INSPECTION RECORD SHEET FOR DRAWINGS 90624 & 90623

(All of these parts are 30 inches long.)

Description	No.	.625 MRP	MOLD OK	SETUP ONLY READINGS	
BOX DWG. NO. 90624					.188
MIN. ~~MAX BOX~~ 6.664 +/-.001	19	O	MAX. INT.	THREAD LENGTH AT PULLOUT	✓
MAX. ~~MIN BOX~~ 6.667 +/-.001	20	O	MIN. INT.	THREAD LENGTH AT PULLOUT	✓
MAX. ~~MIN BOX~~ 6.667 +/-.001	21	-.00025	P MIN INT.	THREAD I.D. AT PULLOUT	✓
PIN DWG. NO. 90623					.195
MAX PIN 6.477+/-.001	22	+.0005	MAX. INT.	THREAD LENGTH TO PULLOUT	✓
MIN PIN 6.474+/-.001	23	.001	MIN. INT.	THREAD TAPER, IN/IN ON DIA.	✓
MIN PIN 6.474+/-.001	24	+.001	P MIN. INT.	IS WIPE FREE OF SHARP EDGES?	✓
				SUR FIN 63 RMS OR BETTER?	✓
				THREAD O.D. AT PULLOUT	✓

Note: Max means Maximium Metal; Min means Minimum metal.

Inspected and recorded by S L Carter Date 7-6-99

1.89 FROM FACE: Box 6SGT = 6.4303 (LG) -.003 (SM) MAX

Pin 6SGT = 6.5923 (SM) +.003 (LG) MIN

3/3

TECHNICAL DATA

working solutions

Working Solutions, Inc.
4810 Nett Street
Houston, TX 77007
(713) 862-3868
(800) 829-4419
Fax (713) 862-5591

SOLUCOAT 5047

Heavy Immersion Zinc Phosphate

SOLUCOAT 5047 is a liquid zinc phosphate for immersion use to produce heavy, extremely fine grained coatings. SOLUCOAT 5047 is especially suited as an anti-galling and corrosion preventive coating. Coating weights between 2000 to 4500 mg/sq.ft. can be easily obtained on low carbon steels such as 1010. coating weights between 1400 and 5200 can be obtained on high carbon steel such as 4130.

SOLUCOAT 5047 is formulated to produce excellent coatings with little or no bath break in. The SOLUCOAT 5047 bath is easy to operate and maintain: it operates over a wide concentration range and has a long bath life due to high tolerance for iron.

PHYSICAL CHARACTERISTICS:

Form	Viscous liquid
Color	Emerald green
pH	Acidic
Solubility	Rapid & complete

OPERATING DATA:

Equipment:	Stainless steel tanks and heating coils are preferred (electric heaters may be quartz or teflon). DO NOT heat phosphate baths from bottom.
Concentration:	3 - 10% by volume
Temperature:	155 - 180°F
Contact Time:	5 - 30 minutes (depending on desired coating weight and material being coated)
Total Acid:	30 - 90
Acid Ratio: (total acid/free acid)	3:1 - 8:1
pH	1.4 - 2.4

Working Solutions, Inc.
4810 Nett Street
Houston, TX 77007
(713) 862-3868
(800) 829-4419
Fax (713) 862-5591

SOLUTION MAKEUP AND MAINTENANCE:

1. Fill tank about 3/4 full of water.

2. Add 6.6 - 10 gallons of SOLUCOAT per 100 gallons of solution. One percent by volume of SOLUCOAT is equal to 9.1 points total acid. Start up and operating total acid should be in the 60 -90 point range.

3. Fill tank to operating level with water and mix thoroughly.

4. Heat bath to recommended operating temperature.

5. Monitor total acid content of the bath by titration (see CONTROL).

6. Maintain bath by adding SOLUCOAT based on the following formula:

   TAPD - Total Acid Points Desired
   ATAP - Actual Total Acid Points (determined by titration)

   Formula:
   (TAPD - ATAP) x .00115 x (YOUR BATH SIZE IN GALLONS) =
   Gallons of SOLUCOAT to Add to Tank

   Example:

Bath Size:	400 gallons
Actual Total Acid Points:	50
Total Acid Points Desired:	70

   Calculation: (70 - 50) x (.00115) x 400 = 9.2 gallons to add

CONTROL:

Total Acid Analysis

Reagents: 0.1N sodium hydroxide (NaOH)
Phenolphthalein Indicator

Procedure:

1. Pipette a 10 ml. sample of cooled bath into a clean 125 ml. flask.

working solutions

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4810 Nett Street
Houston, TX 77007
(713) 862-3868
(800) 829-4419
Fax (713) 862-5591

2. Add 25 ml. of tap water (in hard water areas - distilled or D.I. water).
3. Add 6 drops of Phenolphthalein indicator.
4. While swirling flask contents, titrate with 0.1N sodium hydroxide to a pale pink endpoint. This measurement (in mls.) is Total Acid Points.

Free Acid Analysis

Reagents: 0.1N sodium hydroxide (NaOH)
Bromphenol Blue Indicator

Procedure:

1. Pipette a 10 ml. sample of cooled bath into a clean 125 ml. flask.
2. Add 25 ml. of tap water (in hard water areas - distilled or D.I. water).
3. Add 4-5 drops of bromphenol blue indicator.
4. While swirling sample, titrate with 0.1N sodium hydroxide to a greenish-yellow endpoint. This measurement is Free Acid Points.

Dissolved Iron Analysis (ferrous iron content)

Reagents: 0.05N potassium permanganate
1.0 N sulfuric acid (H_2SO_4)

Procedure:

1. Pipette a 10 ml. cooled sample of bath into a clean 25 ml. flask.
2. Add 1.0 ml. of 1.0 N sulfuric acid.
3. Titrate the sample (while swirling) with 0.05N potassium permanganate to a pink endpoint which is stable for 15 seconds.

Calculation:

Iron Points = ml. 0.05N potassium permanganate x 0.25

% Iron by Weight (Ferrous Iron Content) = Iron Points x 0.1125

SOLUCOAT 5047 is an acidic product. Avoid skin and eye contact. If contact should occur, flush with water for at least 15 minutes. If irritation persists, get medical attention.

FOR FURTHER DETAILS - CONSULT MATERIAL SAFETY DATA SHEET working solutions

Working Solutions, Inc.
4810 Nett Street
Houston, TX 77007
(713) 862-3868
(800) 829-4419
Fax (713) 862-5591

ATTENTION: MR. JOHN WATTS

FAX NUMBER: 281-463-2312 **TELEPHONE NUMBER:** SAME

FROM: JAY. DAVIS

DATE: 5-18-99

NUMBER OF PAGES ***(Including the cover page)*****:** 4

If there are any problems with the transmission of this document, please call (713) 862-3868 and ask for assistance.

HERE IS THE INOFRMATION YOU REQUESTED CONCERNING SOLUCOAT 5047. IF YOU NEED FURTHER ASSISTANCE PLEASE CALL.

APPENDIX D
MAKEUP/BREAKOUT DATA FOR SQUARE THREAD SAMPLES

STRESS ENGINEERING SERVICES, INC.
13800 Westfair East Drive Telefax: (281) 955-2638
Houston, Texas 77041-1101
(281) 955-2900

TELEFAX COVER SHEET

DATE: June 11, 1999
SENT TO: John Watts
FAX NO: 281-463-2312
SENT BY: Tom Asbill
SES PN: 5806
TOTAL PAGES 3 (INCLUDING COVER SHEET)
IF ALL PAGES ARE NOT RECEIVED, CALL: Judy AT (281) 955-2900

MESSAGE:

John –
Attached is the revised makeup procedure.

If any changes are needed, please make them during the test.

We plan to do these on Tuesday and Thursday. Friday another project needs the equipment. So, if we do not finish on Thursday, we will do so the following week.

If you should need me next week, tell Bob Wink or Greg Stafford and they can get in touch with me at the API Standardization Conference in New Orleans.

Best regards,

Tom

D:\ADMIN\FAX

JUNE PRELIMINARY MAKEUP/BREAKOUT SUMMARY
JOHN WATTS 7" FLUSH JOINT CONNECTION
16-Jun-99

PIN NO.	BOX NO.	MAKEUP NO.	LUBR. GRAMS	PLANNED TORQUE	SHOULDER		FULL MAKEUP		SPEED RPM	BREAKOUT TORQUE	REFURBISHING & GALLING OBSERVATIONS
					TORQUE	TURNS	TORQUE	TURNS			
15A	3	MU 1	API 63	4.2 turns	N/A	N/A	6,261	2.165	7	3,004	SLIGHT GALL BACK OF BOX
											DREMEL TO REPAIR
		MU 2	API 54	3.7 turns	7,104	3.499	12,426	3.523	7	13,100	MORE SEVERE GALLING & REPAIR
		MU3	BOL 37	8500	5,394	2.632	9,575	2.633	7	8,820	MINOR GALLING
15B	4	MU1	API 41	8,500	6,812	2.791	8705.2.	2.789	7	7,737	MODERATE TO SEVERE GALL & REPAIR
16A	9	MU 1	API 40	6,000	4,726	2.459	7,229	2.459	7	7,929	SLIGHT GALLING

MAKEUP/BREAKOUT LOG
7" JOHN WATTS CASING CONNECTION

By: G. STAFFORD | Date: 6/14/99 | Page 1 of

	PIN NO.	BOX NO.	MAKEUP NO.	LUBR. GRAMS *	PLANNED TORQUE	SHOULDER		FULL MAKEUP		SPEED RPM	BREAKOUT TORQUE	REFURBISHING & GALLING OBSERVATIONS
						TORQUE	TURNS	TORQUE	TURNS			
6/14	15A	3	1	63 S	4.2 Turns	—	—	6261	2.165	7	3004	Little galling Did not make turns tongs slip (stop)
6/14	15A	3	2	54 S	3.7 Turns	7104	3.499	12426	3.523	7	13100	HEAVIER GALLING 1ST 2 THDS AND LAST 2-3 THDS. PIN + BOX
6/15	15B	4	1	41 S	8500	6812	2.791	8705	2.789	7	7737	SEE ATTACHED NOTES
6/15	15A	3	3	37 BOL	8500	5394	2.632	9575	2.633	7	8820	SEE ATTACHED NOTES
6/15	16A	9	1	40 S	6000	4726	2.459	7229	2.459	7	7929	" " "

* S - NOTES SHELL 72732
BOL - NOTES BEST OF LIFE 2000

THREAD COMPOUND APPLICATION LOG

PN 5806 Page 1 of 1

TEST NO.________ PIPE SIZE 7.0 DATE 6/14/99 BY G. STAFFORD

MAKEUP NO.	PIN END NO.	BOX END NO.	WEIGHT, GRAMS			
			PIN	BOX	TOTAL	
1	15A	3	24	39	63	SHELL API
2	15A	3	26	28	54	SHELL
1	15B	4	19	22	41	SHELL
3	15A	3	19	18	37	BEST LIFE 2000
1	16A	9	19	21	40	SHELL

Client JOHN WATTS	Project No. 5806	Page No. 1 of	By G. STAFFORD	Date 6/14/99
Subject			Checked By	Date

① STOPPED MAKE UP AT 2.3 TURNS BECAUSE OF ~~[illegible]~~ LOUD SQUEAL
BACKED OUT CONNECTION, PIN 15A BOX 3

② HAD SLIGHT GALLING IN BACK OF BOX 3 - LAST 3 RUN OUT THDS. USED DREMEL TOOL TO REPAIR.

③ FOUND EVIDENCE OF PIPE SLIPPING IN JAWS. THIS IS WHAT WAS MAKING NOISE. PICTURE ① + ② BEFORE REPAIR PICTURE ③ + ④ AFTER REPAIR.

④ MADE UP CONNECTION AGAIN. HAD SAME SQUEALING NOISE BUT CONN. SHOULDERED, BROKE OUT AND HAD MORE SEVERE GALLING THIS TIME. 1ST 2 THREADS + LAST 2-3 THREADS ON BOTH PIN AND BOX. ALSO FOUND "HAIRS" THROUGHOUT CONNECTION. MADE MOLDS FOR J. WATTS TO LOOK AT.

6/15/99

① AFTER CLOSER INSPECTION OF PINS WE FOUND "HAIRS" IN THREAD ROOTS, MR. WATTS HAD US REMOVE THEM W/BRASS WIRE BRUSH + DRILL MOTOR.

② AFTER 1ST B/OUT OF PIN 15B BOX 4 HAD ~~SEVERE~~ MODERATE GALLING OF 1ST 2 THDS AND LAST 2-3 THDS. OF BOTH PIN + BOX.

③ MADE UP PIN 15A + BOX 3 FOR 3RD TIME USING BEST OF LIFE 2000. AFTER BREAK OUT NOTICED MINOR GALLING ON PREVIOUS LOCATIONS AS WELL AS SCATTERED LOCATIONS THROUGHOUT THE CENTER OF THE CONNECTION.

④ PER J. WATTS WE GROUND THE FIRST TWO THDS. OF BOXES 9 + 10 ON THE STAB FLANK SIDE TO ELIMINATE ANY BURRS, WE ALSO DEBURRED THE RUN OUT THDS. OF THE BOXES AND THE PINS OF COUPLING #16.

⑤ WE MADE UP 16A PIN AND BOX 9 USING SHELL API MODIFIED. AFTER BREAK OUT WE NOTED SLIGHT GALLING THROUGHOUT THE CONNECTION. PER J. WATTS ALL M+B'S WERE STOPPED AND MATERIAL PALLETIZED TO BE SENT FOR RETHREADING.

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: 2428

Capacity: 10k Lbs.

Shunt: 7302.00 Lbs.

Power Tong

Casing 32.00 Inches

Daq Gain	Daq Offset
2704.21	-0.144

Ctrl Gain	Ctrl Offset
2704.55	-0.144

Cal time date

06/14/1999 9:53 AM

Calibration File

Daq Board

Raw Volts	-0.144	Volts
Load Cell	0.09	Lbs
Torque	0.24	Ft Lbs
Gain	2704.21	Ft Lbs/V
Offset	-0.144	Volts

Control Board

Raw Volts	-0.144	Volts
Load Cell	0.08	Lbs
Torque	0.21	Ft Lbs
Gain	2704.55	Ft Lbs/V
Offset	-0.144	Volts

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: 2428

Capacity: 10k Lbs.

Shunt: 7302.00 Lbs.

Power Tong

Casing 32.00 Inches

Daq Gain	Daq Offset
2704.21	-0.144

Ctrl Gain	Ctrl Offset
2704.55	-0.144

Cal time date

06/14/1999 9:53 AM

Calibration File

Daq Board

Raw Volts	2.556	Volts
Load Cell	7302.59	Lbs
Torque	19473.56	Ft Lbs
Gain	2704.21	Ft Lbs/V
Offset	-0.144	Volts

Control Board

Raw Volts	2.556	Volts
Load Cell	7302.55	Lbs
Torque	19473.47	Ft Lbs
Gain	2704.55	Ft Lbs/V
Offset	-0.144	Volts

Stress Engineering Services
Torque Turn
Test Setup Information

Project Number	5806
Client	John Watts
Pipe Size	7.00
Pipe Weight	32 lbs. ft.
Pipe Grade	P-110
Connection	John Watts Casing
Operator	Greg Stafford

Thread Compound	Shell API 72732	
	Pin	**Box**
Surface Treatment	Phosphate	Plain End

Test Setup File

C:_Project\Torque Turn\DATA\5806.su

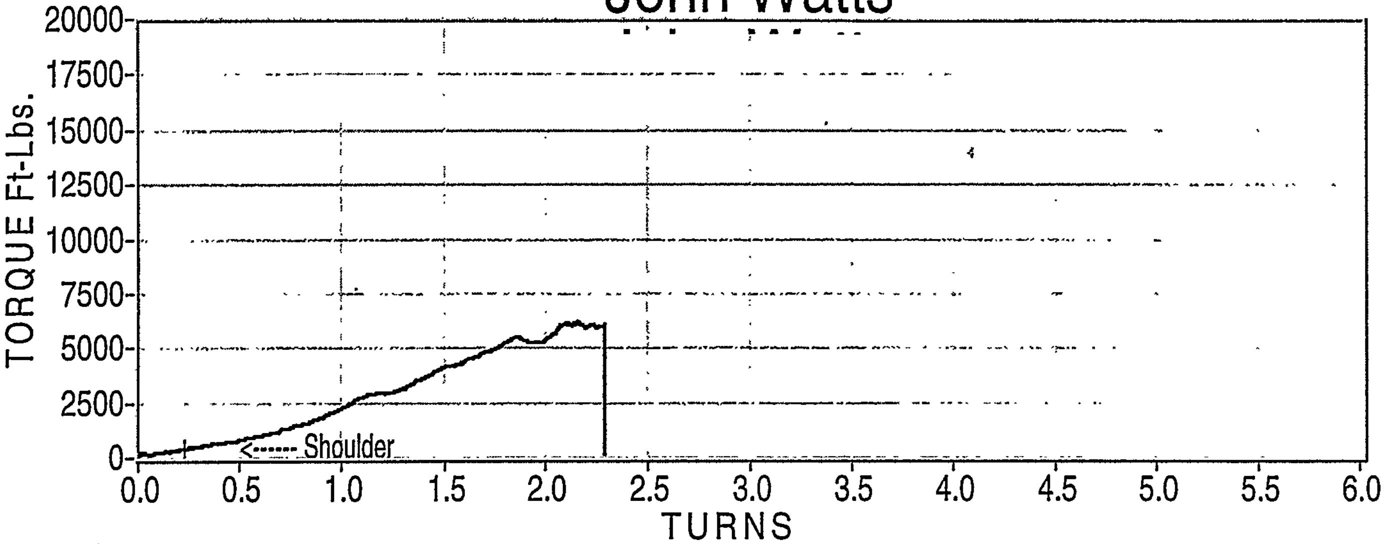
06/14/1999 10:16 AM

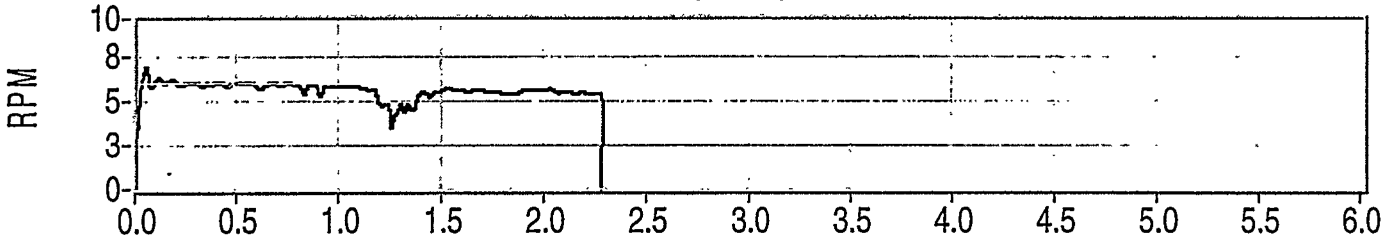
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 1		
Pin Id : 15A	Box Id : 3	
File Name : TT_0315.dat		
Maximum Torque	6261	Ft-Lbs
Shoulder Torque	425	Ft-Lbs
Delta Torque	5837	Ft-Lbs
Turns @ Max. Torque	2.165	Turns
Shoulder Turns	0.228	Turns
Delta Turns	1.937	Turns
Total Turns	2.286	Turns
Pin Dope	24	Grams
Box Dope	39	Grams

Operator:
Greg Stafford

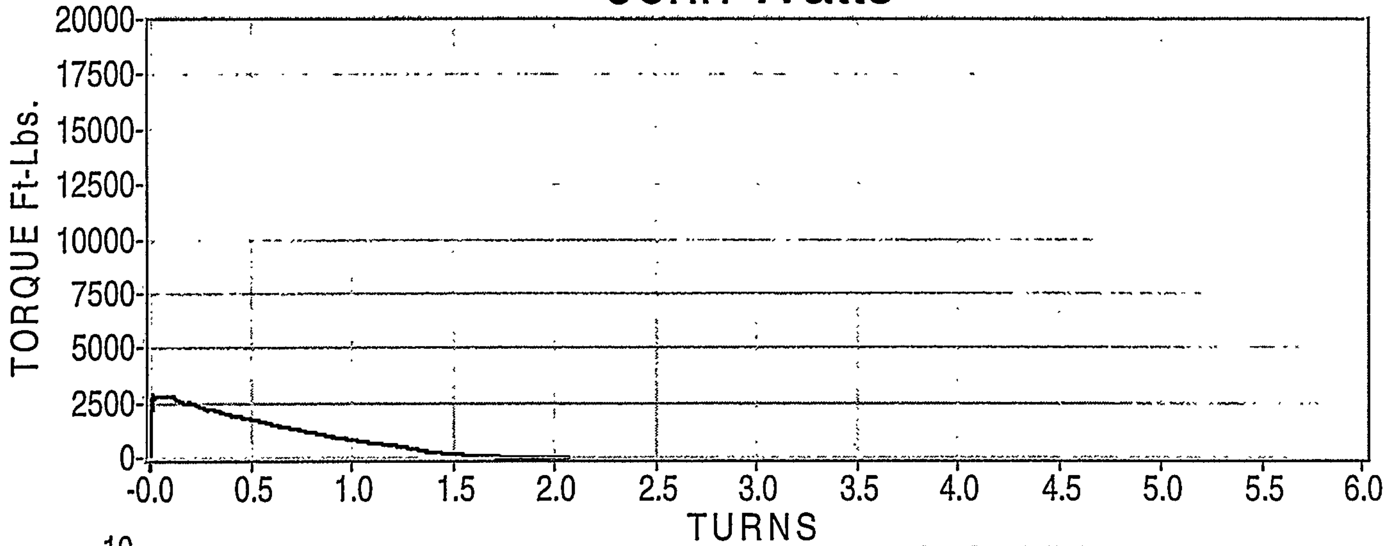
Date:Time of Test
06/14/1999 : 11:37:29 AM

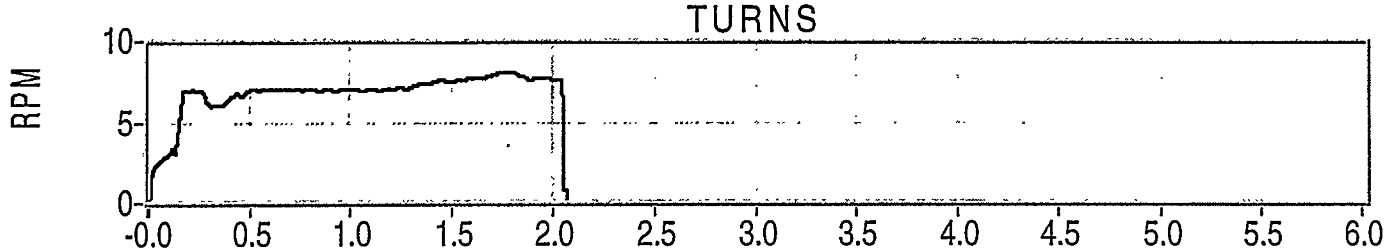
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts





BreakOut

BreakOut # 1	
Pin Id : 15A	**Box Id :** 3
File Name : TT_0316.dat	
Maximum Torque	**3004 Ft-Lbs**

Operator :
Greg Stafford

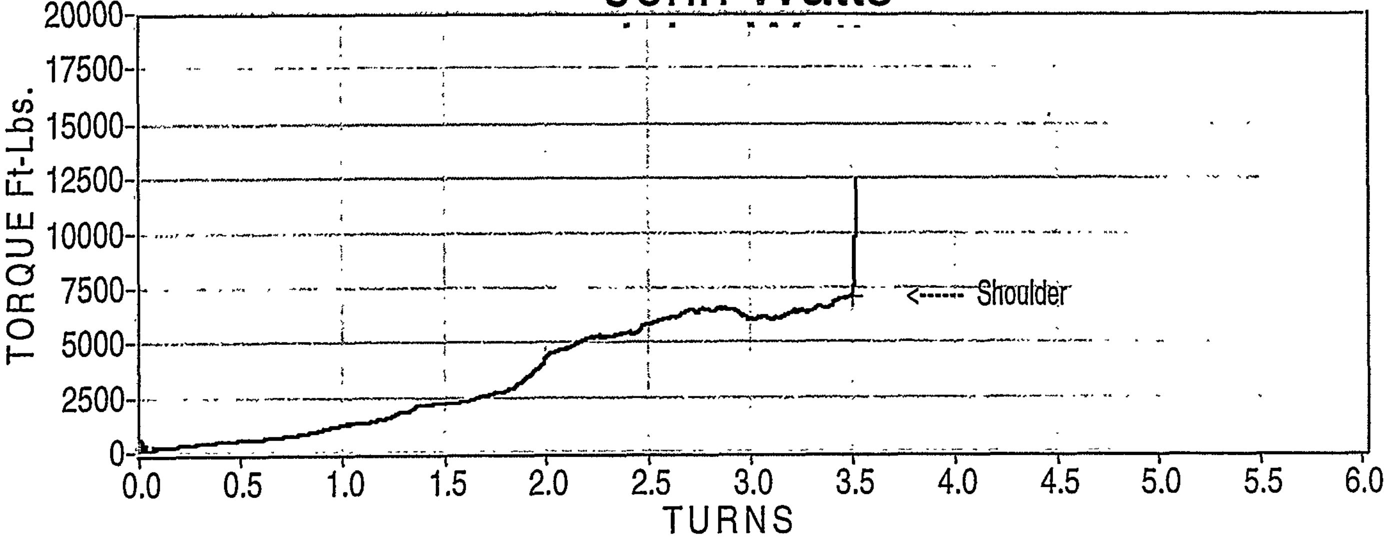
Date : Time of Test
06/14/1999 : 11:41:36 AM

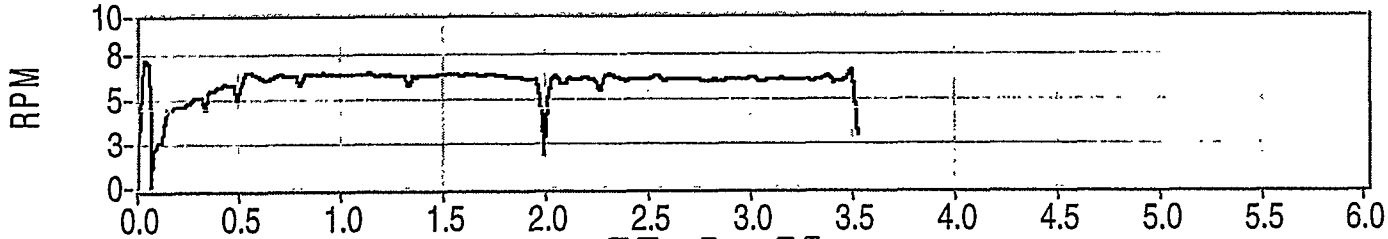
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 2			
Pin Id : 15A	Box Id : 3		
File Name : TT_0317.dat			
Maximum Torque		12426	Ft-Lbs
Shoulder Torque		7104	Ft-Lbs
Delta Torque		5322	Ft-Lbs
Turns @ Max. Torque		3.523	Turns
Shoulder Turns		3.499	Turns
Delta Turns		0.024	Turns
Total Turns		3.523	Turns
Pin Dope		26	Grams
Box Dope		28	Grams

Operator:
Greg Stafford

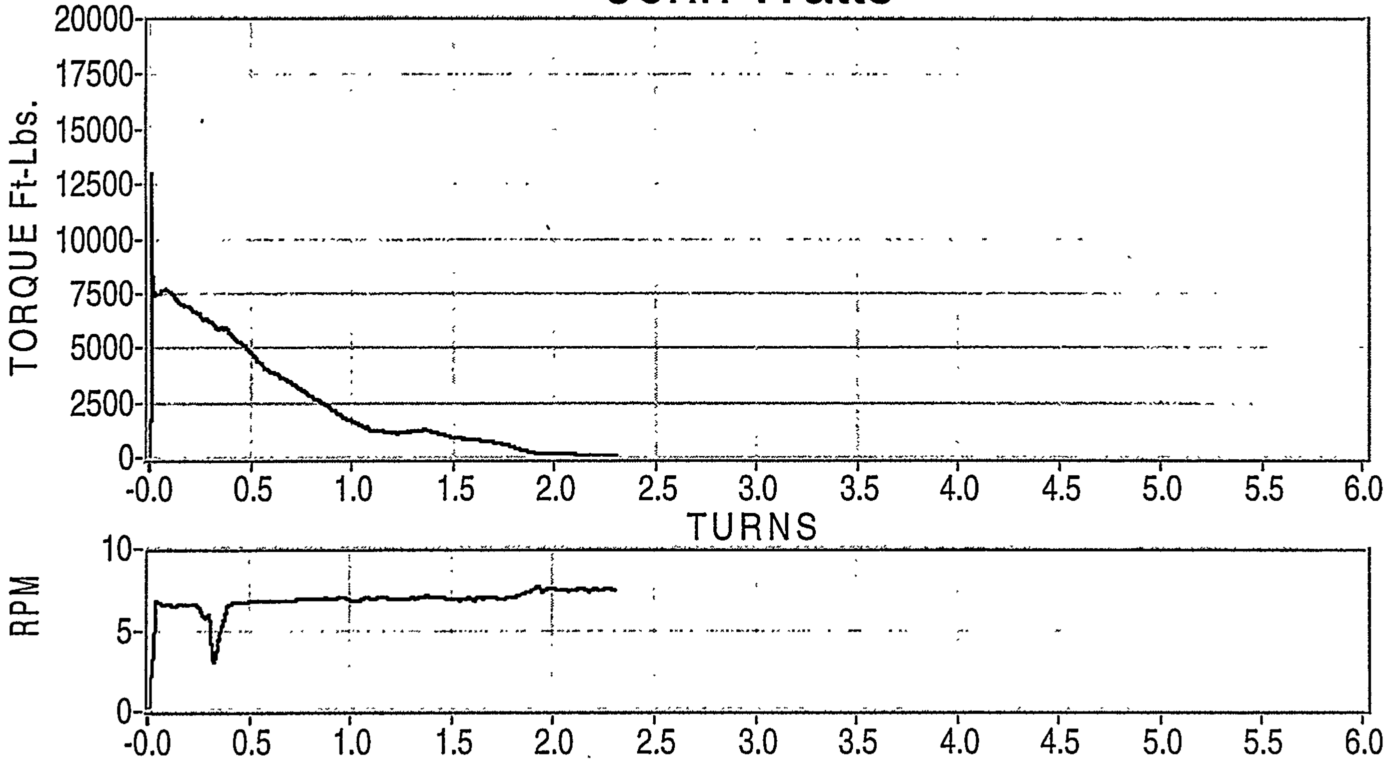
Date:Time of Test
06/14/1999 : 1:58:20 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts



BreakOut

BreakOut # 2	
Pin Id : 15A	Box Id : 3
File Name : TT_0318.dat	
Maximum Torque	13100 Ft-Lbs

Operator :
Greg Stafford

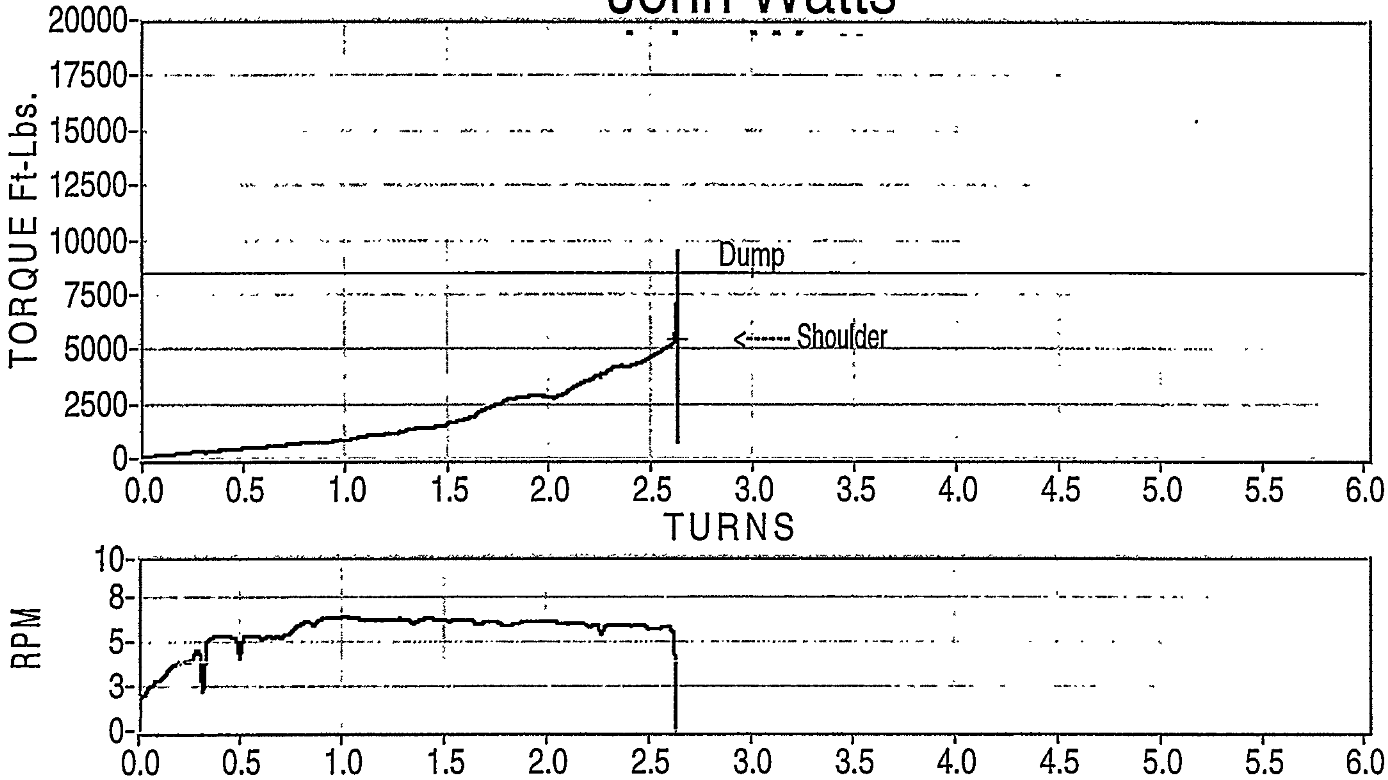
Date : Time of Test
06/14/1999 : 2:20:28 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp

MakeUp # 3	
Pin Id : 15A	**Box Id : 3**
File Name : TT_0321.dat	

Maximum Torque	**9575**	**Ft-Lbs**
Shoulder Torque	**5394**	**Ft-Lbs**
Delta Torque	**4180**	**Ft-Lbs**
Turns @ Max. Torque	**2.633**	**Turns**
Shoulder Turns	**2.632**	**Turns**
Delta Turns	**0.000**	**Turns**
Total Turns	**2.633**	**Turns**
Pin Dope	**19**	**Grams**
Box Dope	**18**	**Grams**

Operator:
Greg Stafford

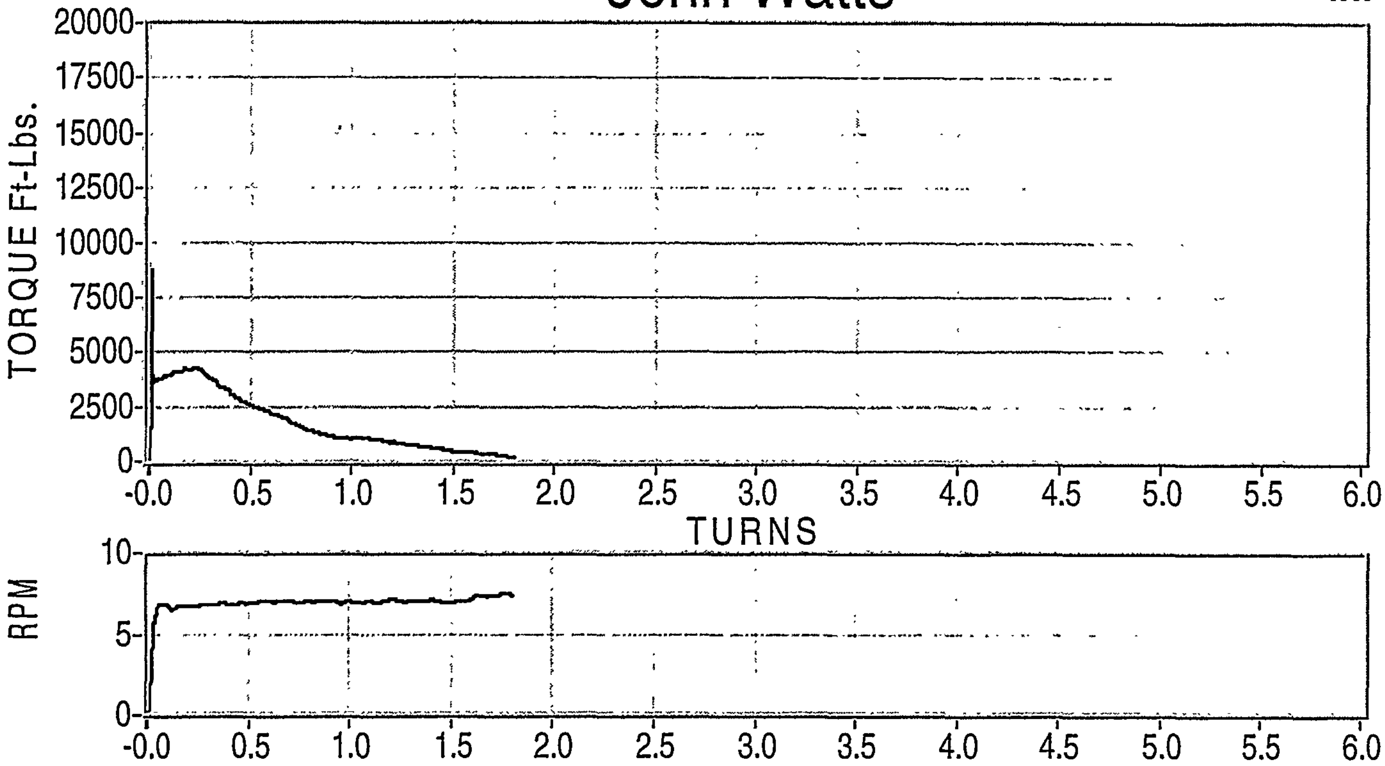
Date:Time of Test
06/15/1999 : 10:10:34 AM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: **5806**

Pipe Size
7.000 in.

John Watts



BreakOut

BreakOut # 3	
Pin Id : 15A	Box Id : 3
File Name : TT_0322.dat	
Maximum Torque	8820 Ft-Lbs

Operator :
Greg Stafford

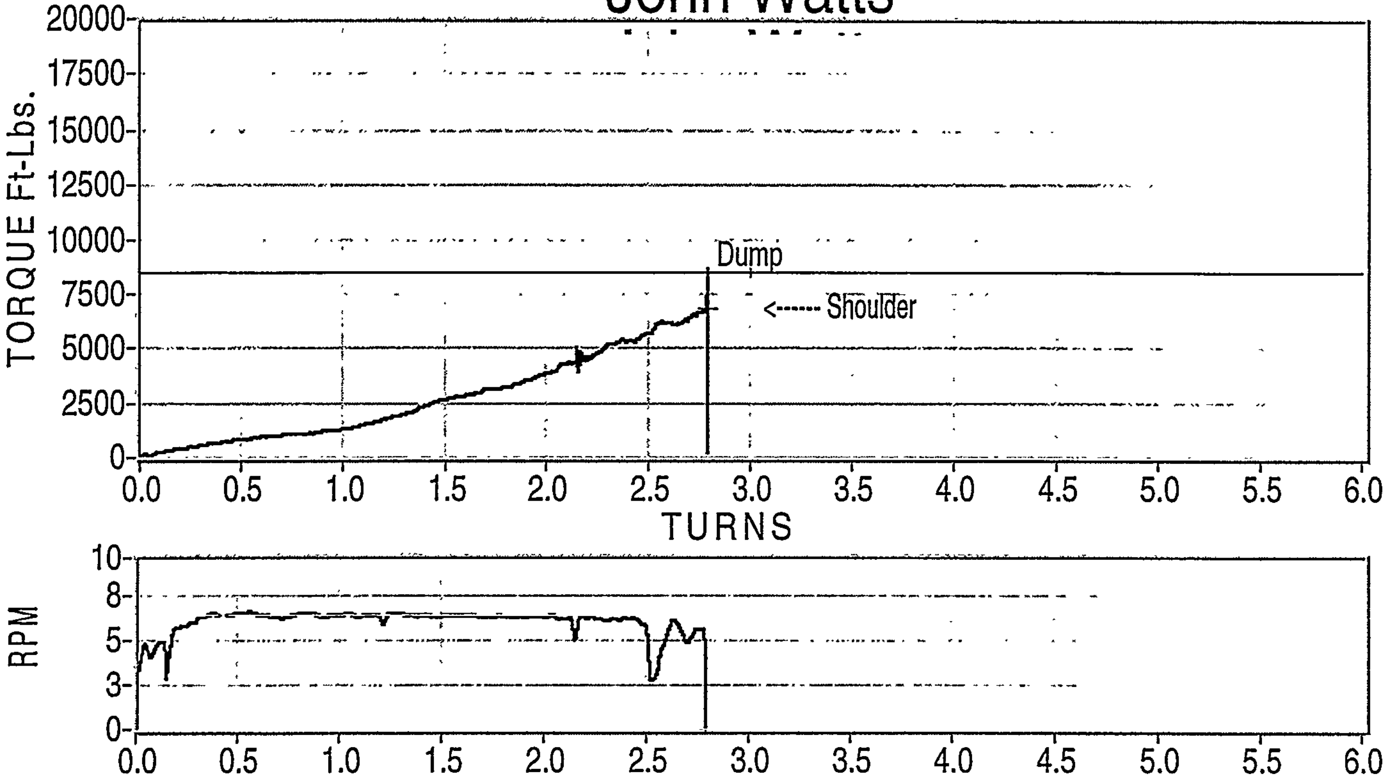
Date : Time of Test
06/15/1999 : 10:12:30 AM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp

MakeUp # 1		
Pin Id : 15B	**Box Id : 4**	
File Name : TT_0319.dat		
Maximum Torque	**8705**	**Ft-Lbs**
Shoulder Torque	**6812**	**Ft-Lbs**
Delta Torque	**1893**	**Ft-Lbs**
Turns @ Max. Torque	**2.789**	**Turns**
Shoulder Turns	**2.791**	**Turns**
Delta Turns	**-0.002**	**Turns**
Total Turns	**2.791**	**Turns**
Pin Dope	**19**	**Grams**
Box Dope	**22**	**Grams**

Operator:
Greg Stafford

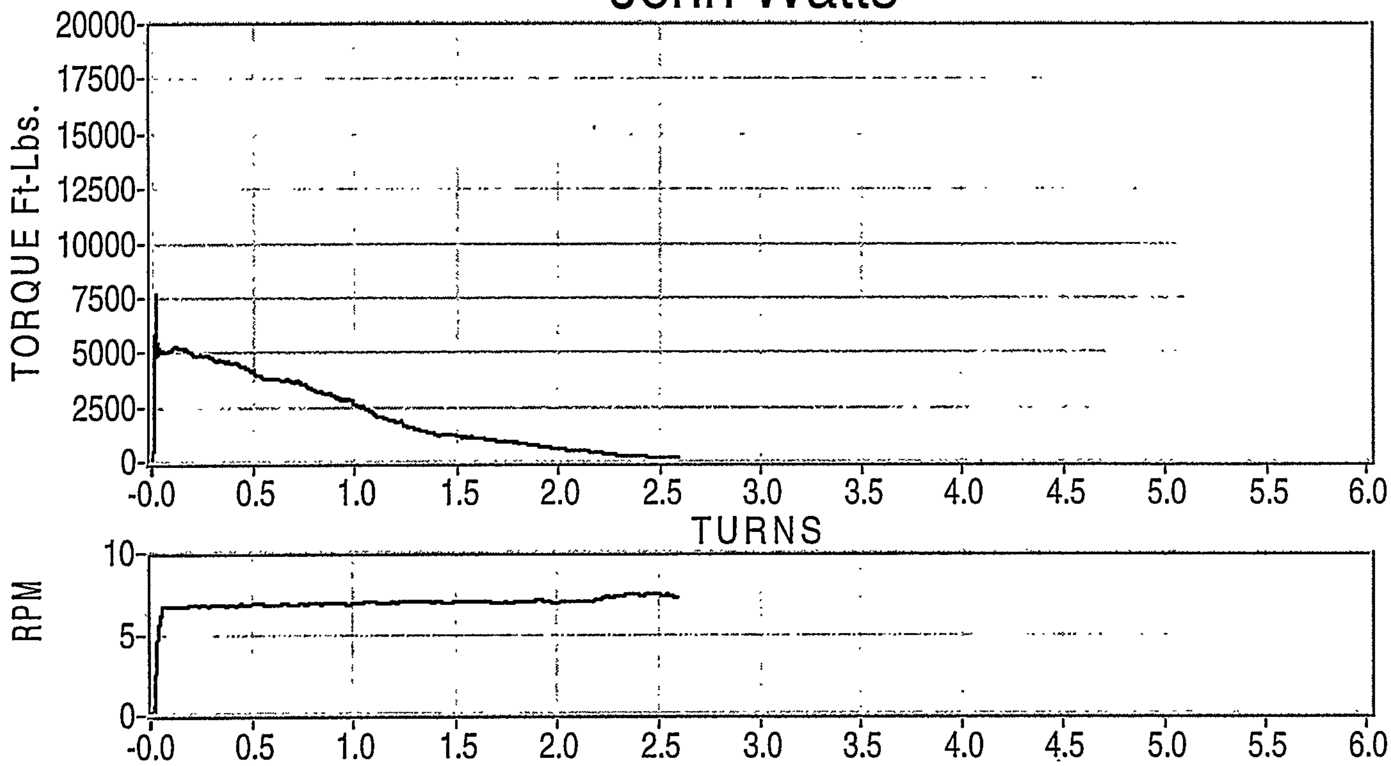
Date:Time of Test
06/15/1999 : 9:23:31 AM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size 7.000 in.

John Watts



BreakOut

BreakOut # 1	
Pin Id : 15B	Box Id : 4
File Name : TT_0320.dat	
Maximum Torque	7737 Ft-Lbs

Operator :
Greg Stafford

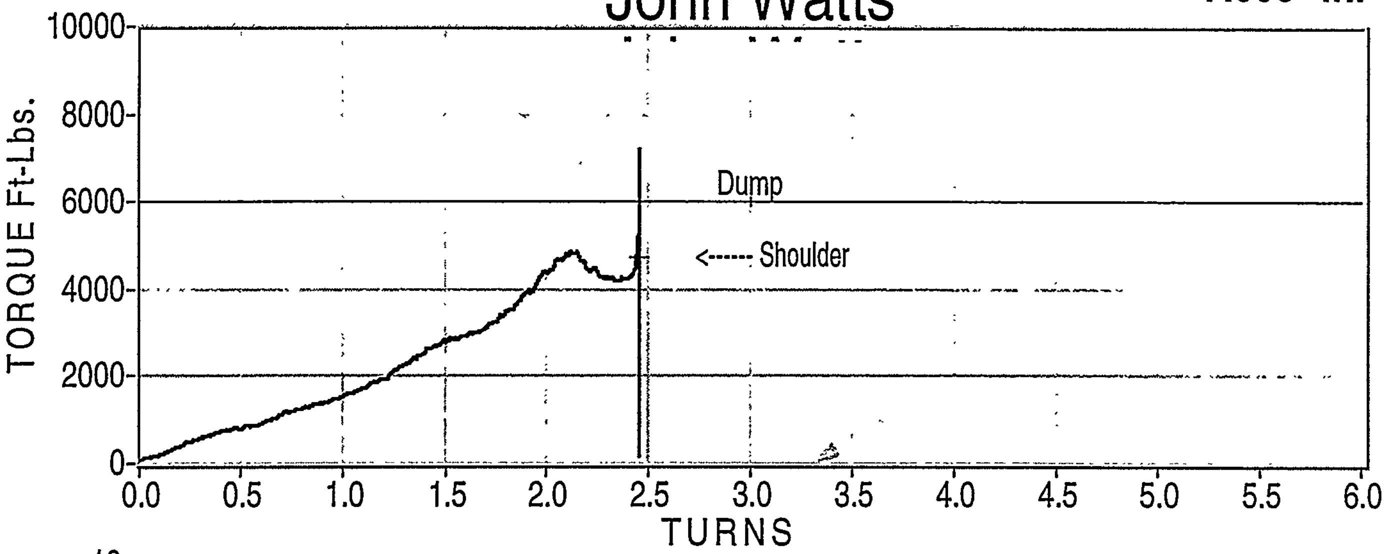
Date : Time of Test
06/15/1999 : 9:27:09 AM

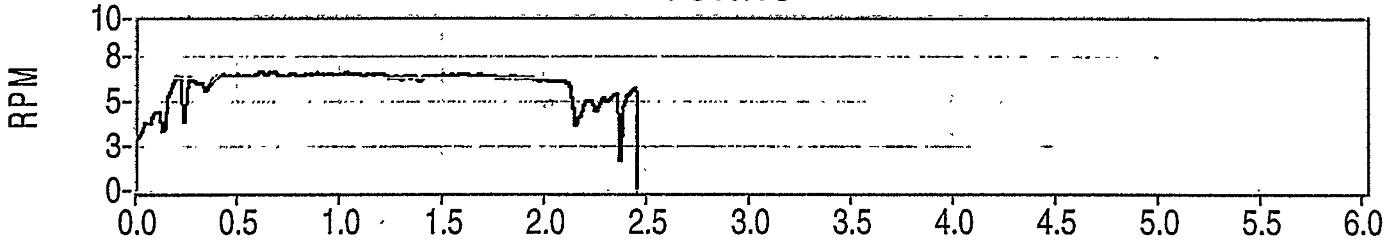
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 1	
Pin Id : 16A	Box Id : 9
File Name : TT_0323.dat	

Maximum Torque	7229	Ft-Lbs
Shoulder Torque	4726	Ft-Lbs
Delta Torque	2503	Ft-Lbs
Turns @ Max. Torque	2.459	Turns
Shoulder Turns	2.459	Turns
Delta Turns	0.000	Turns
Total Turns	2.459	Turns
Pin Dope	19	Grams
Box Dope	21	Grams

Operator:
Greg Stafford

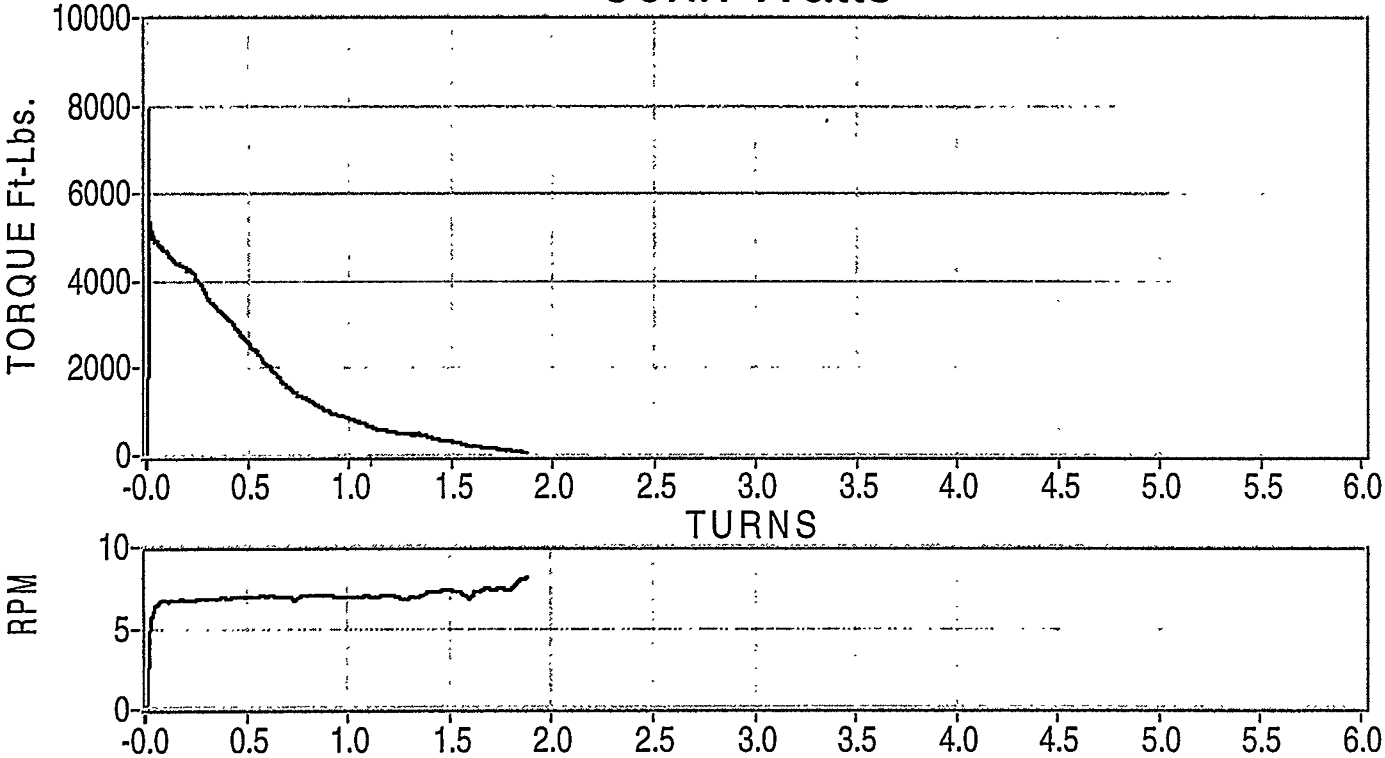
Date:Time of Test
06/15/1999 : 2:23:30 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts



BreakOut

BreakOut # 1	
Pin Id : 16A	Box Id : 9
File Name : TT_0324.dat	
Maximum Torque	7929 Ft-Lbs

Operator :
Greg Stafford

Date : Time of Test
06/15/1999 : 2:26:20 PM

JOHN WATTS CASING CONNECTION
MAKEUP PROCEDURE
7" X 32# P-110
June 14, 1999

TEST SAMPLES IDENTIFIED AS NUMBERS –

- "FJC" Coupled = 1, 2, 3 &4
- "FJ80" Flush = 5 & 6

THREAD COMPOUND TYPE = SHELL 72732 & BOL 2000

- First two makeups use Shell dope
- If no galling, third makeup use BOL dope.
- After third makeup, see John Watts.

COMPOUND AMOUNT APPLIED = ¼ TO ½ FILL THREADS ON BOTH PIN & BOX

RECOMMENDED MAKEUP TORQUE = Initial calculated torques are:
FJC Coupled = 13,000 min. ft-lbs / 15,000 ft-lbs max.
FJ80 Integral = New = 15,000 min. ft-lbs / 17,000 ft-lbs max.
= Used = 13,000 min. ft-lbs / 15,000 ft-lbs max.
Torques will be adjusted per these tests.

FINAL MAKEUPS- MAX TORQUE = SAMPLES 1, 3 & 5
MIN TORQUE = SAMPLES 2, 4 & 6

MAKEUP SPEED = 5 MIN / 9 MAX RPM

PLOT TORQUE/TURN FOR ALL MAKEUPS AND BREAKOUTS

EACH BREAKOUT - CLEAN THREADS ON PIN & BOX AND INPSECT FOR GALLING

FIELD REFURBISHING PROCEDURE: PER JOHN WATTS

- Dents and galling - Remove high spots using a file or emery cloth and clean thoroughly

RECORD ANY GALLING OBSERVED AND REFURBISHING PERFORMED
(tools used such as file or Dremel tool, sand/emery paper & grit, etc.)

PHOTOGRAPH - EQUIPMENT, TYPICAL SETUP, ALL GALLING & DENTS

PRELIMINARY MAKEUP SAMPLES:

1. FJC, COUPLED DESIGN

- First use coupling 15 and pins 3 and 4 for preliminary make/breaks to establish maximum torque and delta torque for maximum thread interference.
- Then use coupling 16 with pins 9 and 10 for preliminary make/breaks to establish maximum torque and delta torque for minimum thread interference.
- This info should establish recommended max. and min torques.
-

2. FJ80, INTEGRAL DESIGN

- Use box 21 and pin 24 and 4 for preliminary make/breaks to establish maximum torque and delta torque for maximum thread interference.
- JW to set minimum recommended torque.

TEST SAMPLE MAKEUPS:

COUPLED SAMPLES 1, 2, 3 & 4-

- All A ends of the couplings makeup one time only to maximum torque.
- Samples 1 and 3 - B end do 2 make/breaks to max. torque and third makeup to max. torque.
- Sample 2 B end – box 6 first and third makeups, box 12 second makeup, first two makeups to max. torque and final makeup to min. torque.
- Sample 4 B end – box 12 first and third makeups, box 6 second makeup, first two makeups to max. torque and final makeup to min. torque.
-

INTEGRAL SAMPLES 5 & 6-

Sample 5 – 2 make/breaks to max. torque and final makeup to max. torque.
Sample 6 —One makeup to min. torque.

Tom Asbill fax(281)955-2638 May 27, 1999
SES

Ref: DOE Tests; Make-up Characteristics.

As you know, torque calcs are very tricky depending on surface finish, hardness and such but for use as a guide my calcs are given below, and also the 8Rd torque taken from the Drillers Manual.

CONNECTION	TORQUE	STAB DEPTH	H.T. TURNS	P.T. TURNS
7- 32# P-110 FJC	13-15000	3.2 IN. +.1/-.03	4.9 -1/+.3	1.6 +/- .3
7- 32# P-110 FJ-80 NEW	15-17000	2.4 IN. +.1/-.03	5.1 -1/+.3	2.9 +/-.3
USED	13-15000	2.6 IN. +.1/-.03	3.6 -1/+.3	1.5 +/-.1
7- 32# P-110 API 8Rd	6730-11240	1.2 in. +/- .125	18 +/- 2	4.4 +/- 1

The make-up of the FJC is complete when it shoulders. The make-up of the FJ-80 is complete when the box face is even with the middle of the last full-thread root of the pin. The make-up turns above do not account for thread dope effect on hand-tight standoff, so perhaps the following procedure will.

1. Make-up the first connection to 150 ft-lbs torque and then measure the standoff.
2. Multiply the inches of standoff by 10 to get the remaining turns to full make-up.
3. Continue make-up of the connection that number of turns.

If you have reservations about this procedure or if you have a better procedure, please let me know.

I would like to review the entire set of tests with you or Bob a week before they begin.

I have placed a P.O. with Custom Threading Inc and the machining is to start Tuesday June 1 and should be finished by Friday. Is there any reason for not having it delivered to SES upon completion? Would you or anyone else at SES like to visit CTI while they are doing the job?

Thanks for finding the 41# pipe. Fax me a bill for all material and I'll have a check in the return mail.

Sincerely,

John D. Watts, P.E. (281)463-2312 phone or fax 5054 Stanhope, Houston, Tx 77084-3033

JOHN WATTS CASING CONNECTION
MAKEUP PROCEDURE
7" X 32# P-110
June 14, 1999

TEST SAMPLES IDENTIFIED AS NUMBERS –

- Coupled = 1, 2, 3 &4
- Flush = 5 & 6

THREAD COMPOUND TYPE = SHELL 72732 OR 72733 & BOL 2000

- First two makeups use Shell dope
- If no galling, third makeup use BOL dope.
- After third makeup, see John Watts.

COMPOUND AMOUNT APPLIED = ¼ TO ½ FILL THREADS ON BOTH PIN & BOX

RECOMMENDED MAKEUP TORQUE = TBD FT-LBS., MAX.
TBD FT-LBS., NOM.
TBD FT-LBS., MIN.

MAKEUP SPEED = 5 MIN - 9 MAX RPM

FINAL MAKEUPS- MAX TORQUE = SAMPLES 1, 3 & 5
MIN TORQUE = SAMPLES 2, 4 & 6

PLOT TORQUE/TURN FOR ALL MAKEUPS AND BREAKOUTS

EACH BREAKOUT - CLEAN THREADS ON PIN & BOX AND INPSECT FOR GALLING

FIELD REFURBISHING PROCEDURE: PER JOHN WATTS

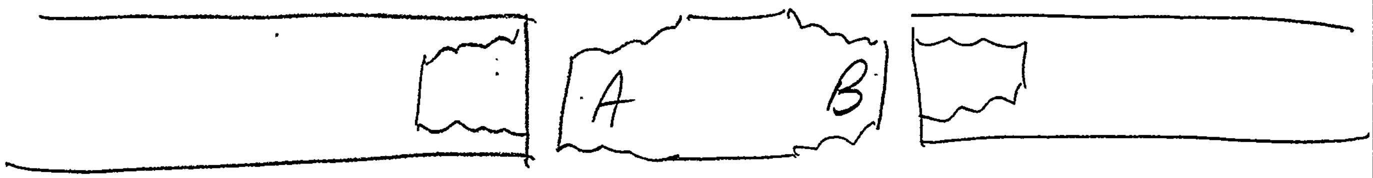
- Dents and galling - Remove high spots using a file or emery cloth and clean thoroughly

RECORD ANY GALLING OBSERVED AND REFURBISHING PERFORMED
(tools used such as file or Dremel tool, sand/emery paper & grit, etc.)

PHOTOGRAPH - EQUIPMENT, TYPICAL SETUP, ALL GALLING & DENTS

Client TWI	Project No. 5806	Page No. of	By WTH	Date 6/11/99
Subject			Checked By	Date

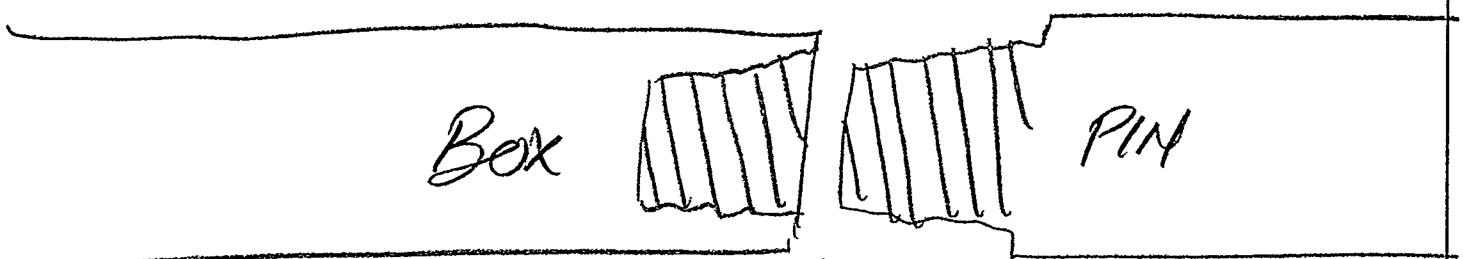
COUPLED SAMPLES



SAMPLE NO.	THD. INT.	BOX NO.	COUPLING NO.	BOX NO.
1	MAX.	1	13	3
2	MAX.	5	14	6
3	MIN.	7	17	8
4	MIN.	11	18	12
M/B PREL.	MAX	3	15	4
M/B PREL	MIN	9	16	10

Client JWI	Project No. 5806	Page No. of	By WTA	Date 6/11/99
Subject			Checked By	Date

FLUSHJOINT SAMPLES



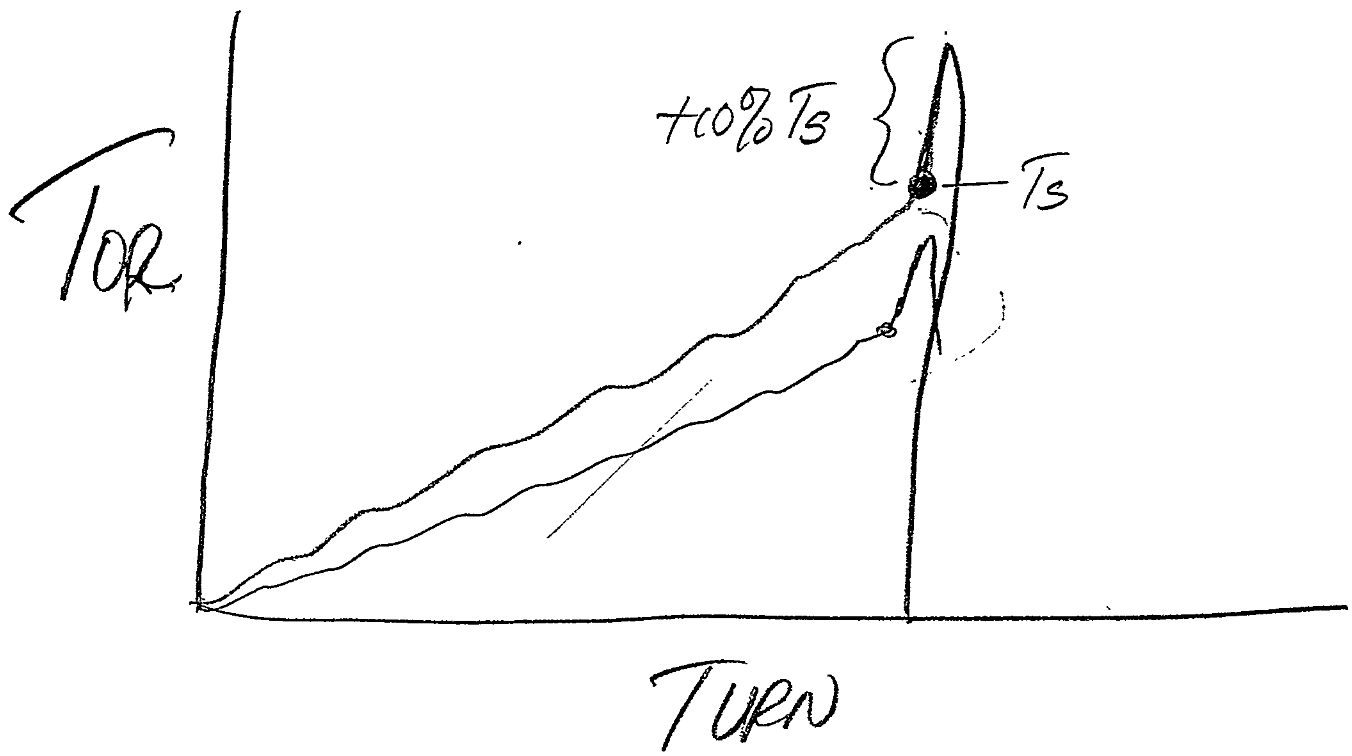
SAMPLE NO.	THD. INT.	BOX NO.	PIN NO.
5	MAX.	19	22
6	MIN.	20	23
M/B PREL.	MIN.	21	24

MAKEUP/BREAKOUT LOG
7" JOHN WATTS CASING CONNECTION

By: ____________ Date: ____________ Page ___ of ___

PIN NO.	BOX NO.	MAKEUP NO.	LUBR. GRAMS	PLANNED TORQUE	SHOULDER		FULL MAKEUP		SPEED RPM	BREAKOUT TORQUE	REFURBISHING & GALLING OBSERVATIONS
					TORQUE	TURNS	TORQUE	TURNS			

Client	Project No.	Page No. of	By	Date
Subject			Checked By	Date



APPENDIX E
PRELIMINARY MAKEUP/BREAKOUT DATA

PRELIMINARY MAKEUP/BREAKOUT SUMMARY
JOHN WATTS 7" FLUSH JOINT CONNECTION
07-Jul-99

PIN NO.	BOX NO.	MAKEUP NO.	LUBR. GRAMS	PLANNED TORQUE	SHOULDER		FULL MAKEUP		SPEED RPM	BREAKOUT TORQUE	COMMENTS
					TORQUE	TURNS	TORQU	TURNS			
15A	4	1	API-30	3TURNS	N/A	N/A	7,424	2.912	3.5	NONE	
		2	SAME	8400	N/A	N/A	8,522	0.027	2.5	8,780	0.002" Gap at shoulder
		3	API-26	8500	7,454	2.085	8,478	2.133	3.500	12,585	0.002" Gap at shoulder
		4	API-23	10,500	N/A	N/A	10,691	2.021	3.500	11,957	Less than 0.002" gap at shoulder
		5	API-25	12,500	5,201	1.983	11,628	2.185	3.500	NONE	Shoulder yielded
15B	5	1	BOL-21	10,000	5,646	2.914	9,013	3.004	3.500	8,145	Shoulder yielded
		2	BOL-18	7000	N/A	N/A	6,941	1.82	3.5	7,564	
		3	BOL-20	7000	N/A	N/A	6,975	2.097	3.5	7,855	
		4	BOL-21	7000	N/A	N/A	7,003	2.066	3.5	6,681	
		5	BOL-22	7000	N/A	N/A	7,028	2.093	3.5	7,569	
17A	8	1	BOL-20	7000	6,019	2.74	7,143	2.739	3.5	7,608	
		2	BOL022	7400	4,863	1.97	7,553	1.986	3.5	7,154	
		3	BOL-23	7400	4,724	1.827	7,648	1.843	3.5	7,400	
		4	SAME	7400	4,545	1.748	7,583	1.764	3.5	8,121	
		5	BOL-19	6400	5,619	2.009	6,665	2.015	3.5	NONE	
17B	10	1	BOL-20	7400	5,956	2.816	7,521	2.834	3.5	8,141	
		2	SAME	7400	5,650	1.814	7,476	1.826	3.5	8,027	
		3	SAME	7400	6,355	1.956	7,526	1.967	3.5	8,295	
		4	SAME	7400	6,300	2.001	7,473	2.001	3.5	8,403	Field repair 4th box inside thread
		5	BOL-25	6400	5,437	2.352	6,586	2.362	3.5	NONE	
24	21	1	BOL-26	3.75 turns	N/A	N/A	4,771	3.757	3.5	5,171	
		2	BOL-20	4800	N/A	N/A	4,717	2.24	3.5	4,682	
		3	BOL-21	4800	N/A	N/A	4,721	2.306	3.5	4,999	
		4	BOL-19	4800	N/A	N/A	4,752	2.107	3.5	5,053	
		5	BOL-20	4800	N/A	N/A	4,737	2.081	3.5	NONE	

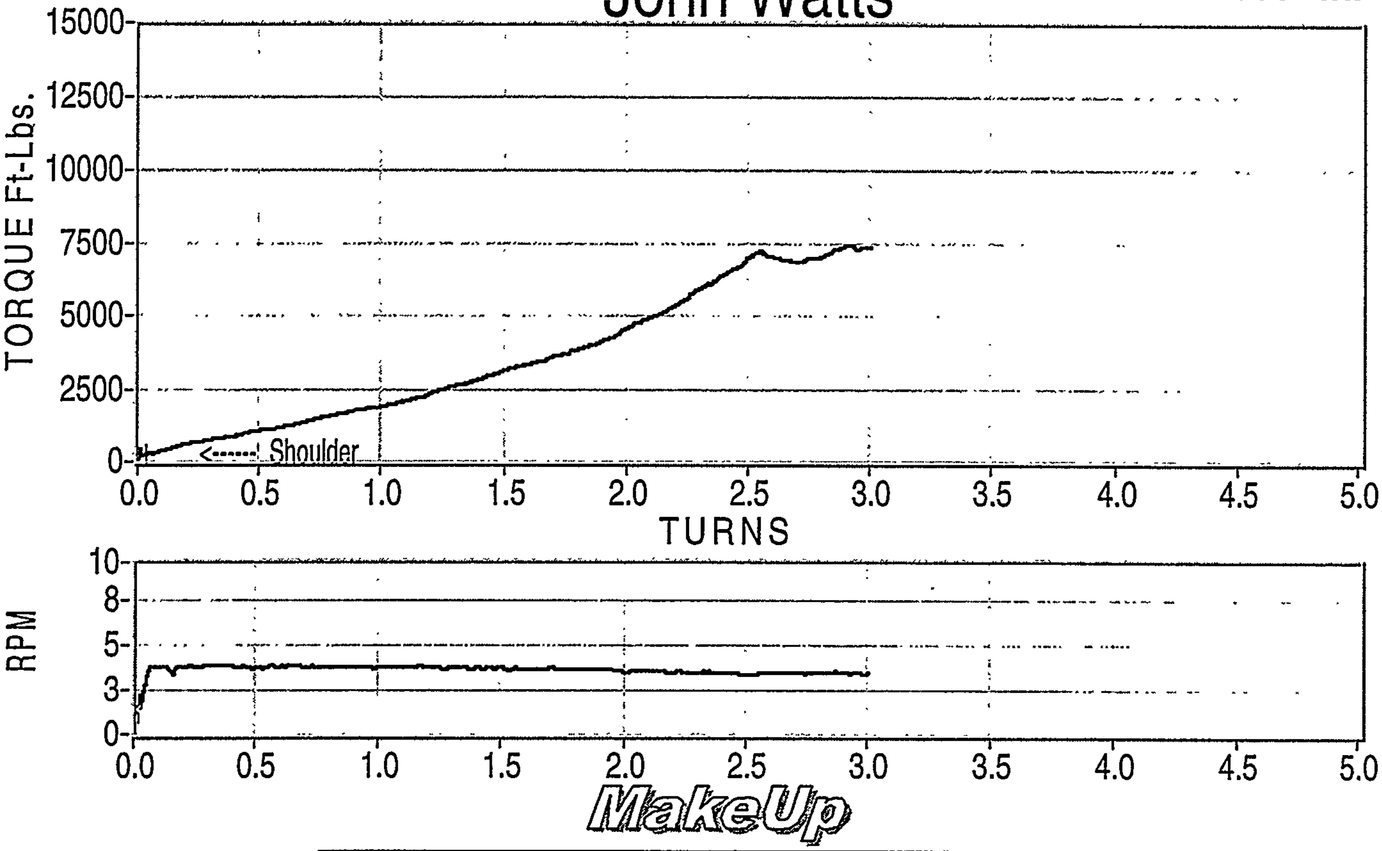
ONLY GALLING WAS FOURTH BREAKOUT OF PIN 17B AND BOX 10.

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp # 1		
Pin Id : 15A	Box Id : 4	
File Name : TT_0017.dat		
Maximum Torque	7424	Ft-Lbs
Shoulder Torque	225	Ft-Lbs
Delta Torque	7199	Ft-Lbs
Turns @ Max. Torque	2.912	Turns
Shoulder Turns	0.039	Turns
Delta Turns	2.872	Turns
Total Turns	3.004	Turns
Pin Dope	0	Grams
Box Dope	30	Grams

Operator:
Greg Stafford

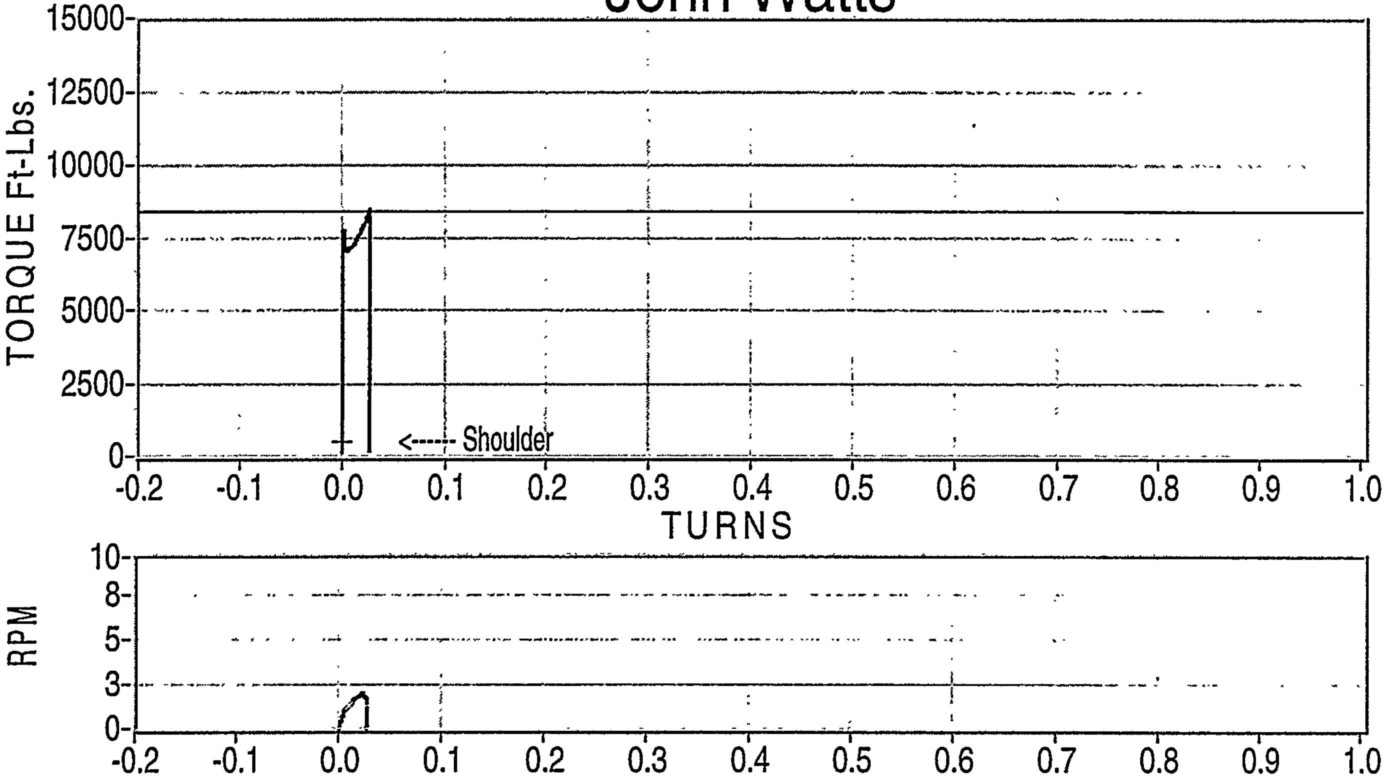
Date:Time of Test
07/07/1999 : 1:13:40 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp

MakeUp # 2	
Pin Id : 15A	Box Id : 4
File Name : TT_0018.dat	

Maximum Torque	8522	Ft-Lbs
Shoulder Torque	468	Ft-Lbs
Delta Torque	8054	Ft-Lbs
Turns @ Max. Torque	0.027	Turns
Shoulder Turns	0.000	Turns
Delta Turns	0.027	Turns
Total Turns	0.028	Turns
Pin Dope	0	Grams
Box Dope	30	Grams

Operator:
Greg Stafford

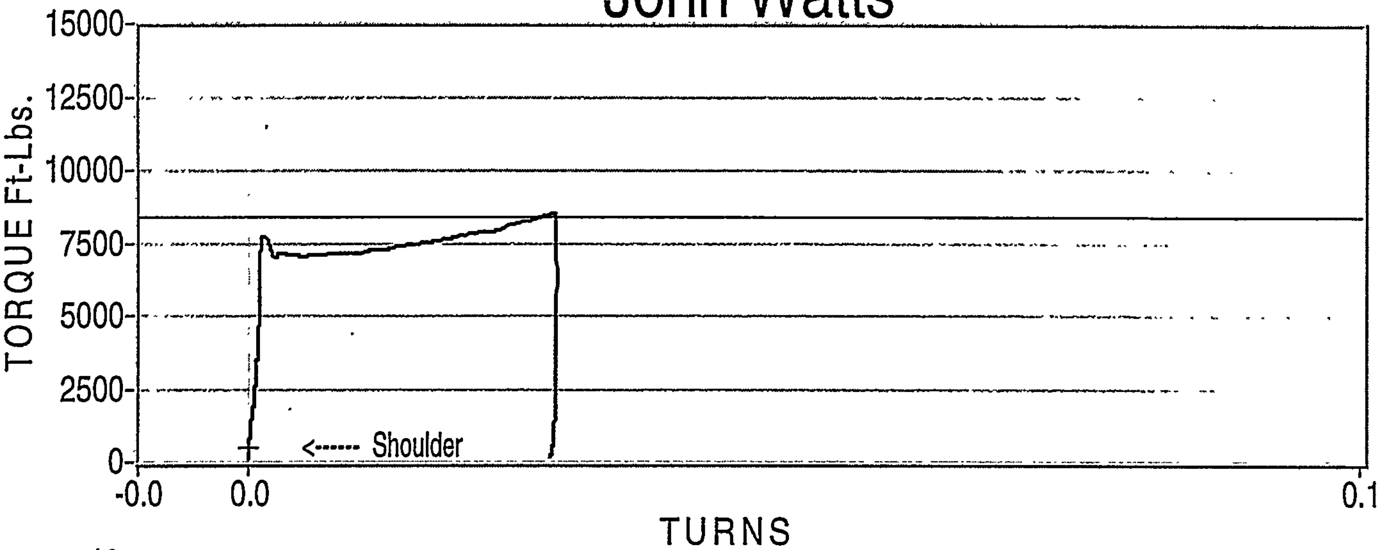
Date:Time of Test
07/07/1999 : 1:18:15 PM

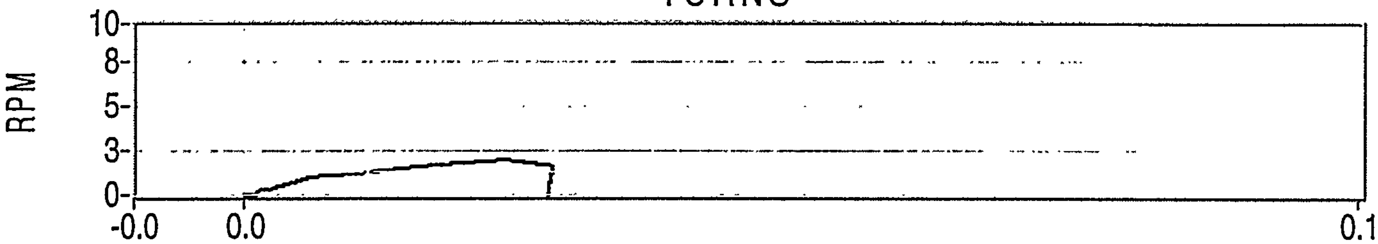
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 2	
Pin Id : 15A	Box Id : 4
File Name : TT_0018.dat	

Maximum Torque	8522	Ft-Lbs
Shoulder Torque	468	Ft-Lbs
Delta Torque	8054	Ft-Lbs
Turns @ Max. Torque	0.027	Turns
Shoulder Turns	0.000	Turns
Delta Turns	0.027	Turns
Total Turns	0.028	Turns
Pin Dope	0	Grams
Box Dope	30	Grams

Operator:
Greg Stafford

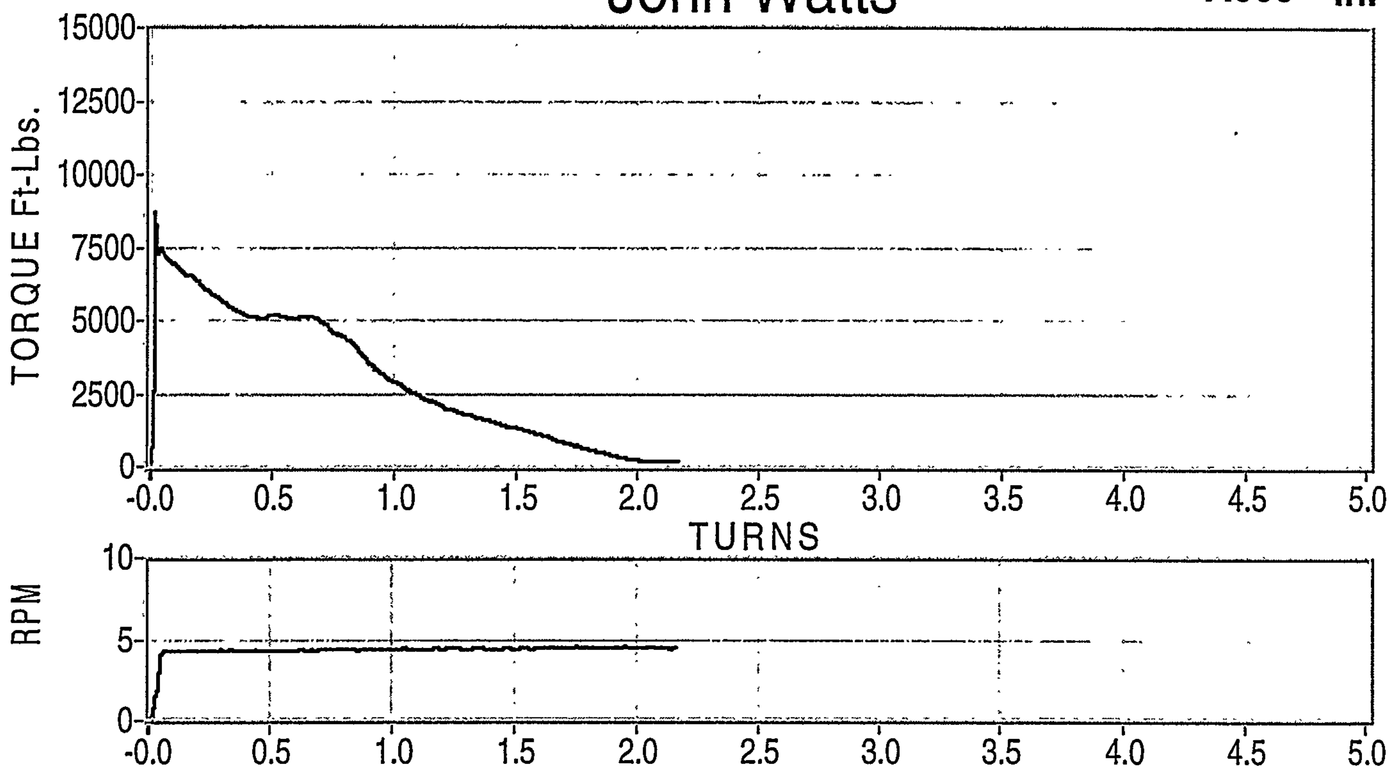
Date:Time of Test
07/07/1999 : 1:18:15 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts



BreakOut

BreakOut # 1	
Pin Id : 15A	**Box Id :** 4
File Name : TT_0019.dat	
Maximum Torque	8780 Ft-Lbs

Operator :
Greg Stafford

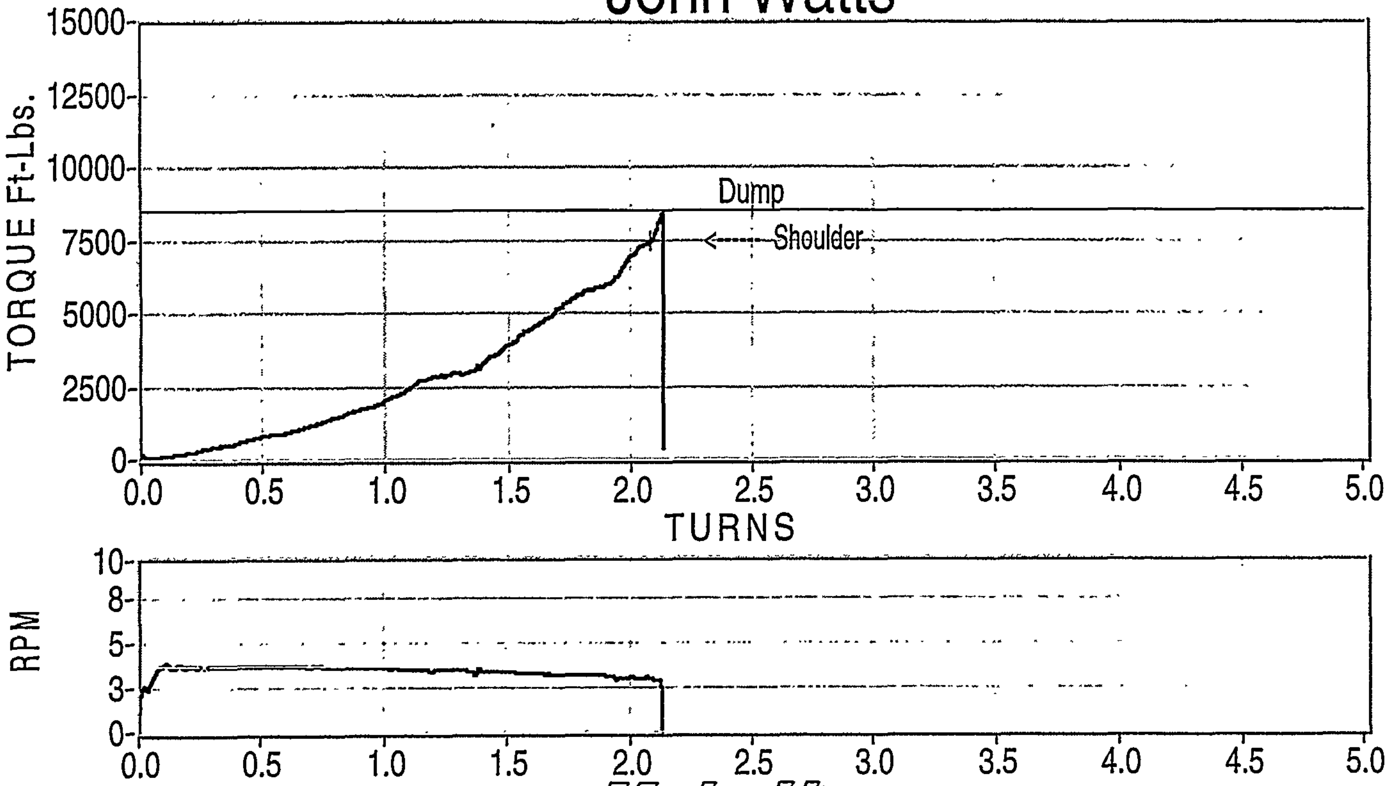
Date : Time of Test
07/07/1999 : 1:23:15 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp

MakeUp # 3	
Pin Id : 15A	**Box Id : 4**
File Name : TT_0020.dat	

Maximum Torque	8478	Ft-Lbs
Shoulder Torque	7454	Ft-Lbs
Delta Torque	1024	Ft-Lbs
Turns @ Max. Torque	2.133	Turns
Shoulder Turns	2.085	Turns
Delta Turns	0.048	Turns
Total Turns	2.133	Turns
Pin Dope	0	Grams
Box Dope	26	Grams

Operator:
Greg Stafford

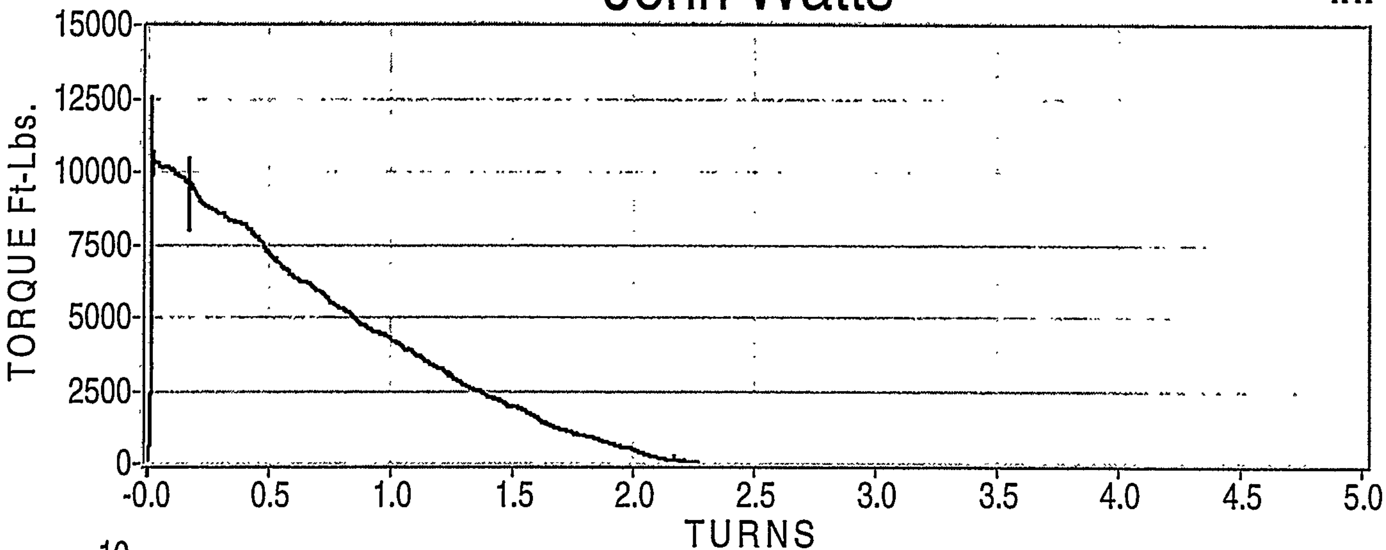
Date:Time of Test
07/07/1999 : 1:39:08 PM

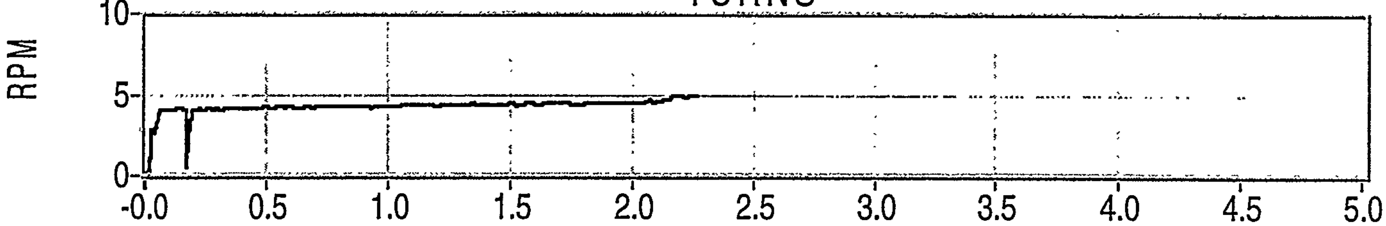
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts





BreakOut

BreakOut # 2	
Pin Id : 15A	Box Id : 4
File Name : TT_0021.dat	
Maximum Torque	12585 Ft-Lbs

Operator :
Greg Stafford

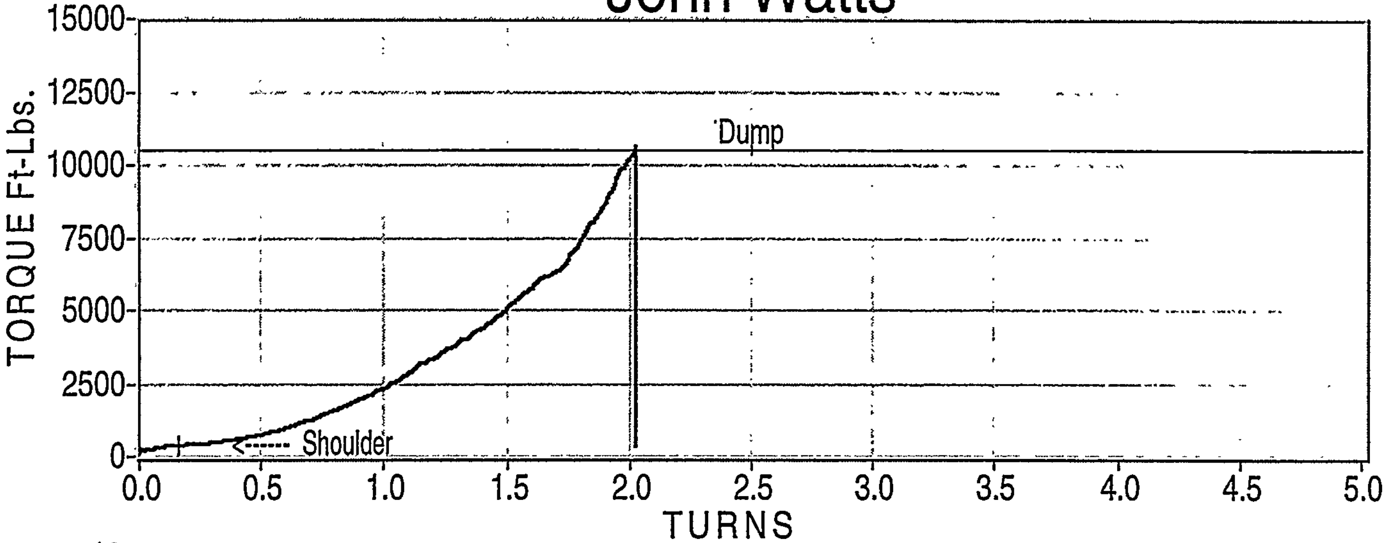
Date : Time of Test
07/07/1999 : 1:46:06 PM

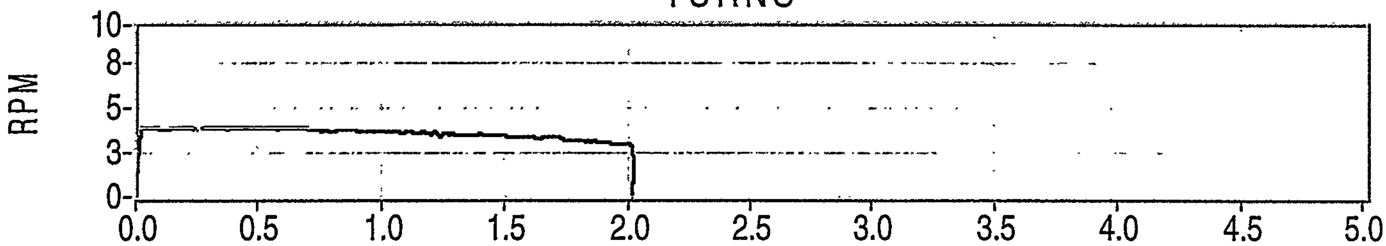
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 4	
Pin Id : 15A	Box Id : 4
File Name : TT_0022.dat	

Maximum Torque	10691	Ft-Lbs
Shoulder Torque	376	Ft-Lbs
Delta Torque	10314	Ft-Lbs
Turns @ Max. Torque	2.021	Turns
Shoulder Turns	0.164	Turns
Delta Turns	1.857	Turns
Total Turns	2.021	Turns
Pin Dope	0	Grams
Box Dope	23	Grams

Operator:
Greg Stafford

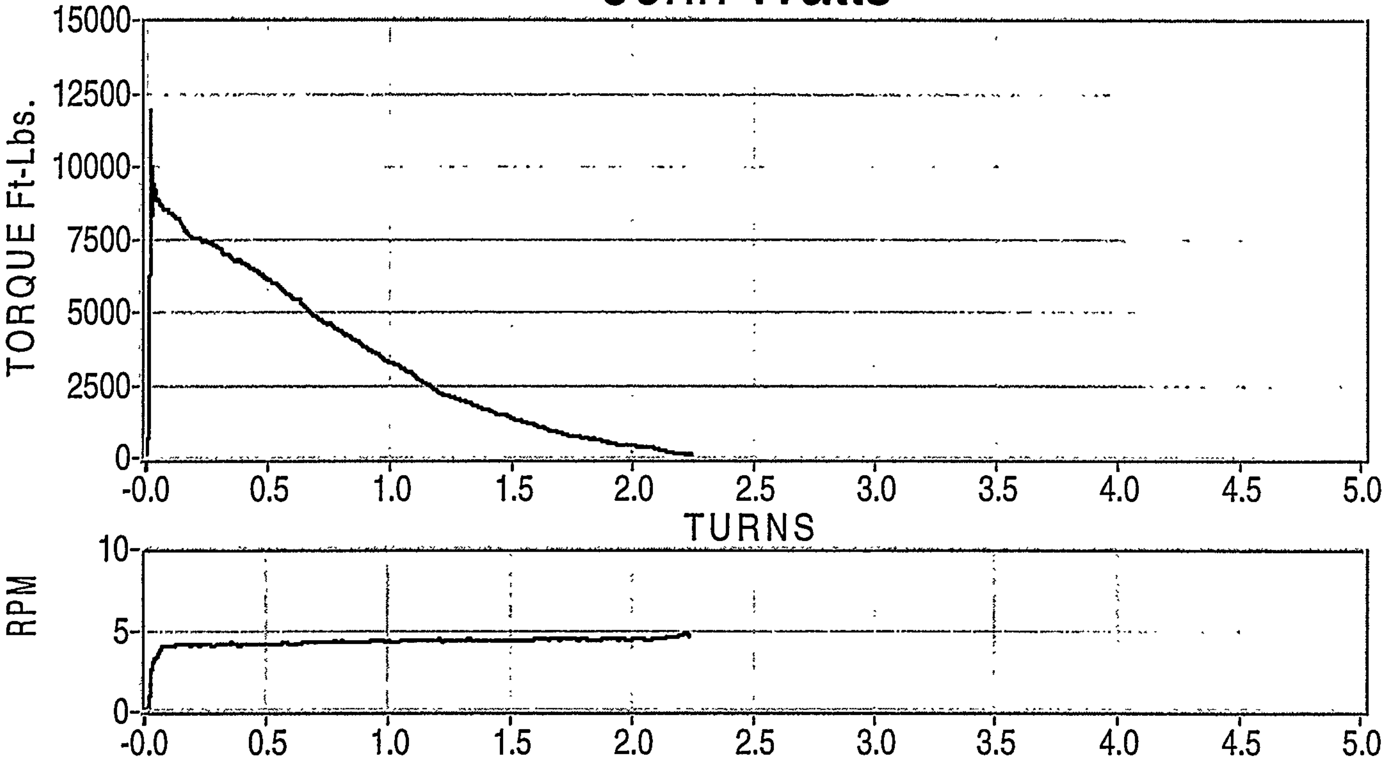
Date:Time of Test
07/07/1999 : 2:01:41 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts



BreakOut

BreakOut # 4	
Pin Id : 15A	**Box Id : 4**
File Name : TT_0023.dat	
Maximum Torque	**11957 Ft-Lbs**

Operator :
Greg Stafford

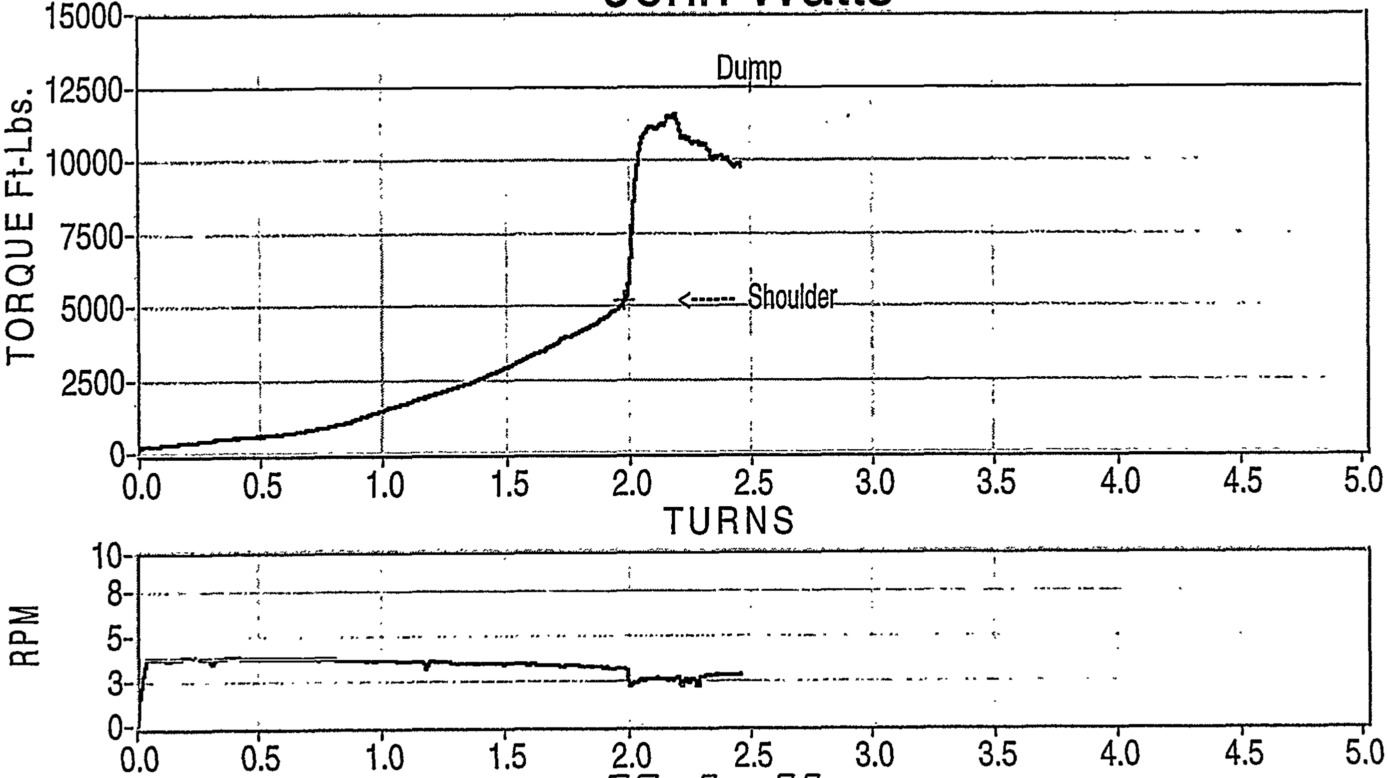
Date : Time of Test
07/07/1999 : 2:04:56 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp

MakeUp # 5		
Pin Id : 15A	**Box Id : 4**	
File Name : TT_0024.dat		
Maximum Torque	11628	Ft-Lbs
Shoulder Torque	5201	Ft-Lbs
Delta Torque	6426	Ft-Lbs
Turns @ Max. Torque	2.185	Turns
Shoulder Turns	1.983	Turns
Delta Turns	0.202	Turns
Total Turns	2.459	Turns
Pin Dope	0	Grams
Box Dope	25	Grams

Shell
72732

Operator:
Greg Stafford

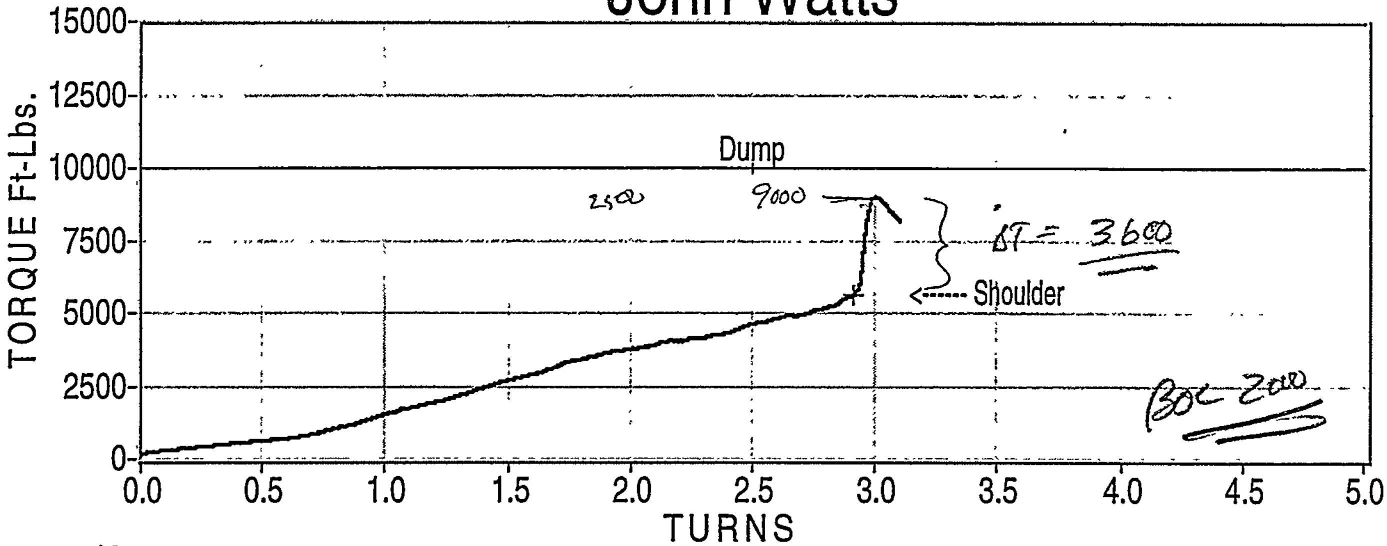
Date:Time of Test
07/07/1999 : 2:19:20 PM

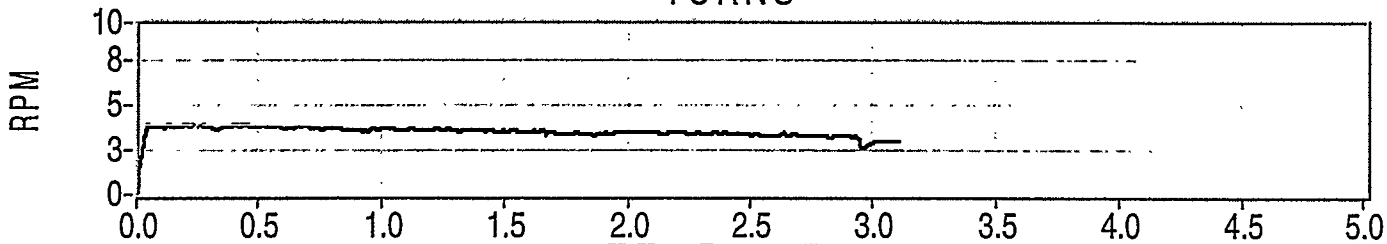
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 1		
Pin Id : 15B	Box Id : 5	
File Name : TT_0025.dat		
Maximum Torque	9013	Ft-Lbs
Shoulder Torque	5646	Ft-Lbs
Delta Torque	3367	Ft-Lbs
Turns @ Max. Torque	3.004	Turns
Shoulder Turns	2.914	Turns
Delta Turns	0.090	Turns
Total Turns	3.104	Turns
Pin Dope	0	Grams
Box Dope	21	Grams

Operator:
Greg Stafford

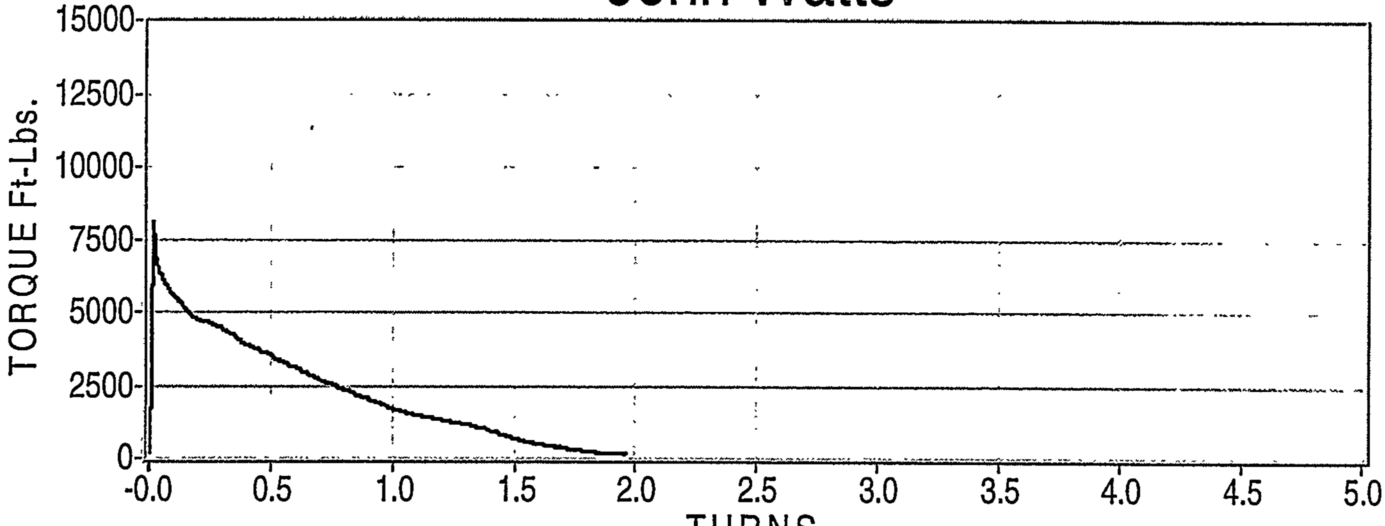
Date:Time of Test
07/07/1999 : 2:56:24 PM

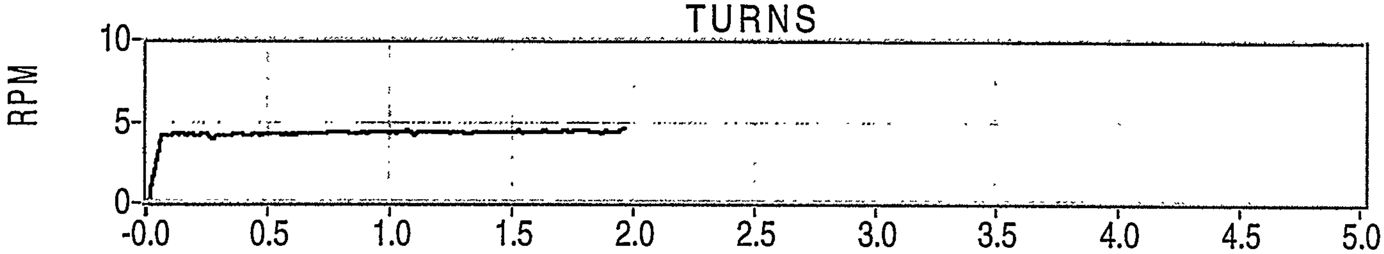
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts





BreakOut

BreakOut # 1	
Pin Id : 15B	Box Id : 5
File Name : TT_0026.dat	
Maximum Torque	8145 Ft-Lbs

Operator :
Greg Stafford

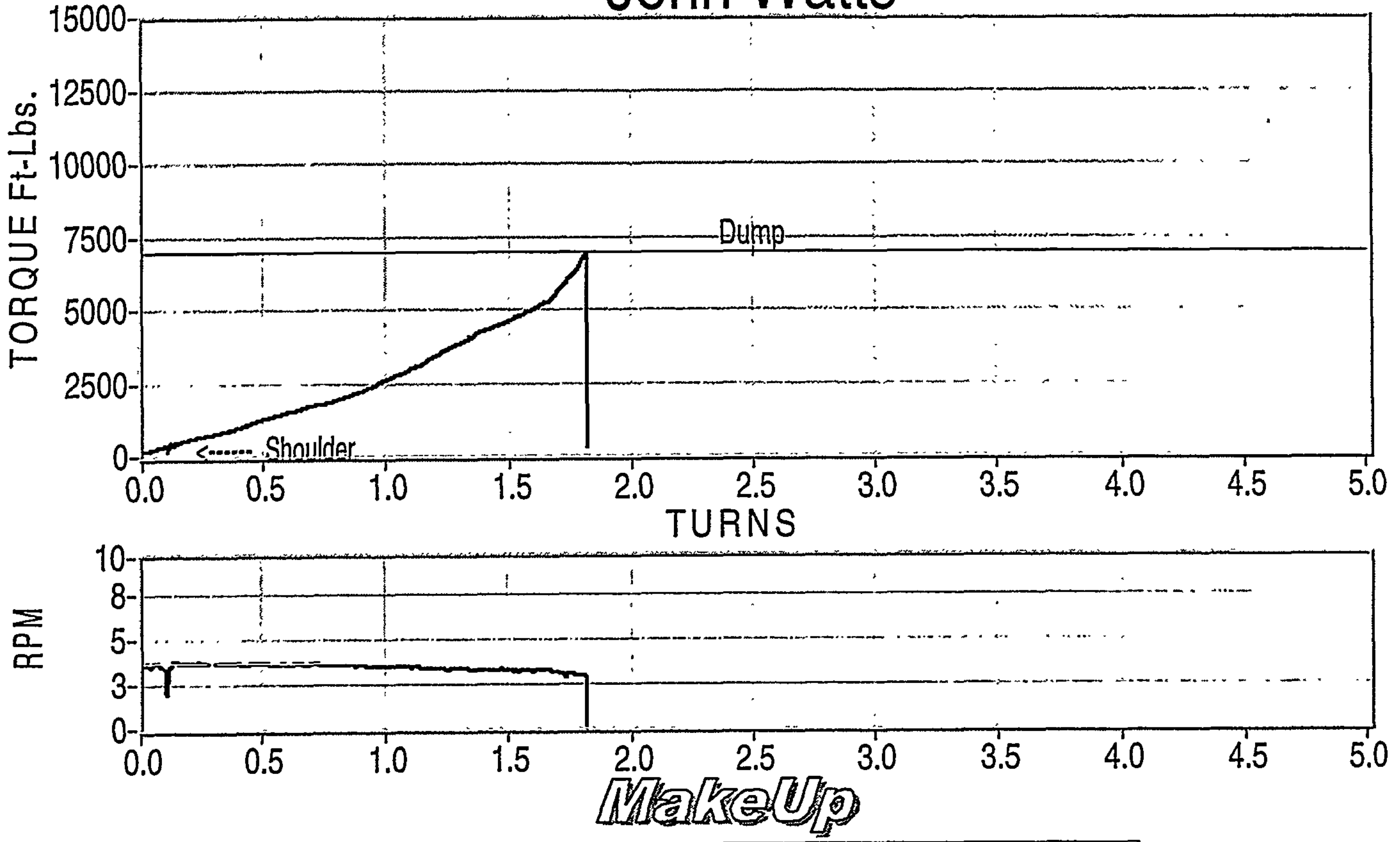
Date : Time of Test
07/07/1999 : 3:01:16 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp # 2	
Pin Id : 15B	Box Id : 5
File Name : TT_0027.dat	

Maximum Torque	6941	Ft-Lbs
Shoulder Torque	182	Ft-Lbs
Delta Torque	6759	Ft-Lbs
Turns @ Max. Torque	1.820	Turns
Shoulder Turns	0.000	Turns
Delta Turns	1.820	Turns
Total Turns	1.820	Turns
Pin Dope	0	Grams
Box Dope	18	Grams

Operator:
Greg Stafford

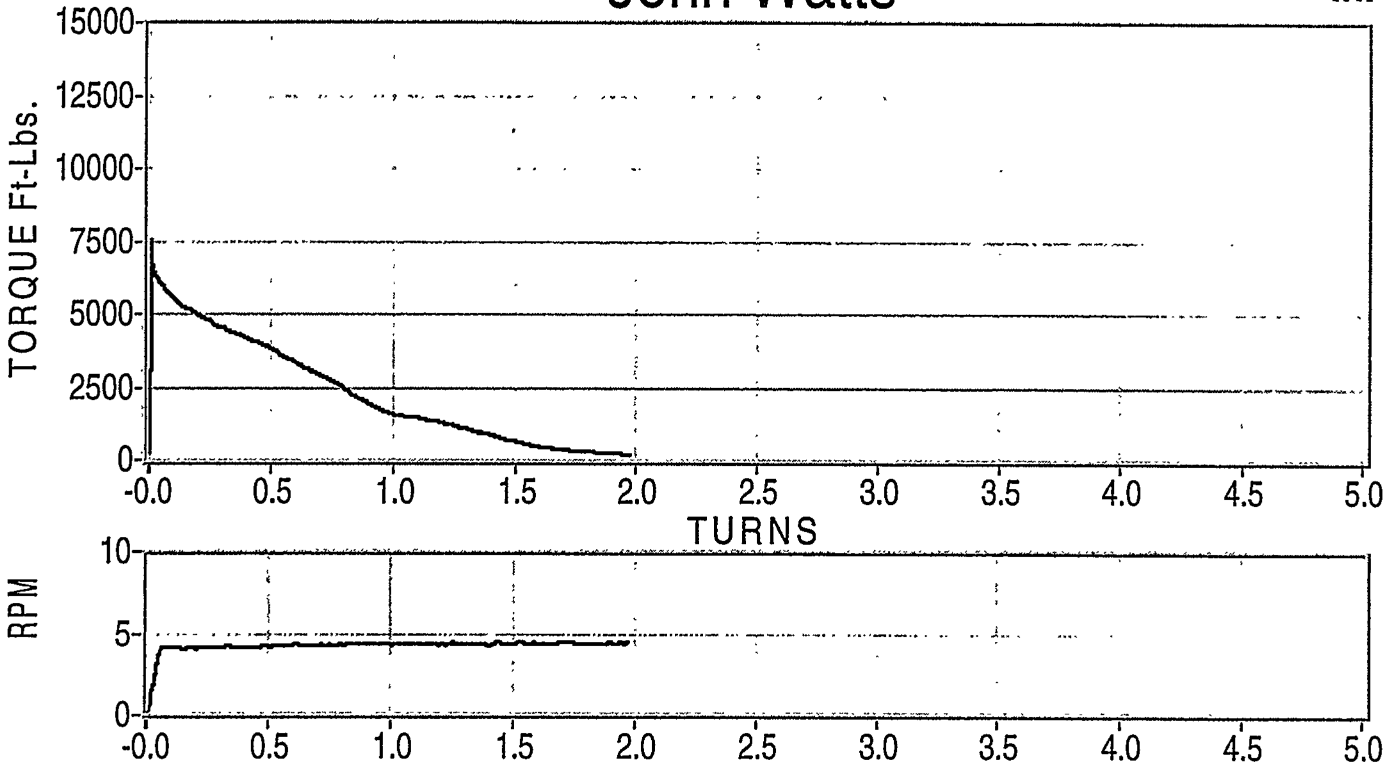
Date:Time of Test
07/07/1999 : 3:13:43 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts



BreakOut

BreakOut # 2	
Pin Id : 15B	Box Id : 5
File Name : TT_0028.dat	
Maximum Torque	7564 Ft-Lbs

Operator :
Greg Stafford

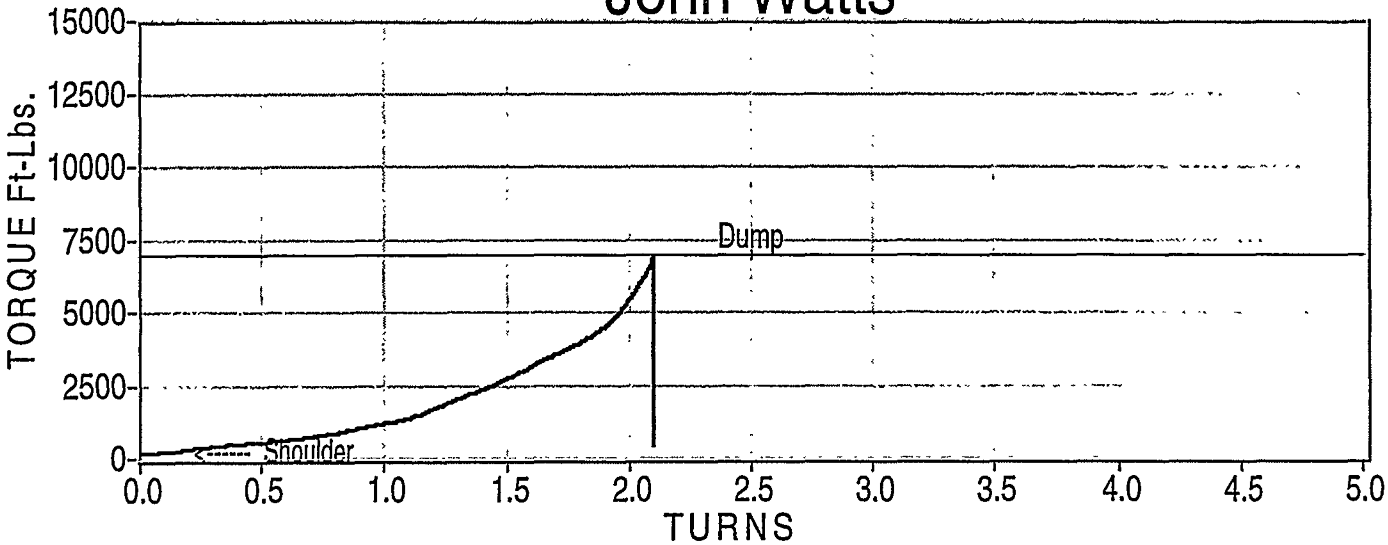
Date : Time of Test
07/07/1999 : 3:17:35 PM

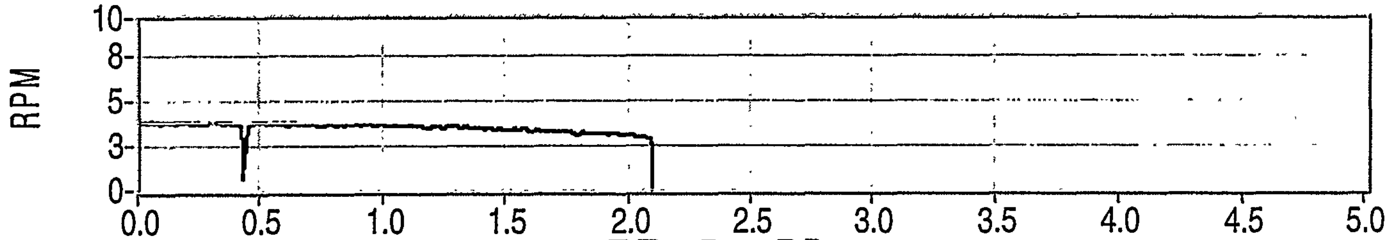
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 3	
Pin Id : 15B	Box Id : 5
File Name : TT_0029.dat	

Maximum Torque	6975	Ft-Lbs
Shoulder Torque	161	Ft-Lbs
Delta Torque	6814	Ft-Lbs
Turns @ Max. Torque	2.097	Turns
Shoulder Turns	0.000	Turns
Delta Turns	2.097	Turns
Total Turns	2.097	Turns
Pin Dope	0	Grams
Box Dope	20	Grams

Operator:
Greg Stafford

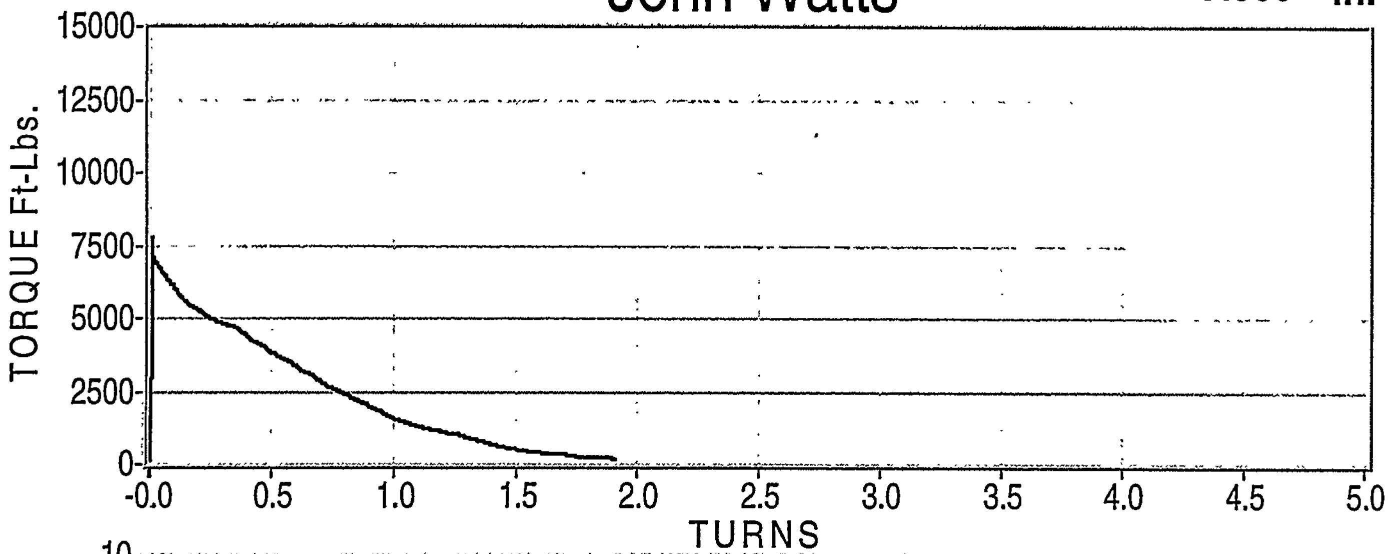
Date:Time of Test
07/07/1999 : 3:30:56 PM

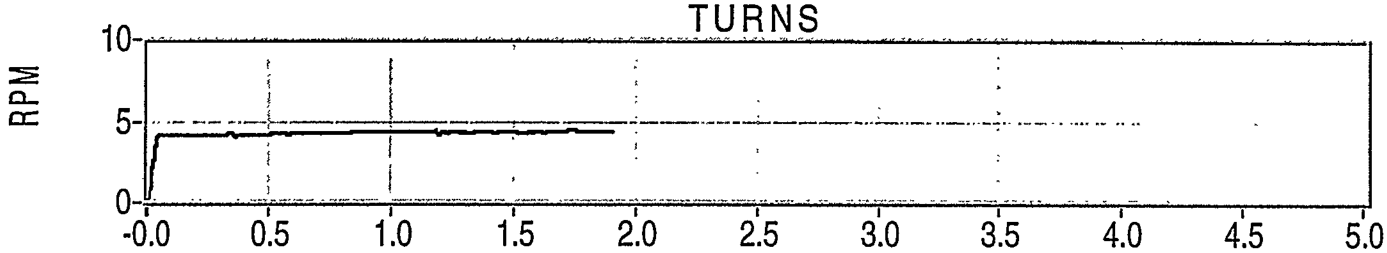
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts





BreakOut

BreakOut # 3	
Pin Id : 15B	Box Id : 5
File Name : TT_0030.dat	
Maximum Torque	7855 Ft-Lbs

Operator :
Greg Stafford

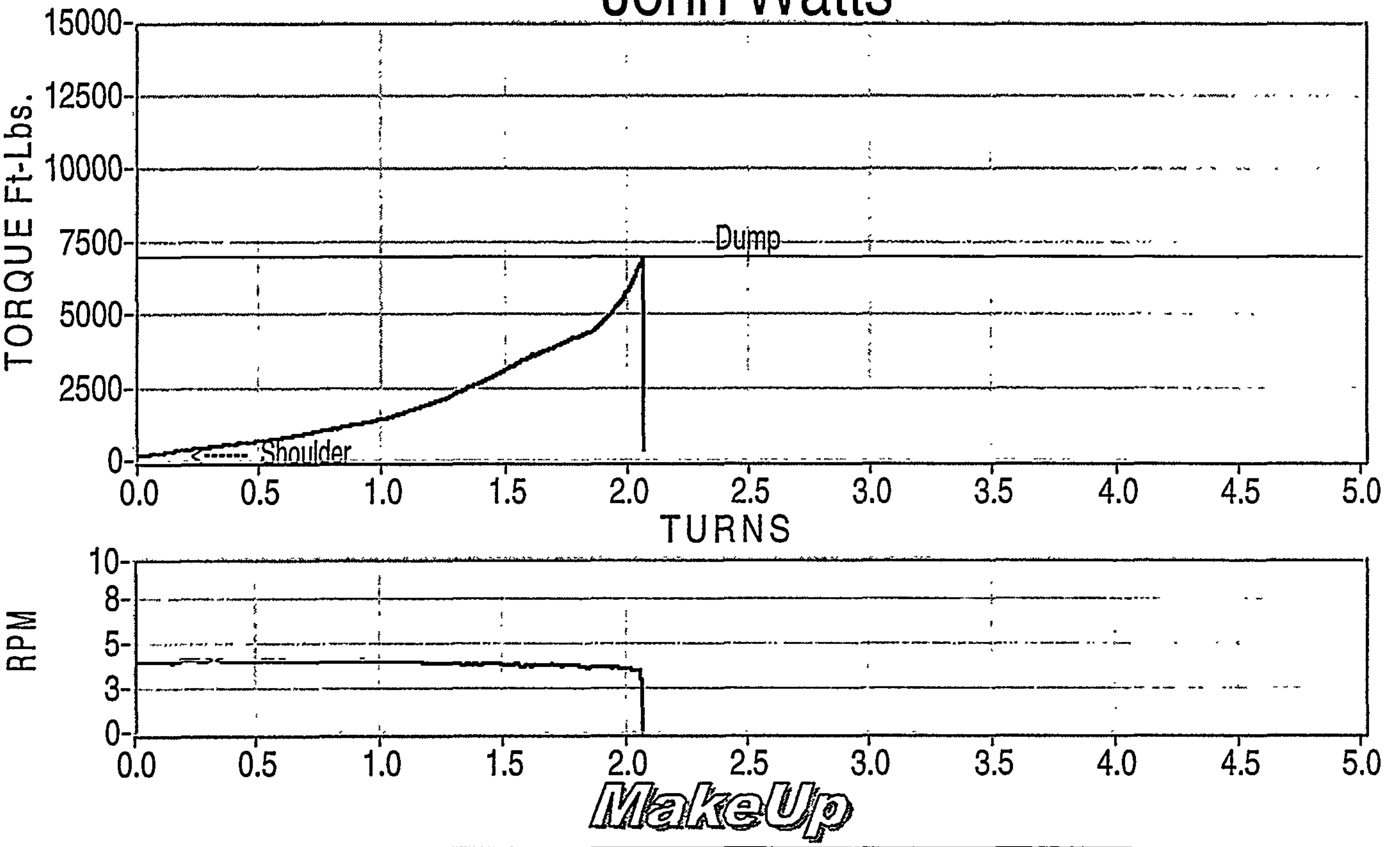
Date : Time of Test
07/07/1999 : 3:32:37 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp # 4	
Pin Id : 15B	**Box Id : 5**
File Name : TT_0031.dat	

Maximum Torque	7003	Ft-Lbs
Shoulder Torque	168	Ft-Lbs
Delta Torque	6834	Ft-Lbs
Turns @ Max. Torque	2.066	Turns
Shoulder Turns	0.000	Turns
Delta Turns	2.066	Turns
Total Turns	2.066	Turns
Pin Dope	0	Grams
Box Dope	21	Grams

Operator:
Greg Stafford

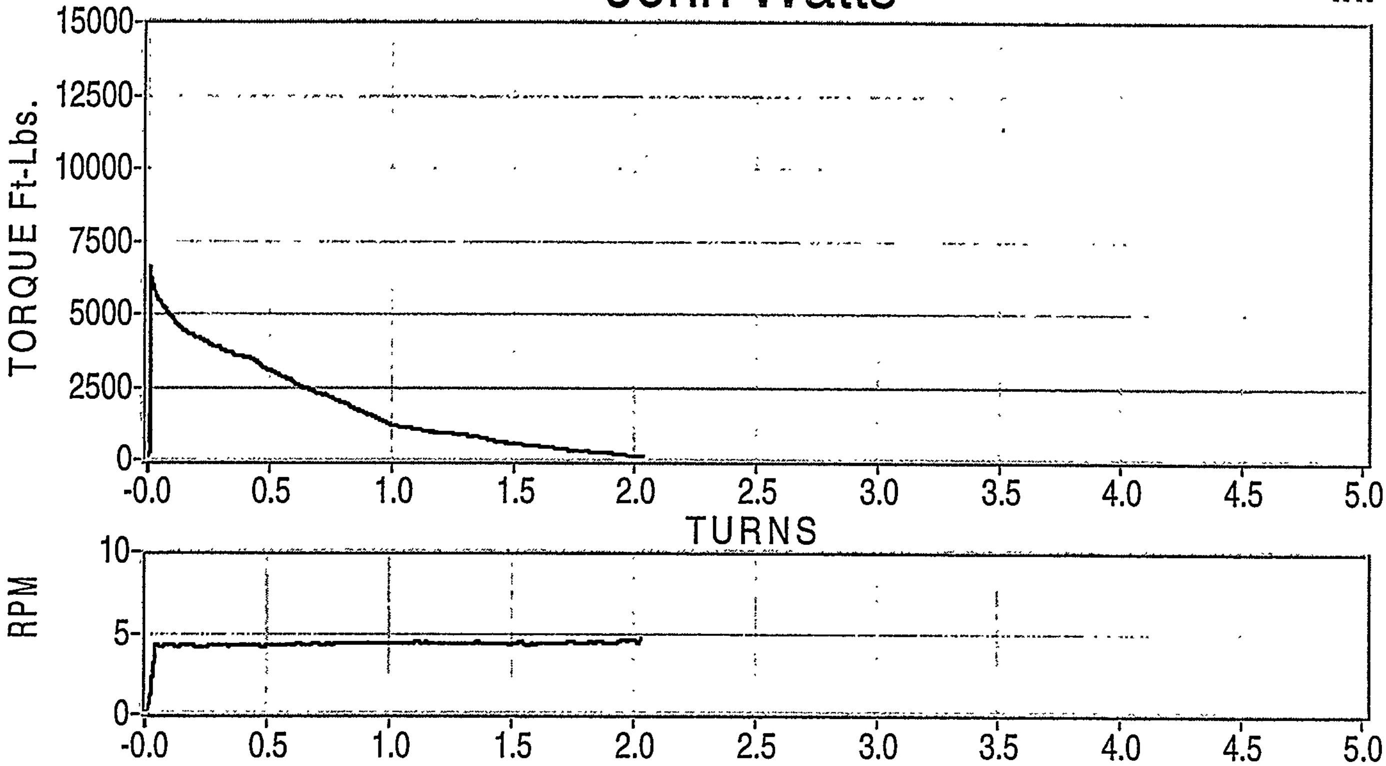
Date:Time of Test
07/07/1999 : 3:45:04 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts



BreakOut

BreakOut # 4	
Pin Id : 15B	Box Id : 5
File Name : TT_0032.dat	
Maximum Torque	6681 Ft-Lbs

Operator :
Greg Stafford

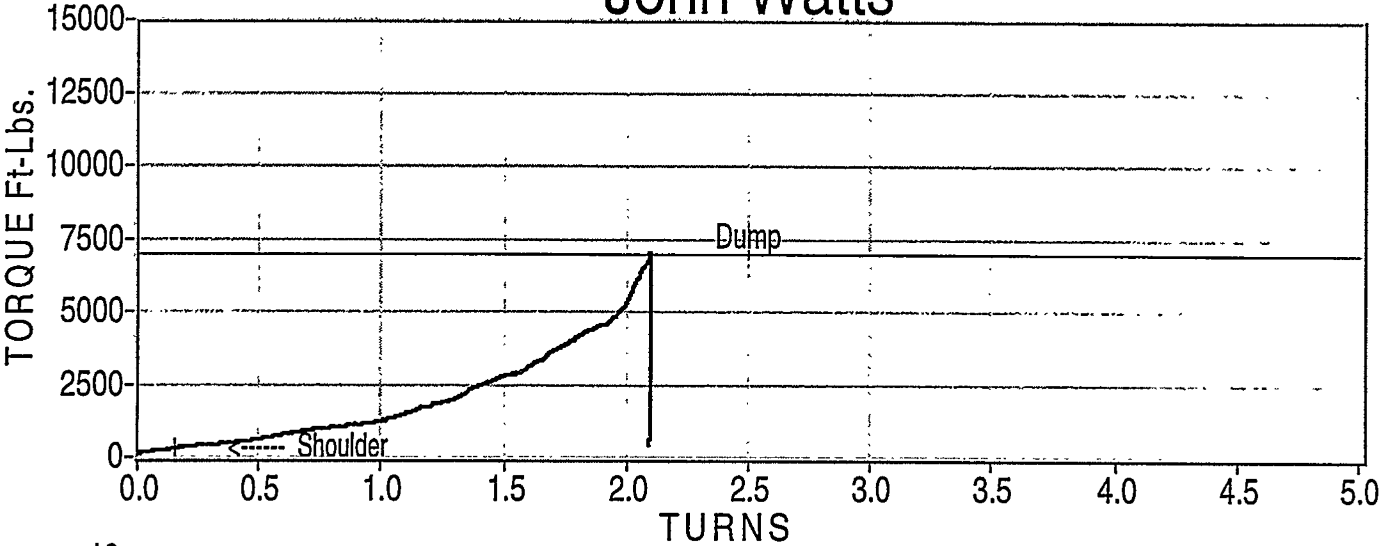
Date : Time of Test
07/07/1999 : 3:46:29 PM

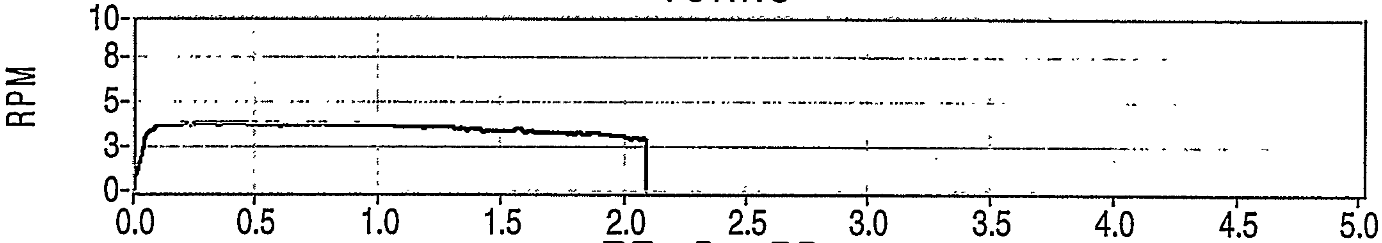
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 5		
Pin Id : 15B	Box Id : 5	
File Name : TT_0033.dat		
Maximum Torque	7028	Ft-Lbs
Shoulder Torque	310	Ft-Lbs
Delta Torque	6718	Ft-Lbs
Turns @ Max. Torque	2.093	Turns
Shoulder Turns	0.154	Turns
Delta Turns	1.939	Turns
Total Turns	2.093	Turns
Pin Dope	0	Grams
Box Dope	22	Grams

Operator:
Greg Stafford

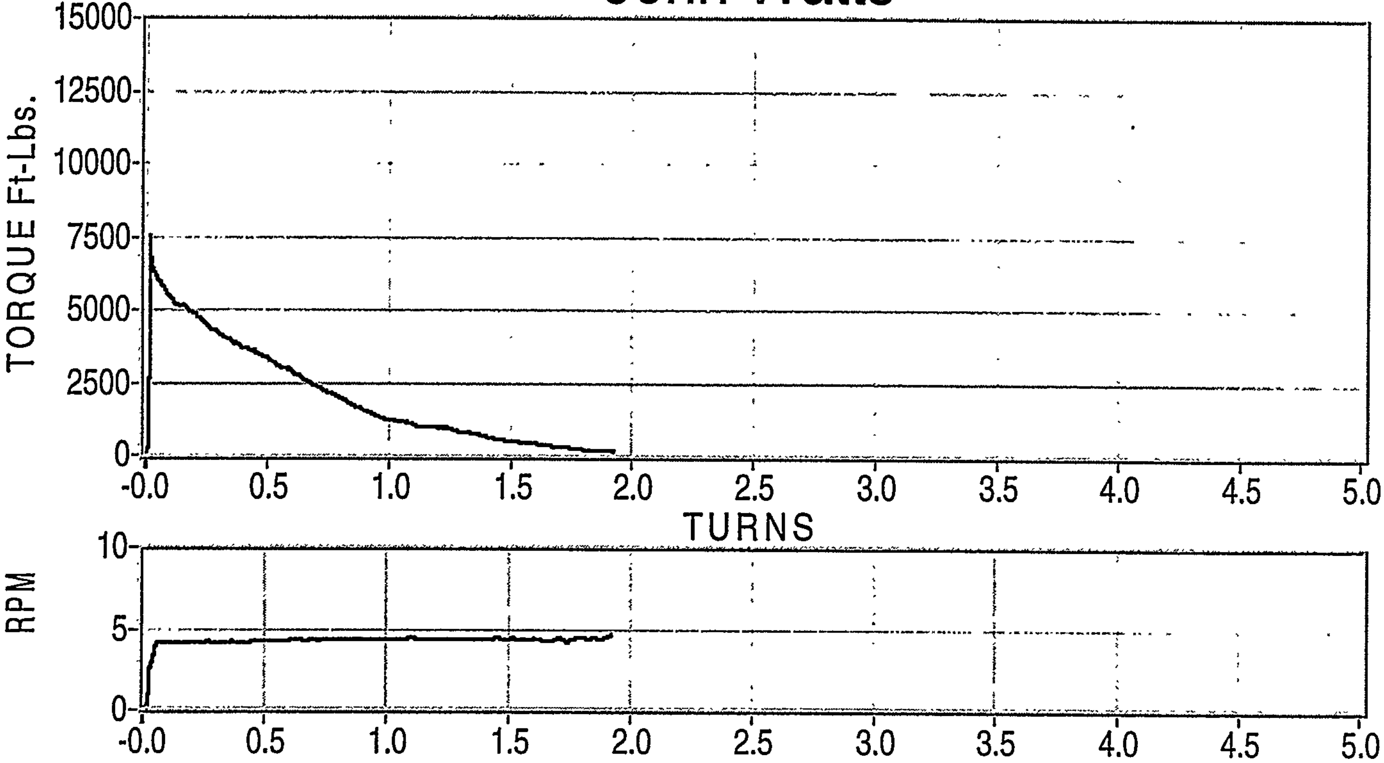
Date:Time of Test
07/07/1999 : 3:59:09 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size 7.000 in.

John Watts



BreakOut

BreakOut # 5	
Pin Id : 15B	Box Id : 5
File Name : TT_0034.dat	
Maximum Torque	7569 Ft-Lbs

Operator :
Greg Stafford

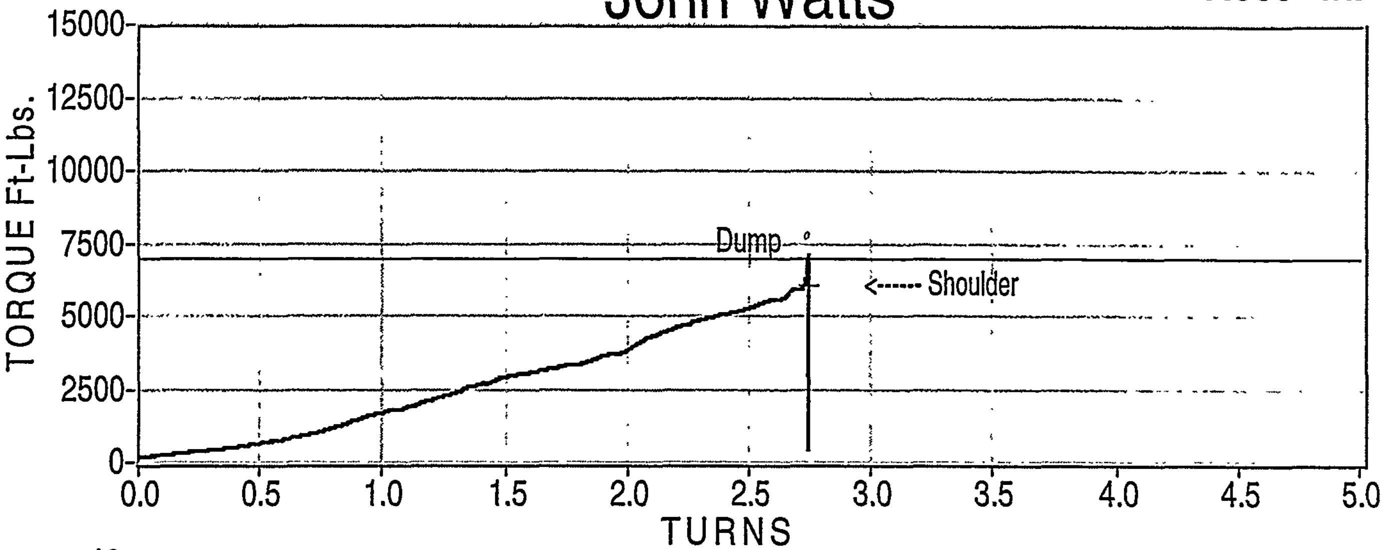
Date : Time of Test
07/07/1999 : 4:01:56 PM

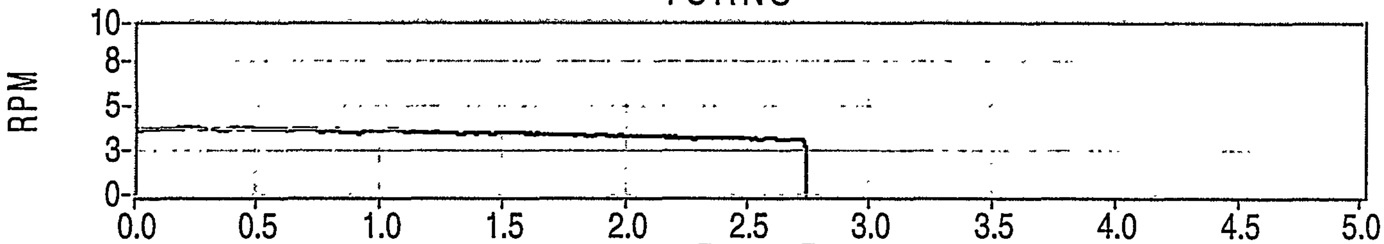
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 1			
Pin Id : 17A	**Box Id : 8**		
File Name : TT_0035.dat			
Maximum Torque		7143	Ft-Lbs
Shoulder Torque		6019	Ft-Lbs
Delta Torque		1124	Ft-Lbs
Turns @ Max. Torque		2.739	Turns
Shoulder Turns		2.740	Turns
Delta Turns		-0.000	Turns
Total Turns		2.740	Turns
Pin Dope		0	Grams
Box Dope		20	Grams

Operator:
Greg Stafford

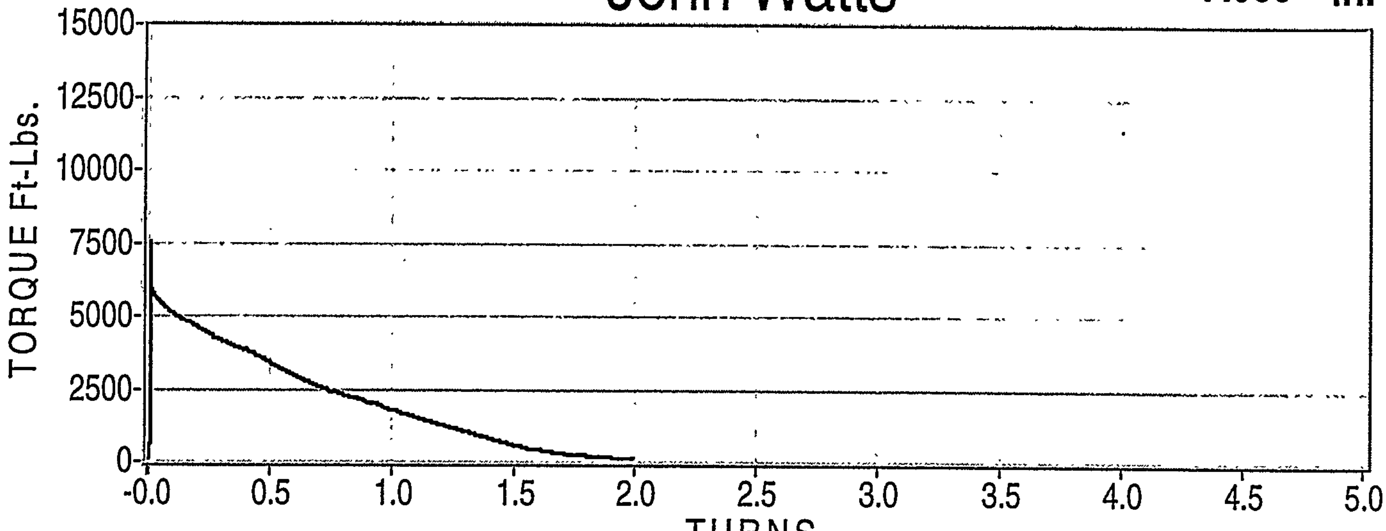
Date:Time of Test
07/07/1999 : 4:43:05 PM

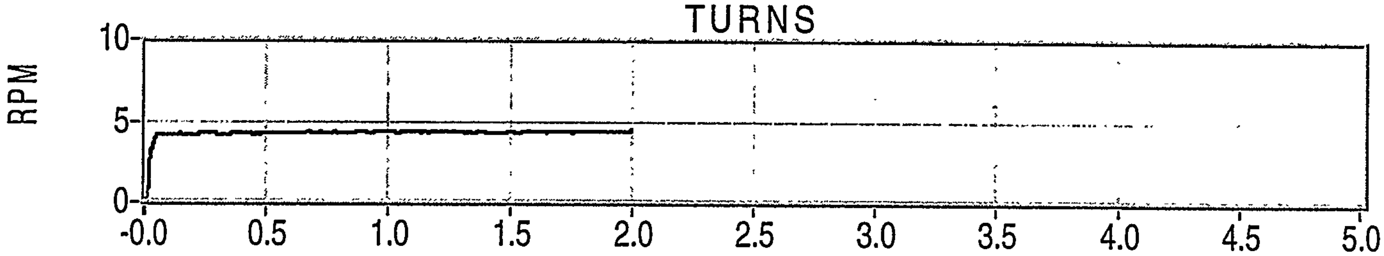
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts





BreakOut

BreakOut # 1	
Pin Id : 17A	**Box Id : 8**
File Name : TT_0036.dat	
Maximum Torque	**7608 Ft-Lbs**

Operator :
Greg Stafford

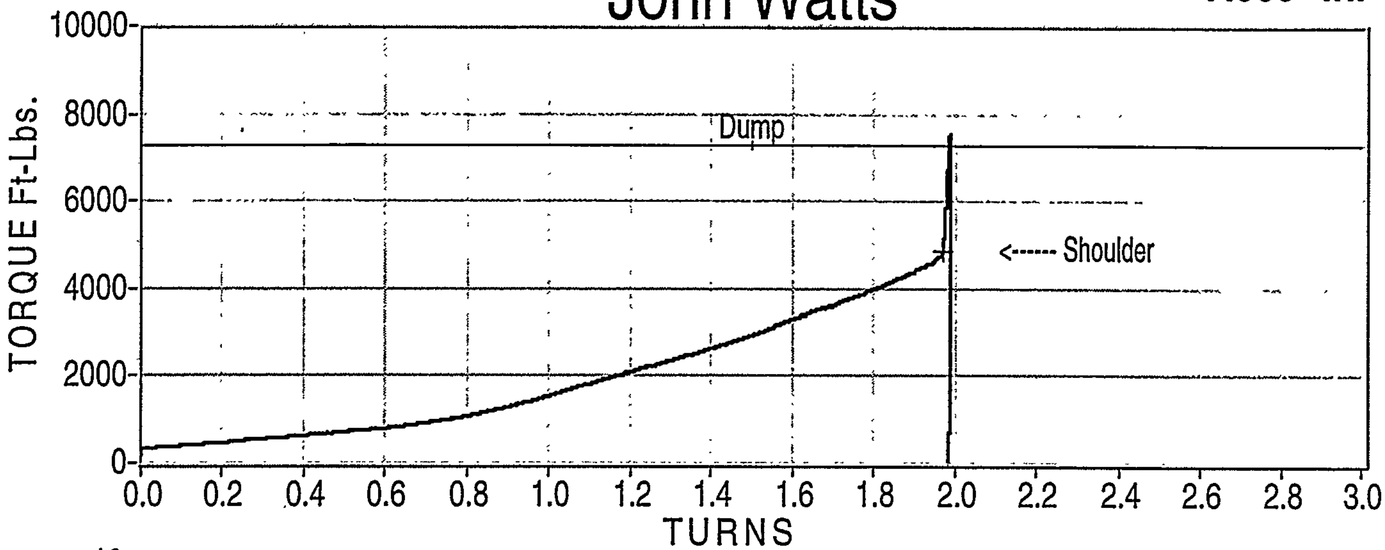
Date : Time of Test
07/07/1999 : 4:47:05 PM

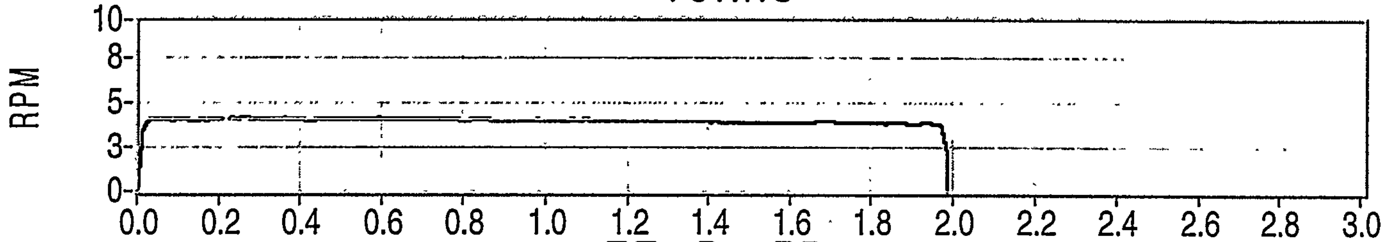
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size 7.000 in.

John Watts





MakeUp

MakeUp # 2	
Pin Id : 17A	**Box Id : 8**
File Name : TT_0037.dat	

Maximum Torque	7553	Ft-Lbs
Shoulder Torque	4863	Ft-Lbs
Delta Torque	2691	Ft-Lbs
Turns @ Max. Torque	1.986	Turns
Shoulder Turns	1.970	Turns
Delta Turns	0.017	Turns
Total Turns	1.986	Turns
Pin Dope	0	Grams
Box Dope	22	Grams

Operator:
Greg Stafford

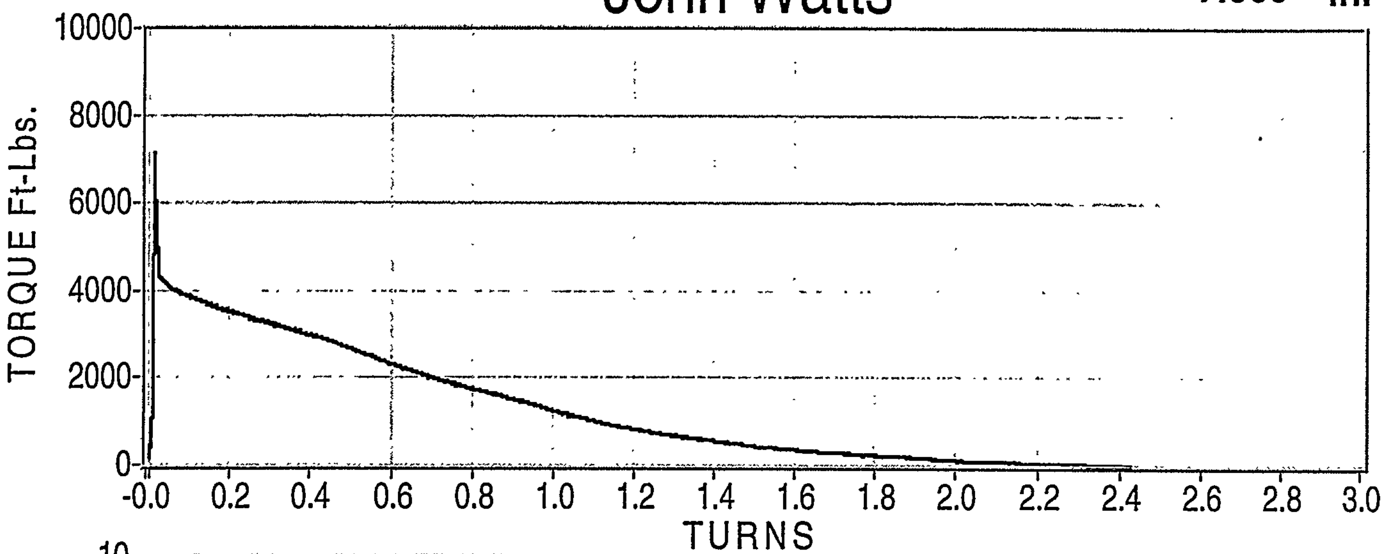
Date:Time of Test
07/08/1999 : 6:53:45 AM

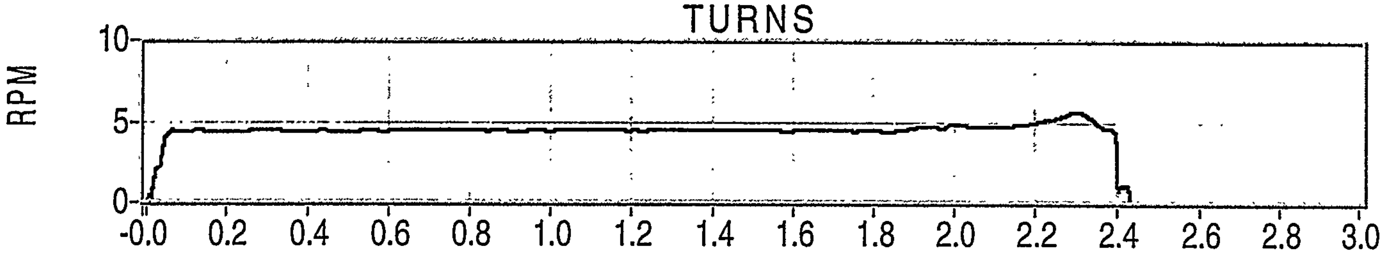
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts





BreakOut

BreakOut # 2	
Pin Id : 17A	**Box Id : 8**
File Name : TT_0038.dat	
Maximum Torque	**7154 Ft-Lbs**

Operator :
Greg Stafford

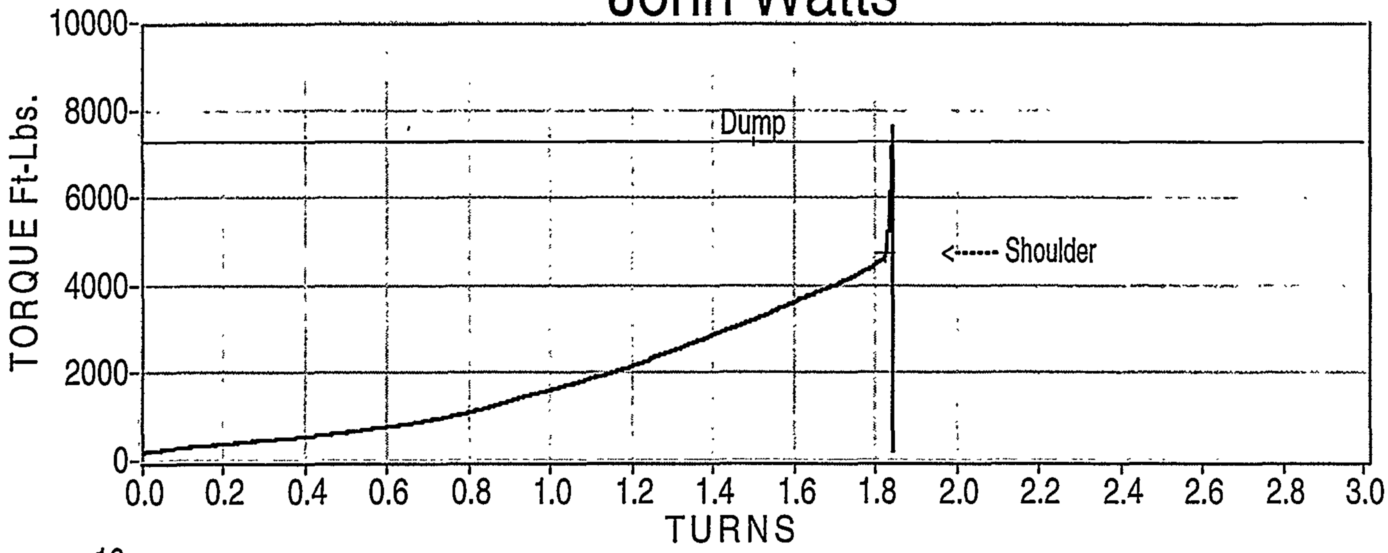
Date : Time of Test
07/08/1999 : 6:58:48 AM

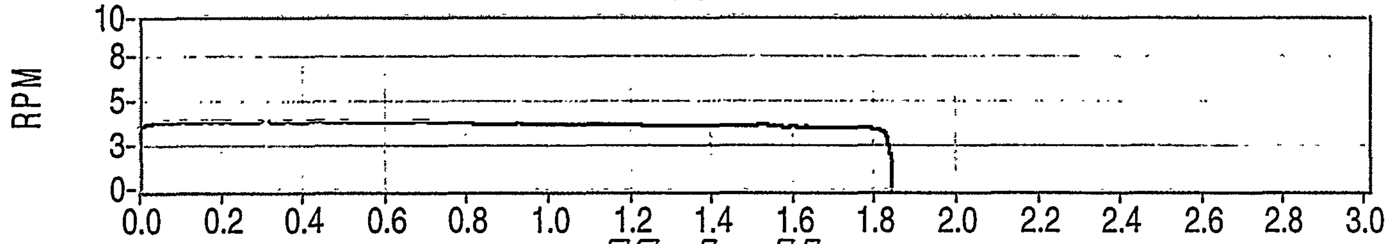
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size 7.000 in.

John Watts





MakeUp

MakeUp # 3	
Pin Id : 17A	Box Id : 8
File Name : TT_0039.dat	

Maximum Torque	7648	Ft-Lbs
Shoulder Torque	4724	Ft-Lbs
Delta Torque	2924	Ft-Lbs
Turns @ Max. Torque	1.843	Turns
Shoulder Turns	1.827	Turns
Delta Turns	0.015	Turns
Total Turns	1.843	Turns
Pin Dope	0	Grams
Box Dope	0	Grams

Operator:
Greg Stafford

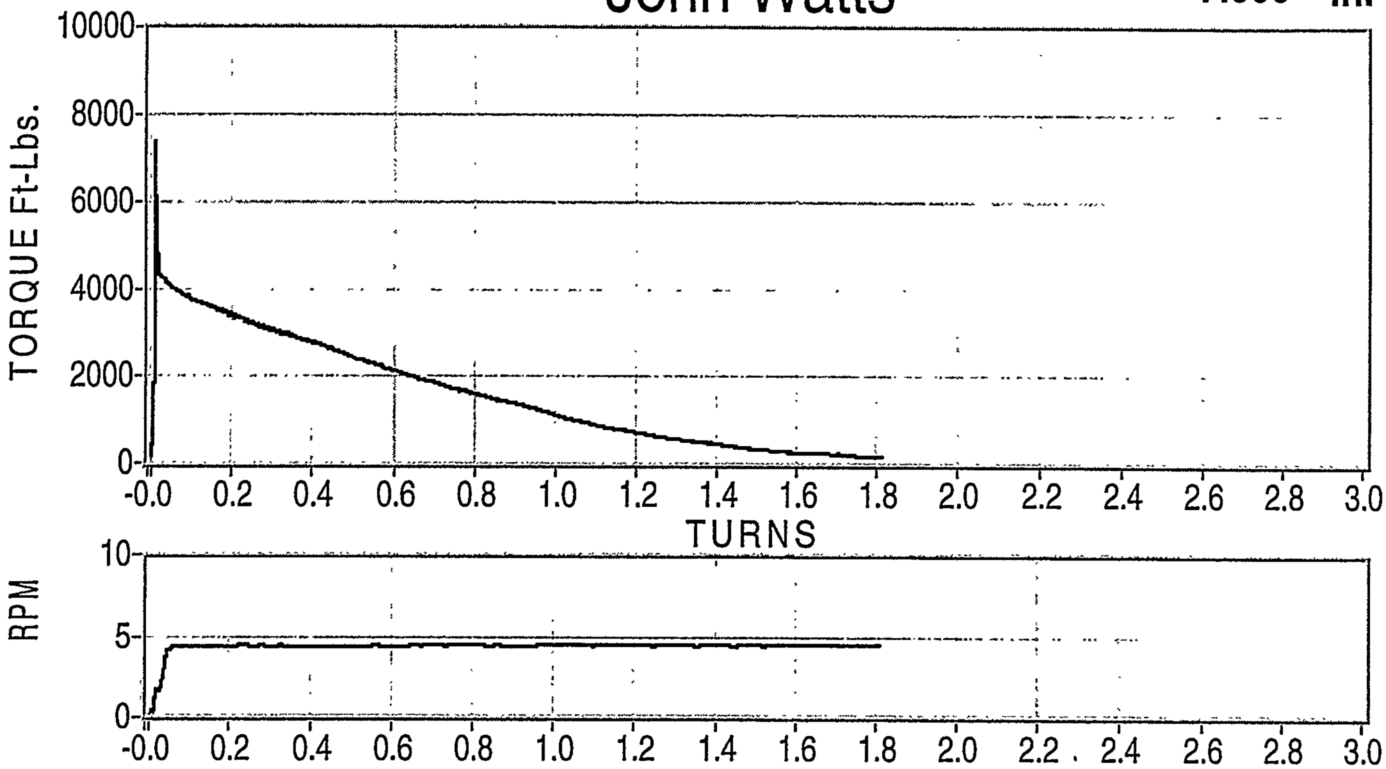
Date:Time of Test
07/08/1999 : 7:15:08 AM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts



BreakOut

BreakOut # 3	
Pin Id : 17A	Box Id : 8
File Name : TT_0040.dat	
Maximum Torque	7400 Ft-Lbs

Operator :
Greg Stafford

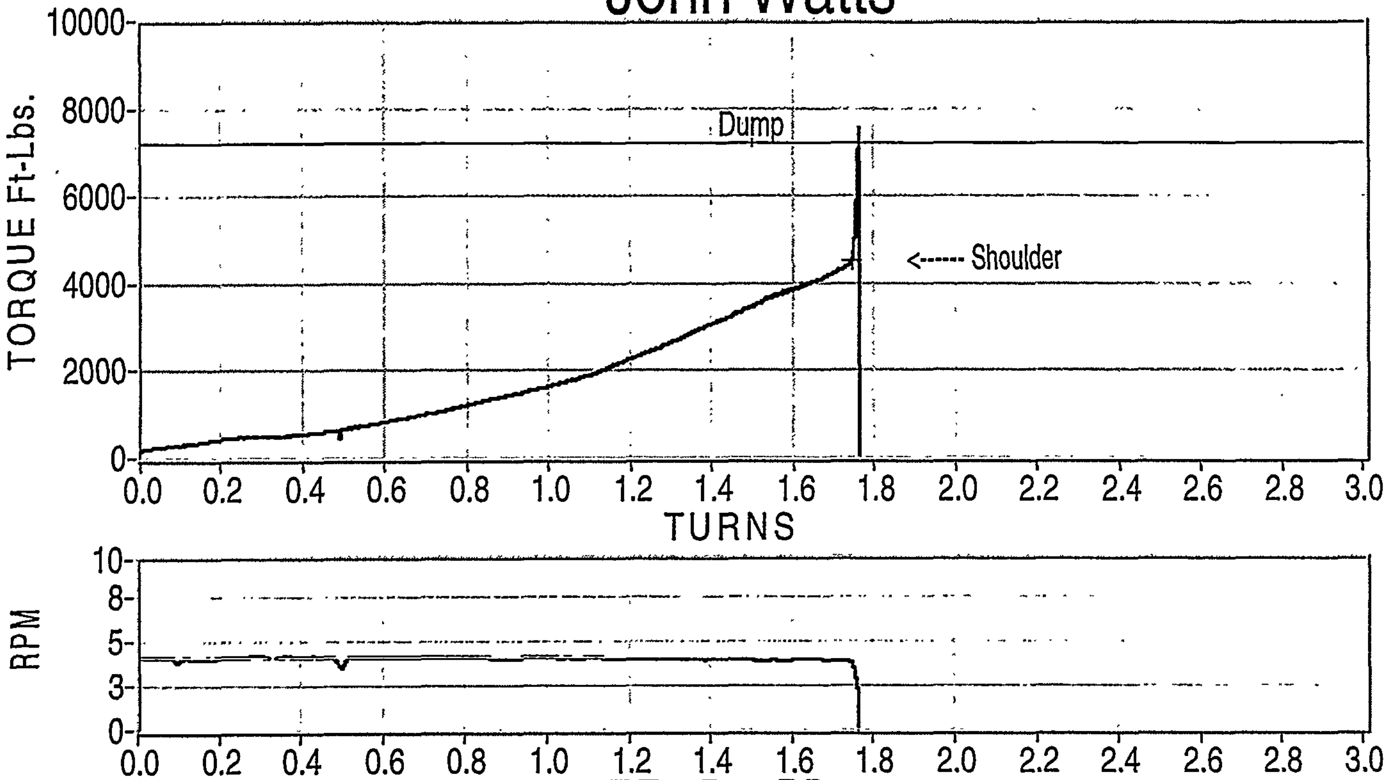
Date : Time of Test
07/08/1999 : 7:20:22 AM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp

MakeUp # 4	
Pin Id : 17A	Box Id : 8
File Name : TT_0041.dat	

Maximum Torque	7583	Ft-Lbs
Shoulder Torque	4545	Ft-Lbs
Delta Torque	3038	Ft-Lbs
Turns @ Max. Torque	1.764	Turns
Shoulder Turns	1.748	Turns
Delta Turns	0.016	Turns
Total Turns	1.764	Turns
Pin Dope	0	Grams
Box Dope	0	Grams

Operator:
Greg Stafford

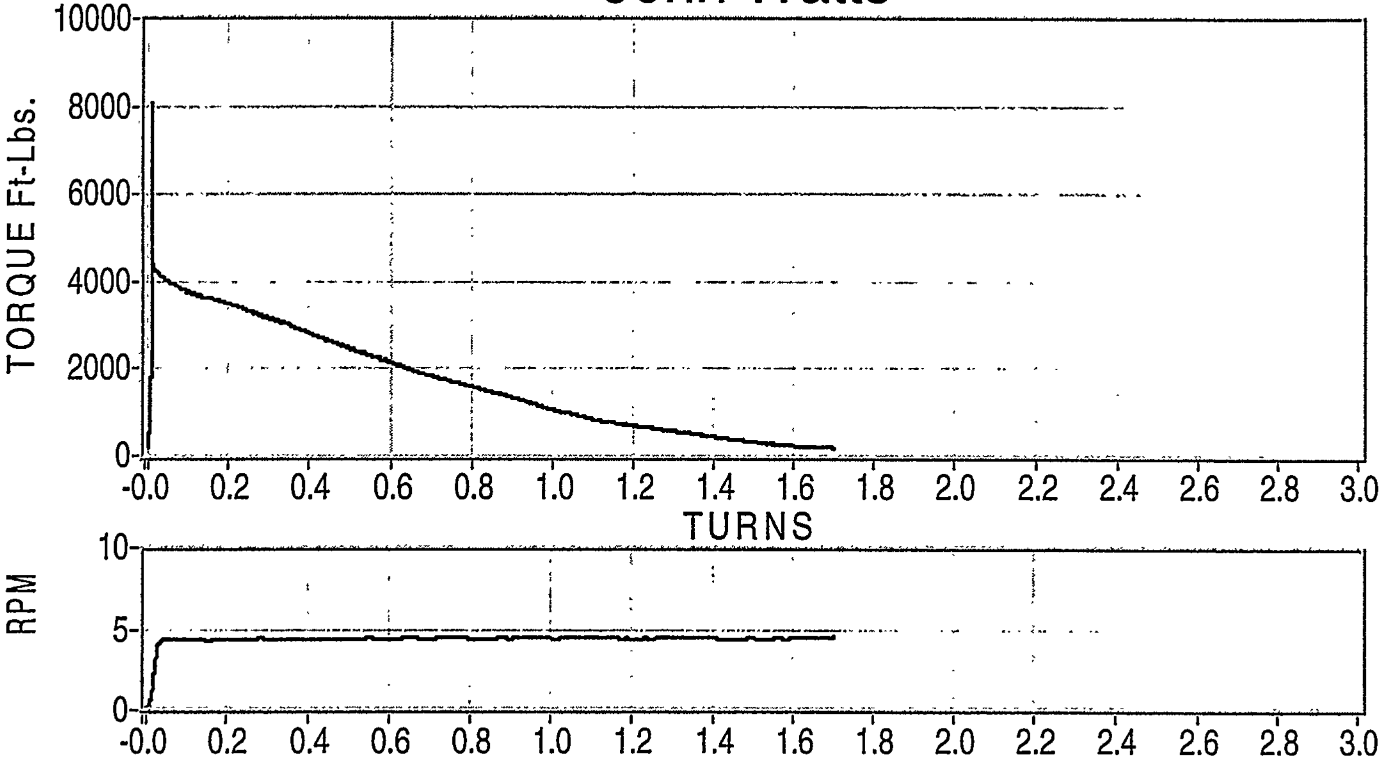
Date:Time of Test
07/08/1999 : 7:27:16 AM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size 7.000 in.

John Watts



BreakOut

BreakOut # 4	
Pin Id : 17A	Box Id : 8
File Name : TT_0042.dat	
Maximum Torque	8121 Ft-Lbs

Operator :
Greg Stafford

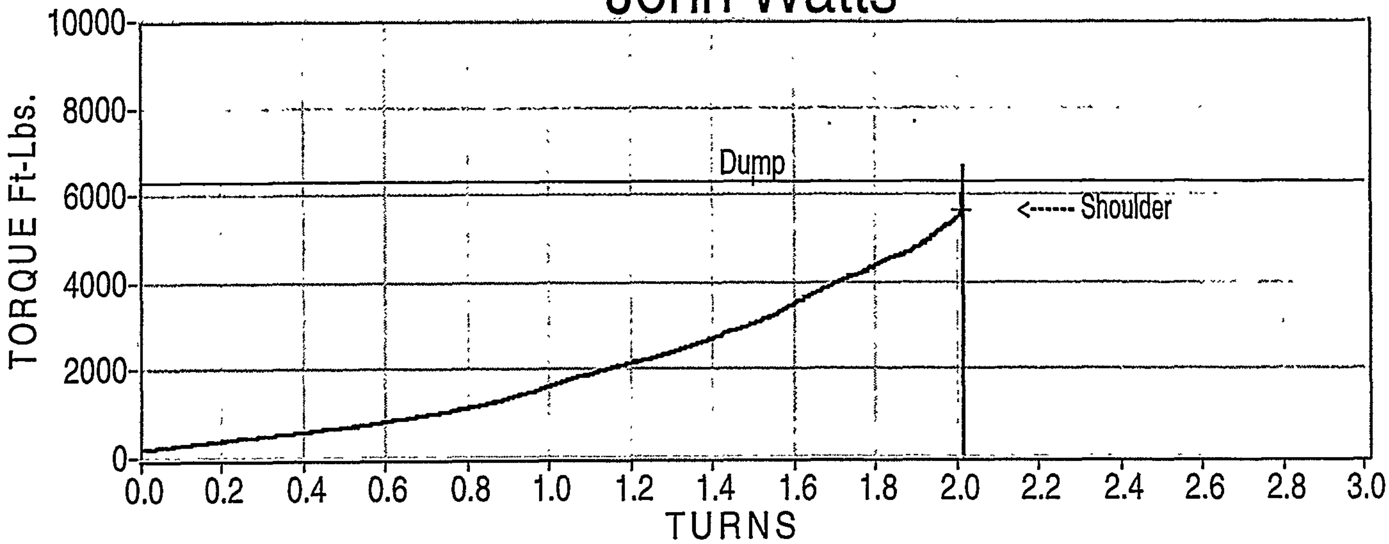
Date : Time of Test
07/08/1999 : 7:29:54 AM

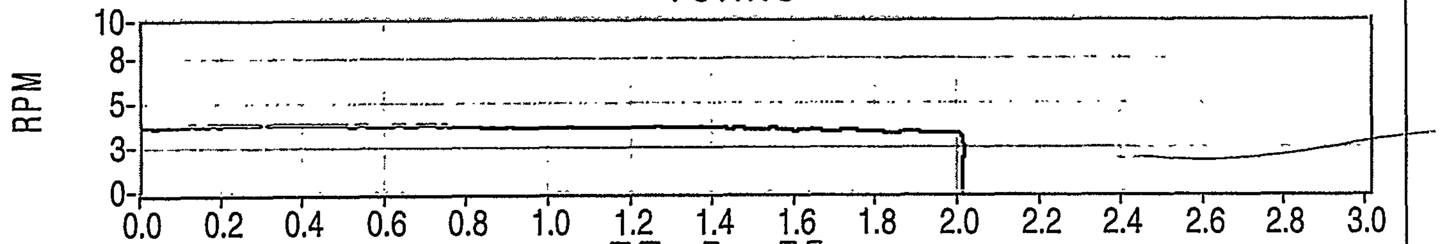
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size 7.000 in.

John Watts





MakeUp

MakeUp # 5		
Pin Id : 17A	Box Id : 8	
File Name : TT_0043.dat		
Maximum Torque	6665	Ft-Lbs
Shoulder Torque	5619	Ft-Lbs
Delta Torque	1045	Ft-Lbs
Turns @ Max. Torque	2.015	Turns
Shoulder Turns	2.009	Turns
Delta Turns	0.006	Turns
Total Turns	2.015	Turns
Pin Dope	0	Grams
Box Dope	19	Grams

Operator:
Greg Stafford

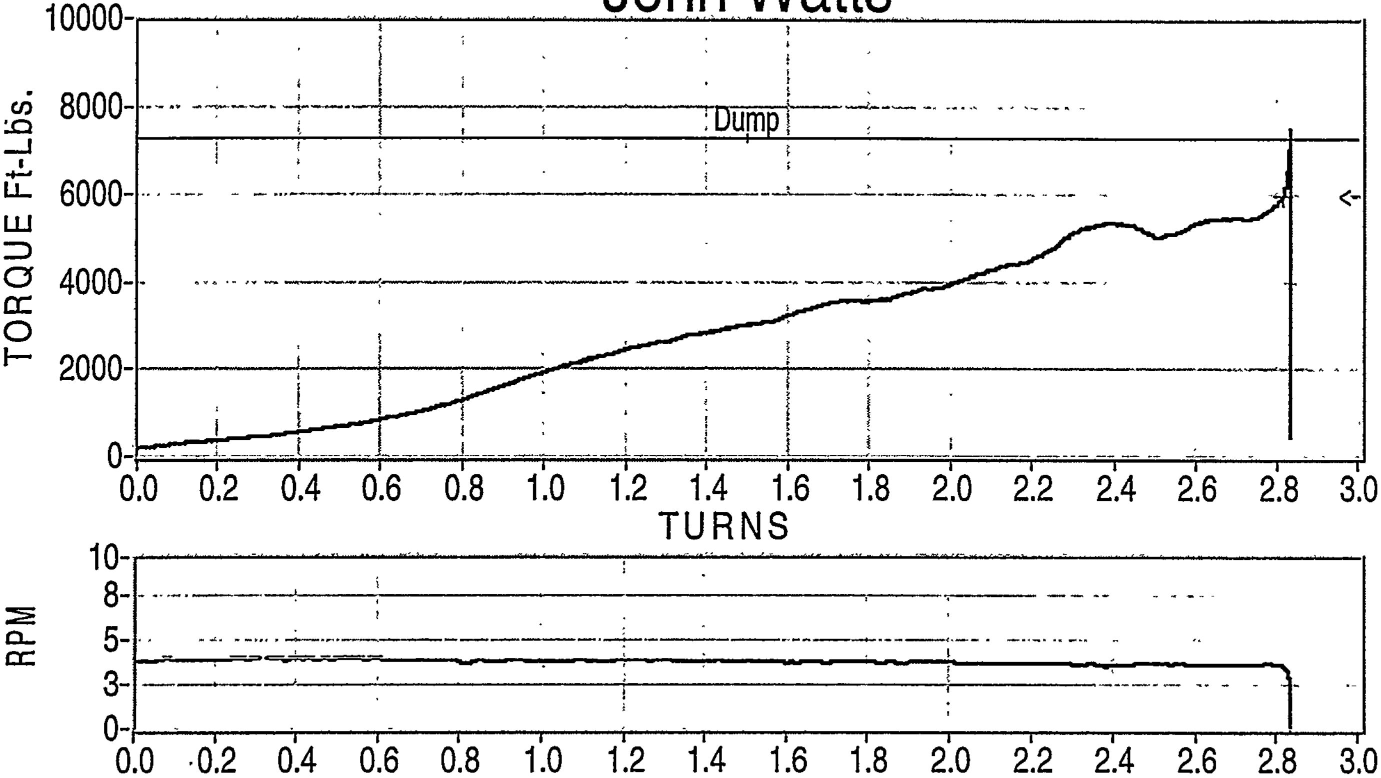
Date:Time of Test
07/08/1999 : 7:43:39 AM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp

MakeUp # 1	
Pin Id : 17B	**Box Id : 10**
File Name : TT_0044.dat	

Maximum Torque	7521	Ft-Lbs
Shoulder Torque	5956	Ft-Lbs
Delta Torque	1565	Ft-Lbs
Turns @ Max. Torque	2.834	Turns
Shoulder Turns	2.816	Turns
Delta Turns	0.018	Turns
Total Turns	2.834	Turns
Pin Dope	0	Grams
Box Dope	20	Grams

Operator:
Greg Stafford

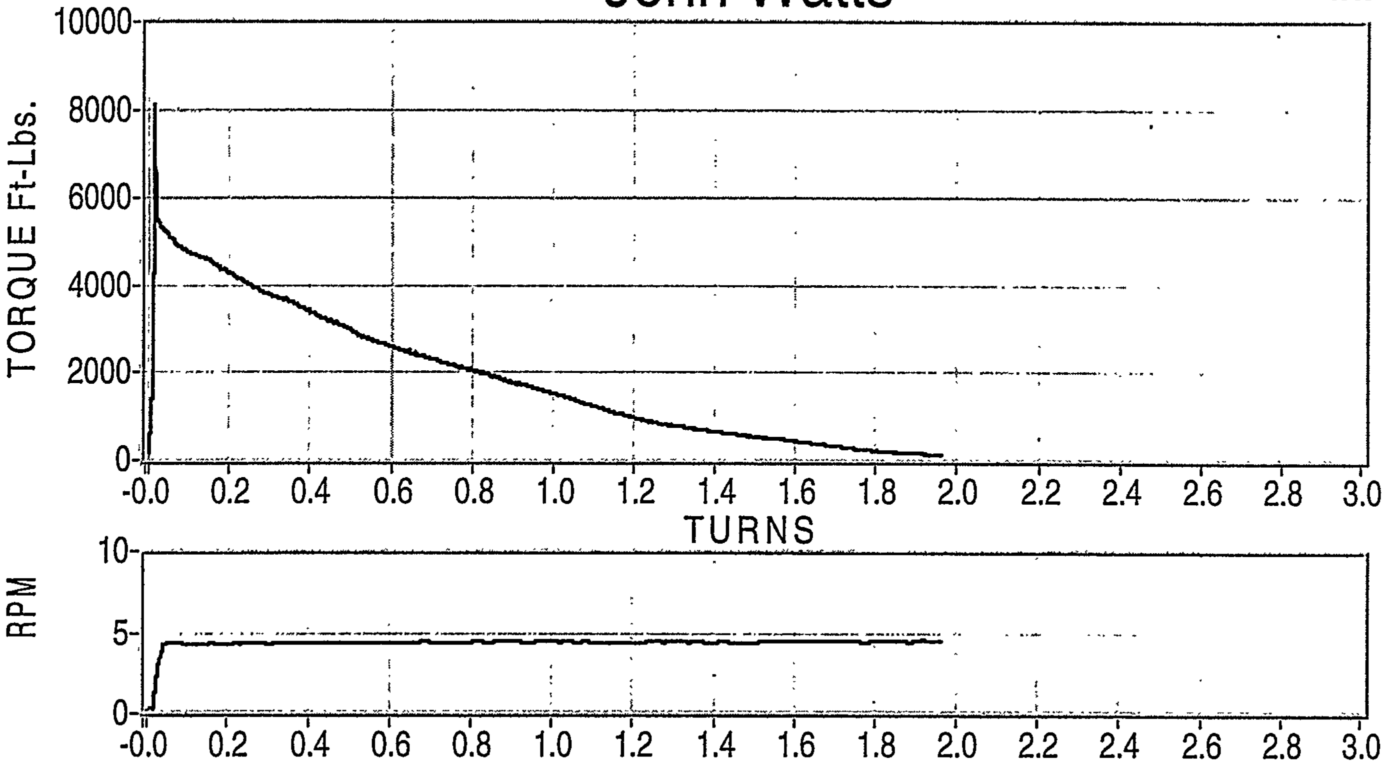
Date:Time of Test
07/08/1999 : 8:02:58 AM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts



BreakOut

BreakOut # 1	
Pin Id : 17B	**Box Id :** 10
File Name : TT_0045.dat	
Maximum Torque	8141 Ft-Lbs

Operator :
Greg Stafford

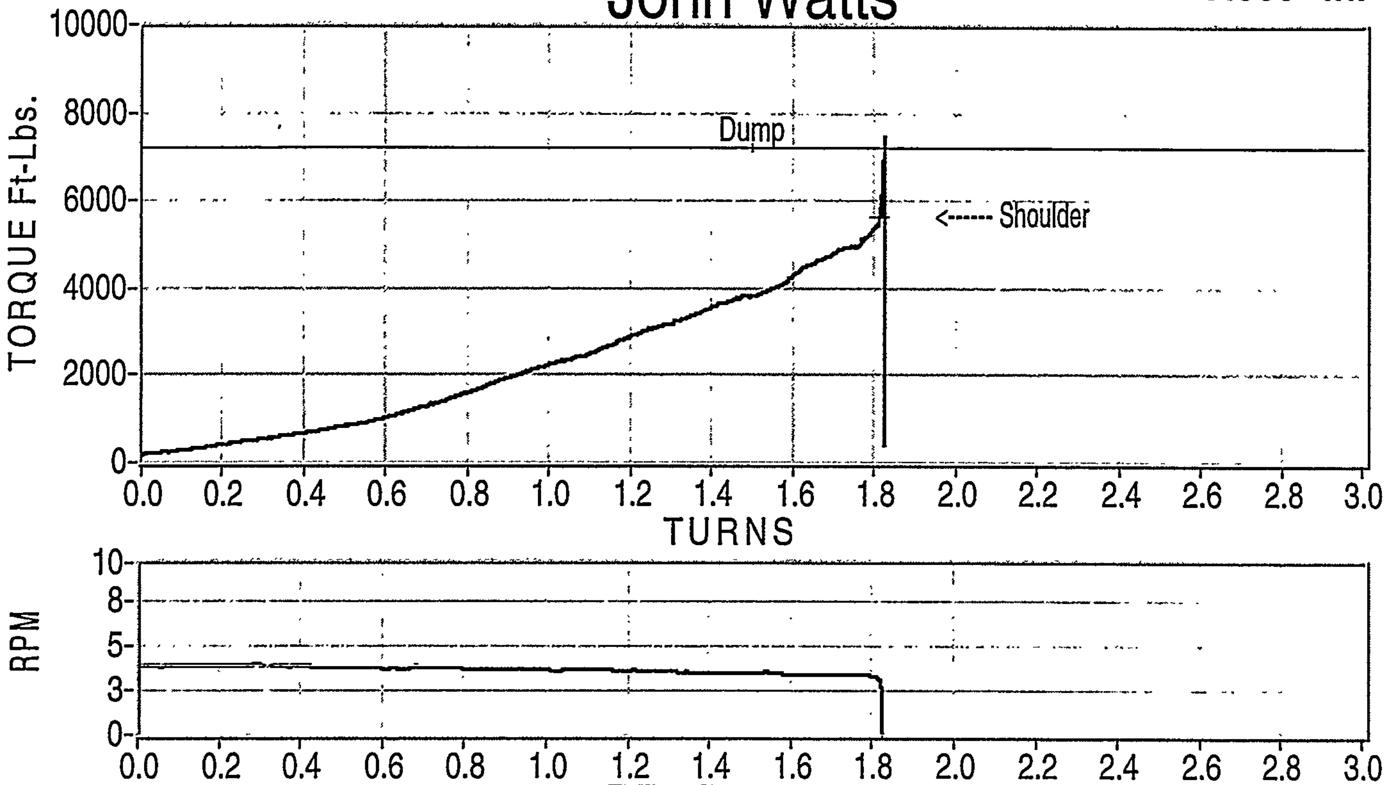
Date : Time of Test
07/08/1999 : 8:05:12 AM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp

MakeUp # 2		
Pin Id : 17B	Box Id : 10	
File Name : TT_0046.dat		
Maximum Torque	7476	Ft-Lbs
Shoulder Torque	5650	Ft-Lbs
Delta Torque	1827	Ft-Lbs
Turns @ Max. Torque	1.826	Turns
Shoulder Turns	1.814	Turns
Delta Turns	0.011	Turns
Total Turns	1.826	Turns
Pin Dope	0	Grams
Box Dope	0	Grams

Operator:
Greg Stafford

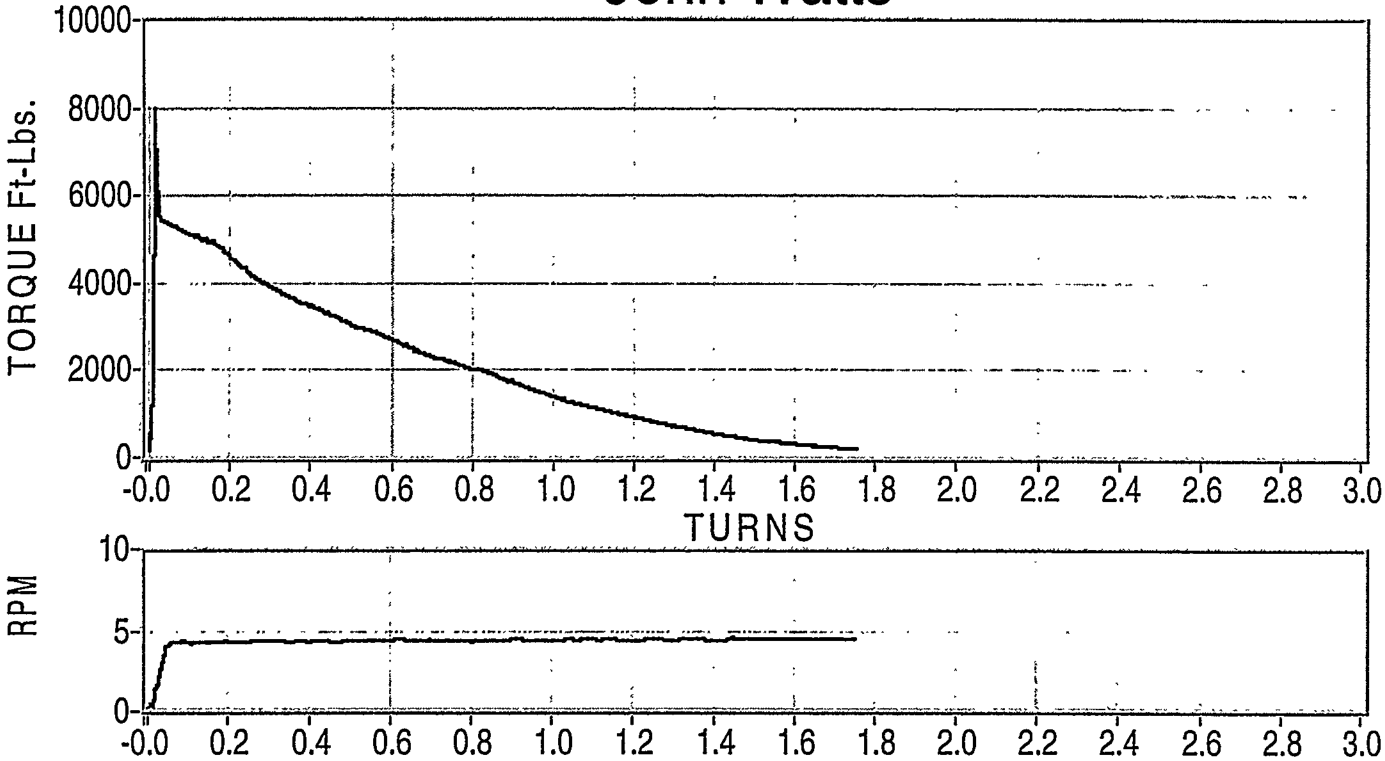
Date:Time of Test
07/08/1999 : 8:09:44 AM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size 7.000 in.

John Watts



BreakOut

BreakOut # 2	
Pin Id : 17B	**Box Id :** 10
File Name : TT_0047.dat	
Maximum Torque	8027 Ft-Lbs

Operator :
Greg Stafford

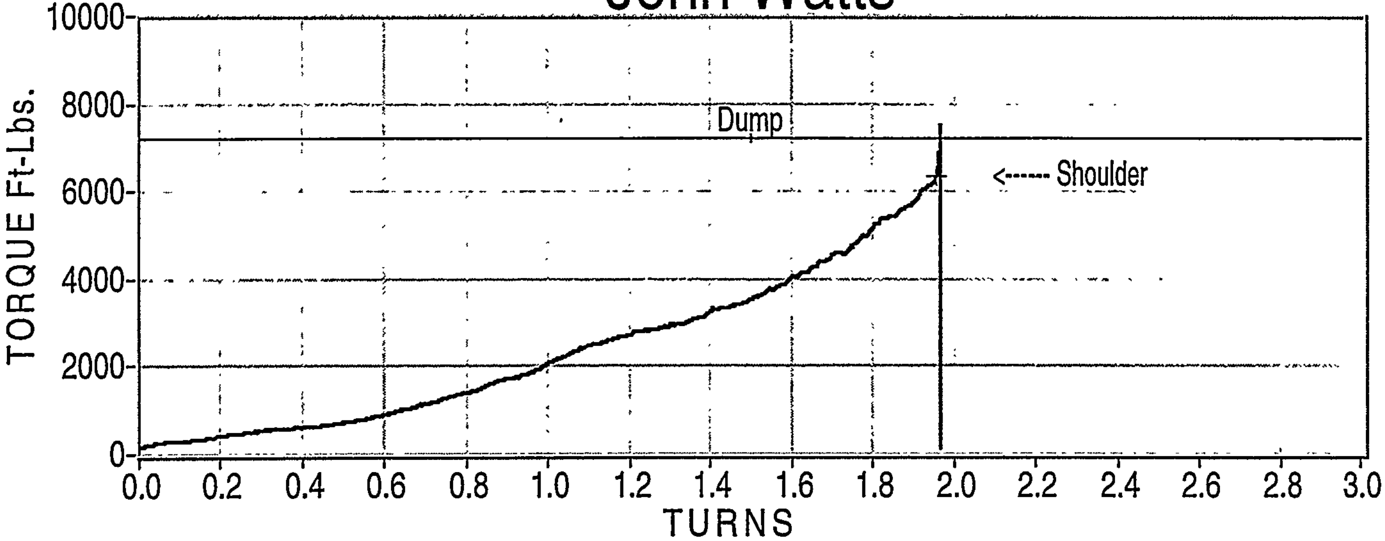
Date : Time of Test
07/08/1999 : 8:11:20 AM

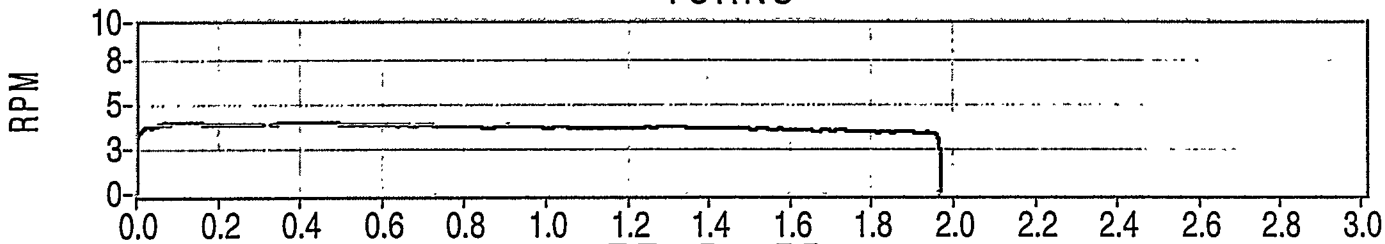
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 3		
Pin Id : 17B	**Box Id : 10**	
File Name : TT_0048.dat		
Maximum Torque	**7526**	**Ft-Lbs**
Shoulder Torque	**6355**	**Ft-Lbs**
Delta Torque	**1171**	**Ft-Lbs**
Turns @ Max. Torque	**1.967**	**Turns**
Shoulder Turns	**1.956**	**Turns**
Delta Turns	**0.011**	**Turns**
Total Turns	**1.967**	**Turns**
Pin Dope	**0**	**Grams**
Box Dope	**0**	**Grams**

Operator:
Greg Stafford

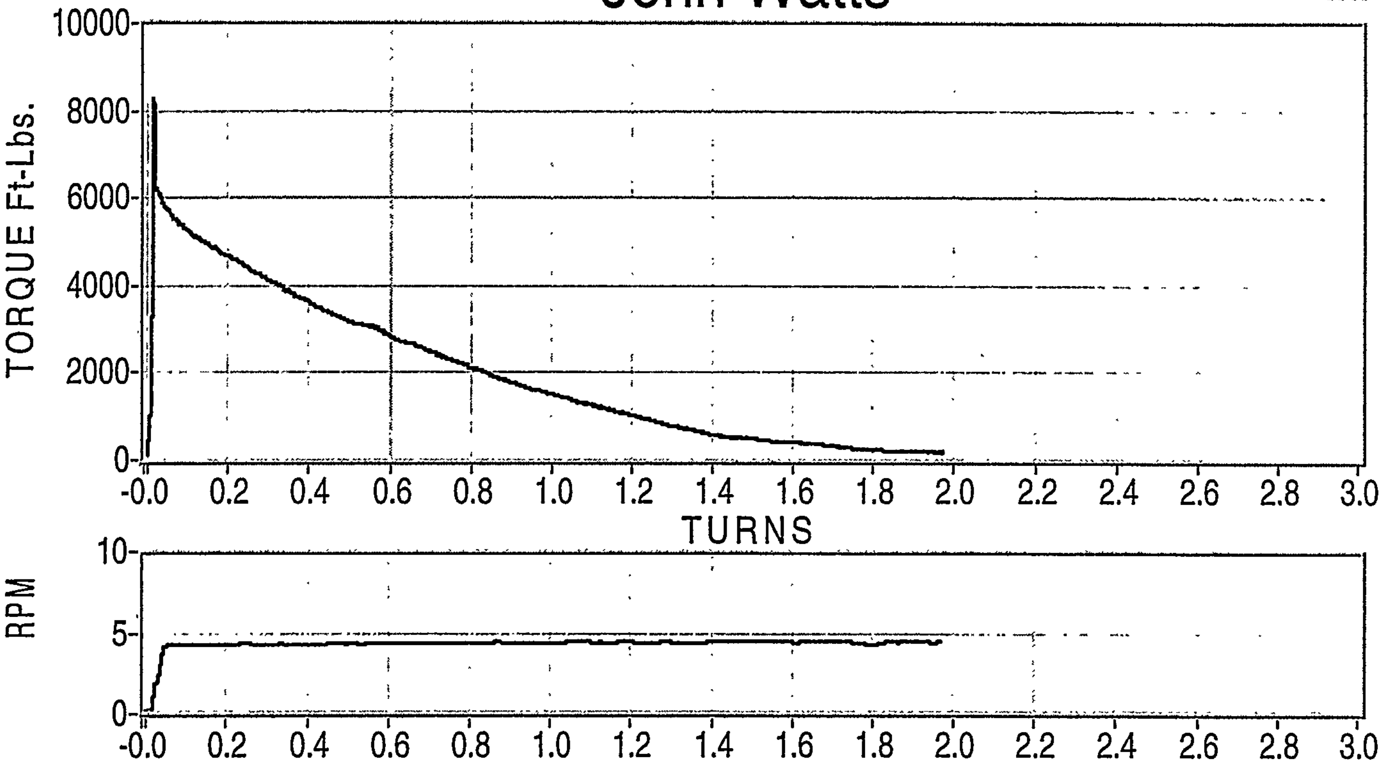
Date:Time of Test
07/08/1999 : 8:15:23 AM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts



BreakOut

BreakOut # 3	
Pin Id : 17B	**Box Id : 10**
File Name : TT_0049.dat	
Maximum Torque	**8295 Ft-Lbs**

Operator :
Greg Stafford

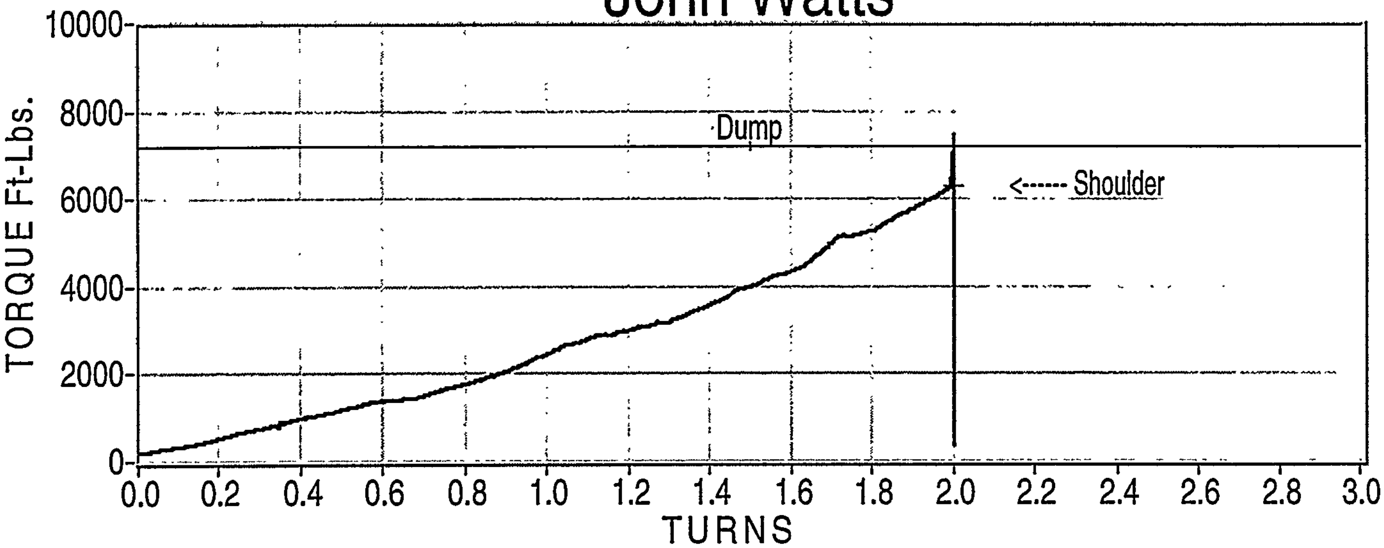
Date : Time of Test
07/08/1999 : 8:18:22 AM

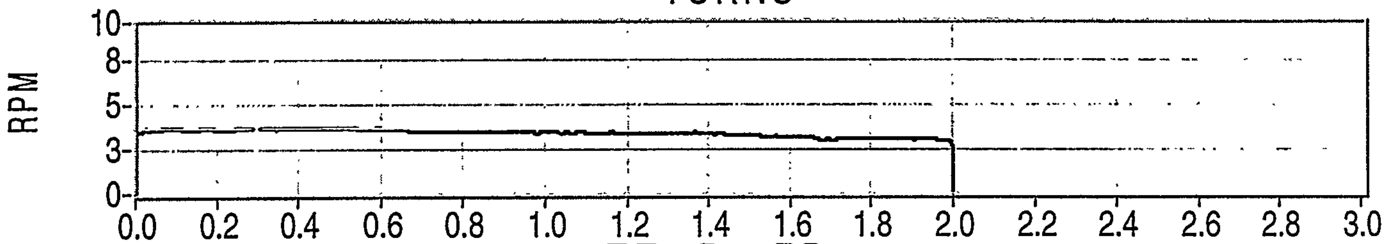
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size 7.000 in.

John Watts





MakeUp

MakeUp # 4		
Pin Id : 17B	Box Id : 10	
File Name : TT_0050.dat		
Maximum Torque	7473	Ft-Lbs
Shoulder Torque	6300	Ft-Lbs
Delta Torque	1173	Ft-Lbs
Turns @ Max. Torque	2.001	Turns
Shoulder Turns	2.001	Turns
Delta Turns	0.000	Turns
Total Turns	2.001	Turns
Pin Dope	0	Grams
Box Dope	0	Grams

Operator:
Greg Stafford

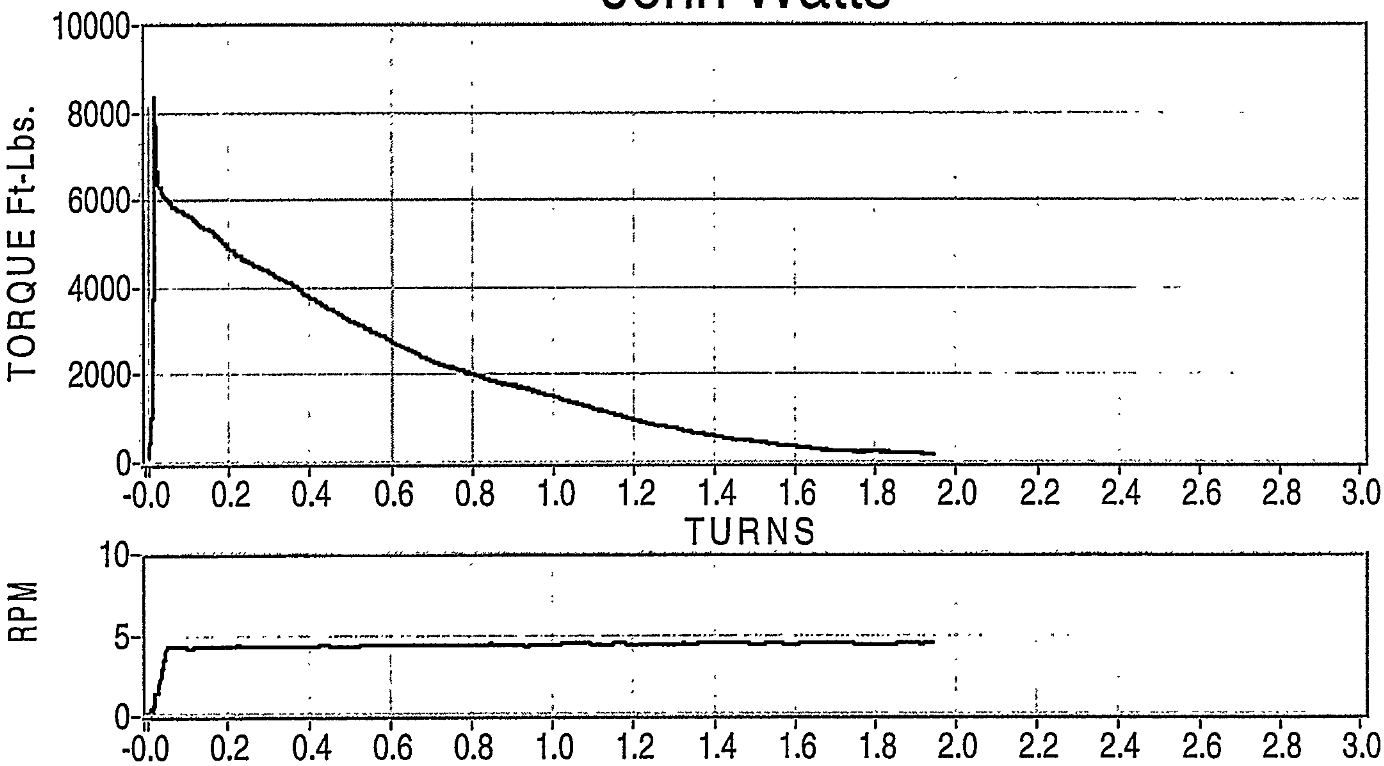
Date:Time of Test
07/08/1999 : 8:30:02 AM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts



BreakOut

BreakOut # 4	
Pin Id : 17B	Box Id : 10
File Name : TT_0051.dat	
Maximum Torque	8403 Ft-Lbs

Operator :
Greg Stafford

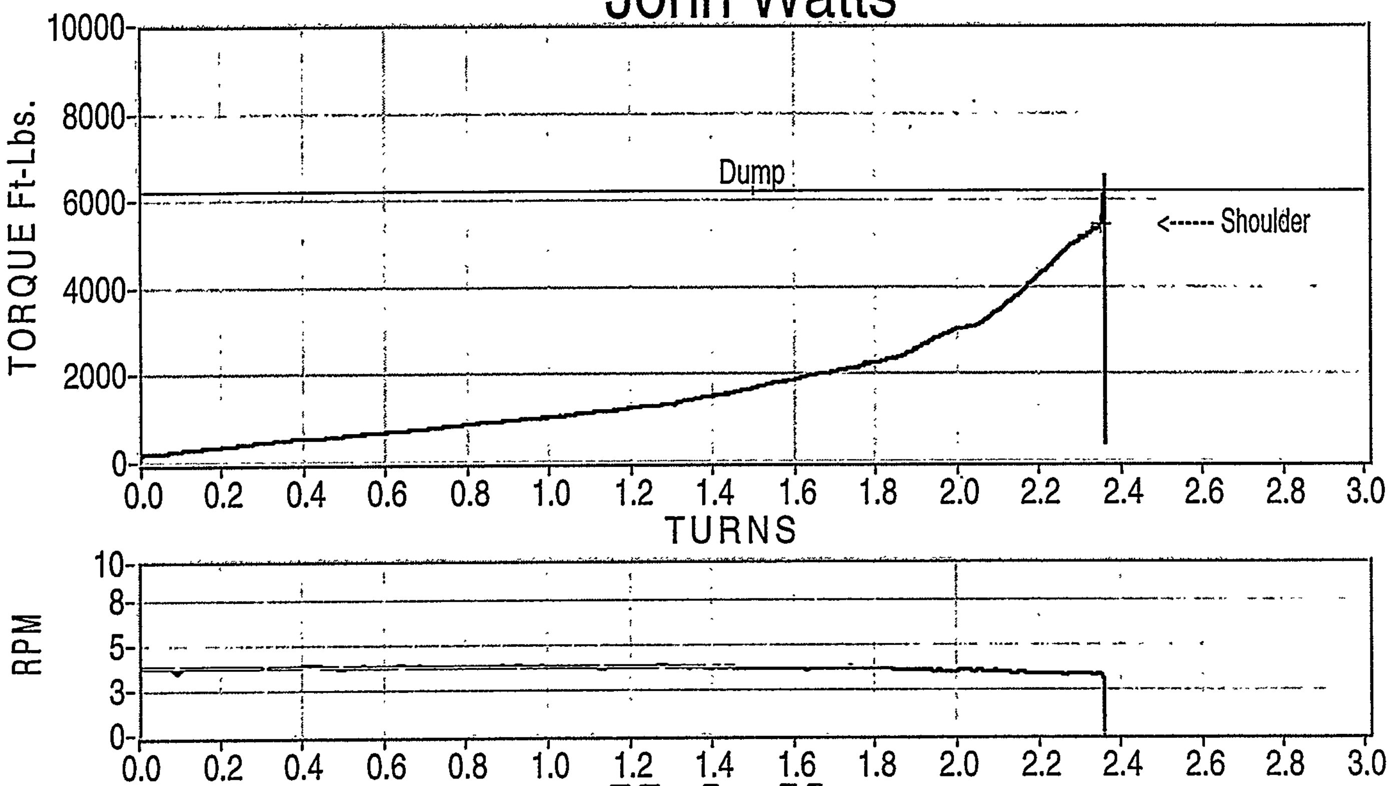
Date : Time of Test
07/08/1999 : 8:31:49 AM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size 7.000 in.

John Watts



MakeUp

MakeUp # 5		
Pin Id : 17B	Box Id : 10	
File Name : TT_0052.dat		
Maximum Torque	6586	Ft-Lbs
Shoulder Torque	5437	Ft-Lbs
Delta Torque	1149	Ft-Lbs
Turns @ Max. Torque	2.362	Turns
Shoulder Turns	2.352	Turns
Delta Turns	0.009	Turns
Total Turns	2.362	Turns
Pin Dope	0	Grams
Box Dope	20	Grams

Operator:
Greg Stafford

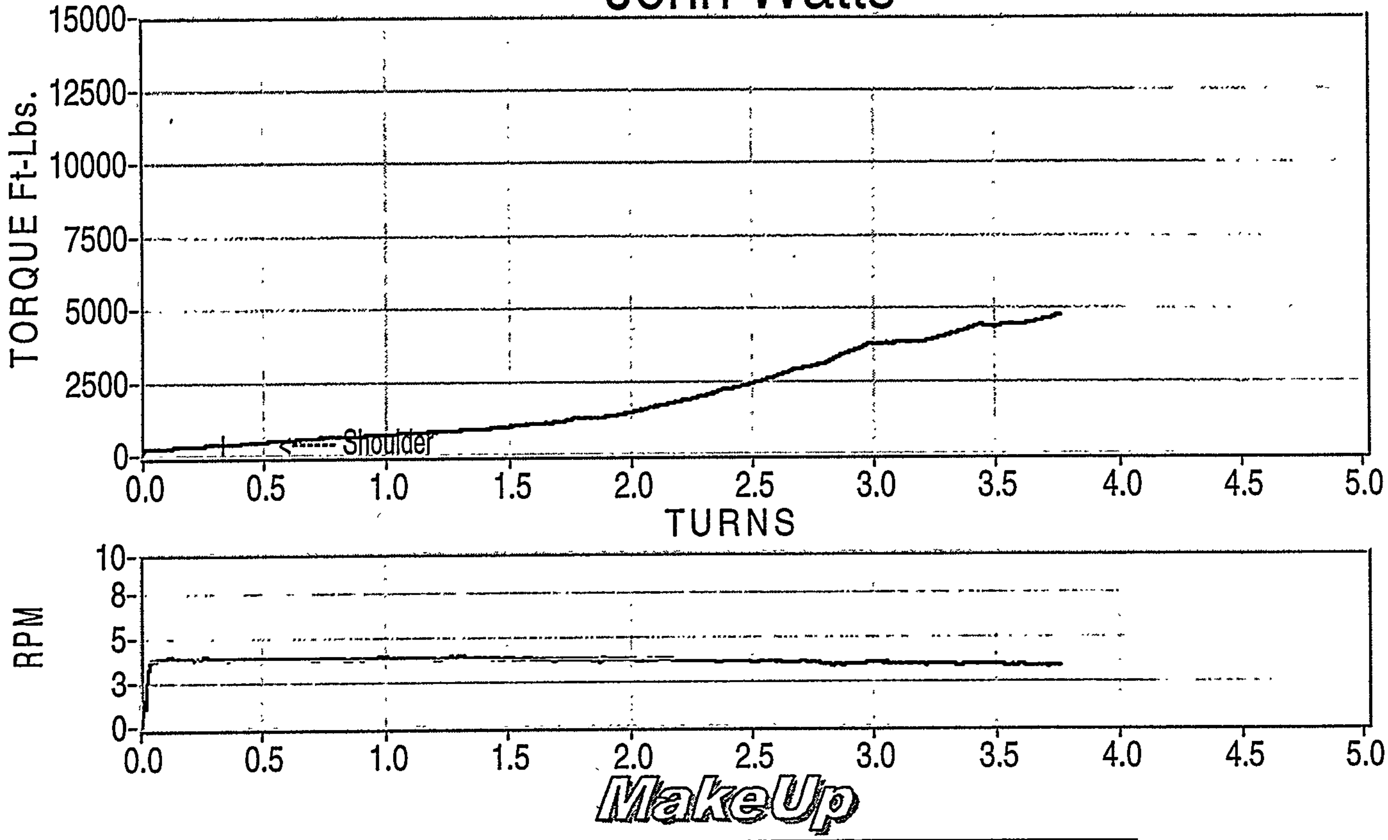
Date:Time of Test
07/08/1999 : 8:51:47 AM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp # 1		
Pin Id : 24	Box Id : 21	
File Name : TT_0053.dat		
Maximum Torque	4771	Ft-Lbs
Shoulder Torque	356	Ft-Lbs
Delta Torque	4415	Ft-Lbs
Turns @ Max. Torque	3.757	Turns
Shoulder Turns	0.326	Turns
Delta Turns	3.431	Turns
Total Turns	3.760	Turns
Pin Dope	14	Grams
Box Dope	12	Grams

Operator:
Greg Stafford

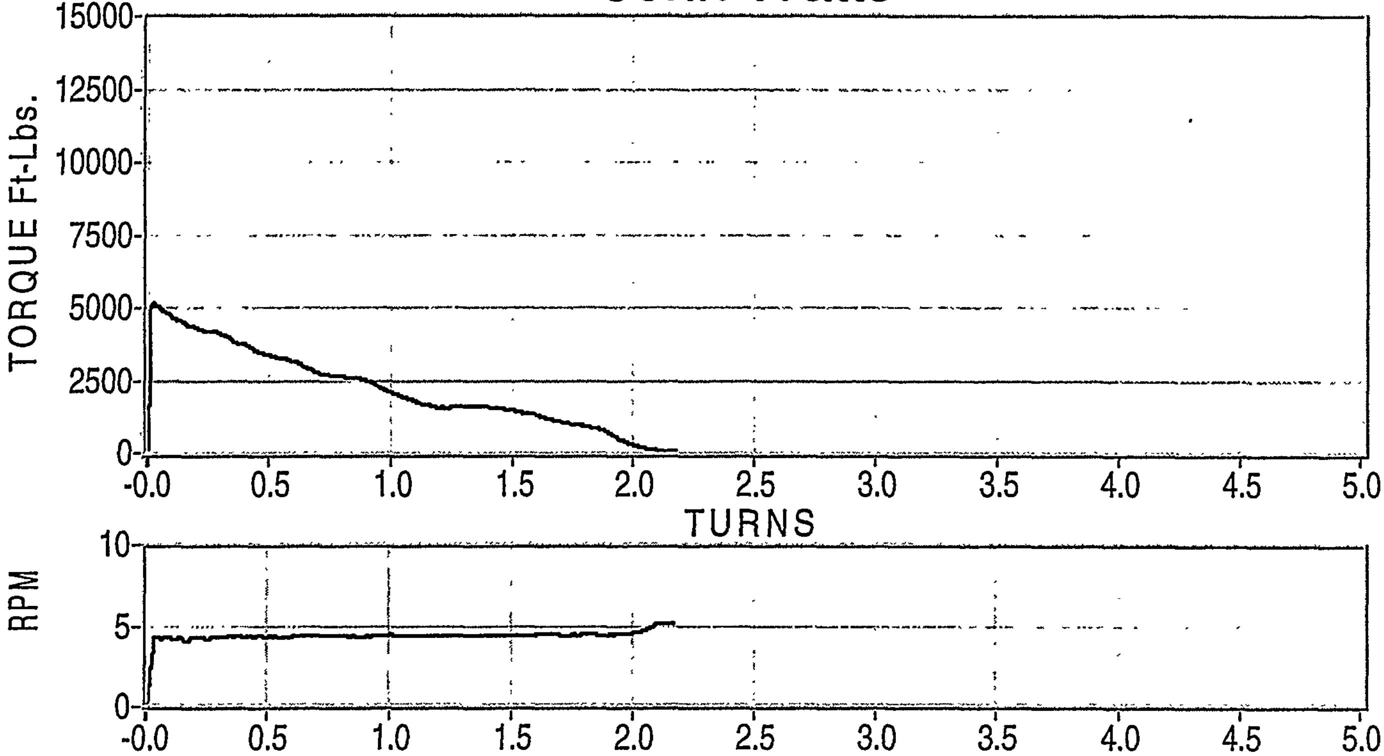
Date:Time of Test
07/08/1999 : 10:18:16 AM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts



BreakOut

BreakOut # 1	
Pin Id : 24	Box Id : 21
File Name : TT_0054.dat	
Maximum Torque	5171 Ft-Lbs

Operator :
Greg Stafford

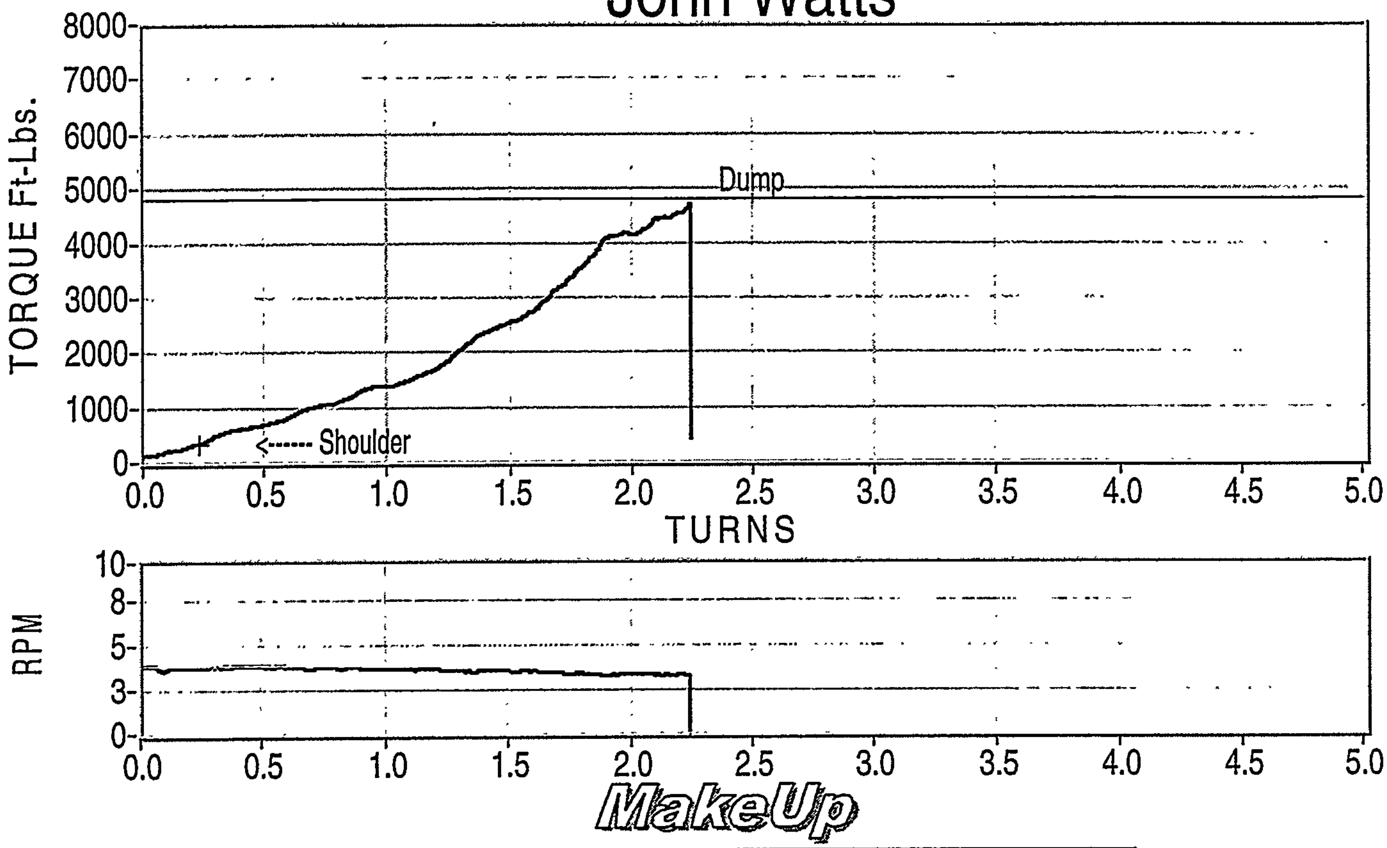
Date : Time of Test
07/08/1999 : 10:23:30 AM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp # 2	
Pin Id : 24	Box Id : 21
File Name : TT_0055.dat	

Maximum Torque	4714	Ft-Lbs
Shoulder Torque	341	Ft-Lbs
Delta Torque	4373	Ft-Lbs
Turns @ Max. Torque	2.240	Turns
Shoulder Turns	0.236	Turns
Delta Turns	2.004	Turns
Total Turns	2.242	Turns
Pin Dope	0	Grams
Box Dope	12	Grams

Operator:
Greg Stafford

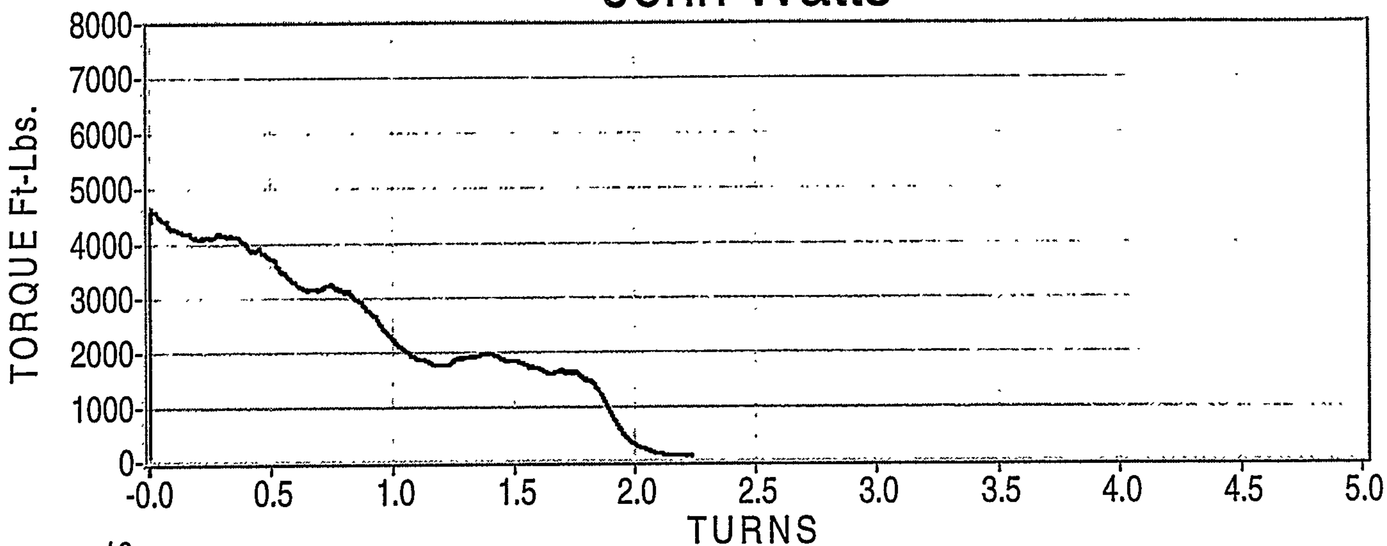
Date:Time of Test
07/08/1999 : 10:40:01 AM

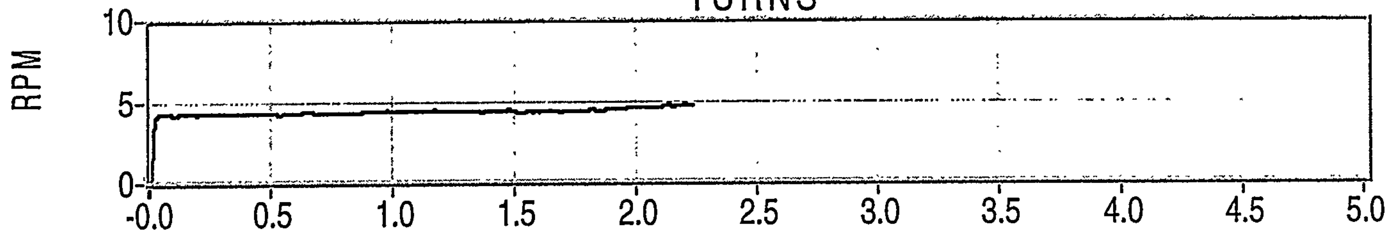
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size 7.000 in.

John Watts





BreakOut

BreakOut # 2	
Pin Id : 24	Box Id : 21
File Name : TT_0056.dat	
Maximum Torque	4682 Ft-Lbs

Operator :
Greg Stafford

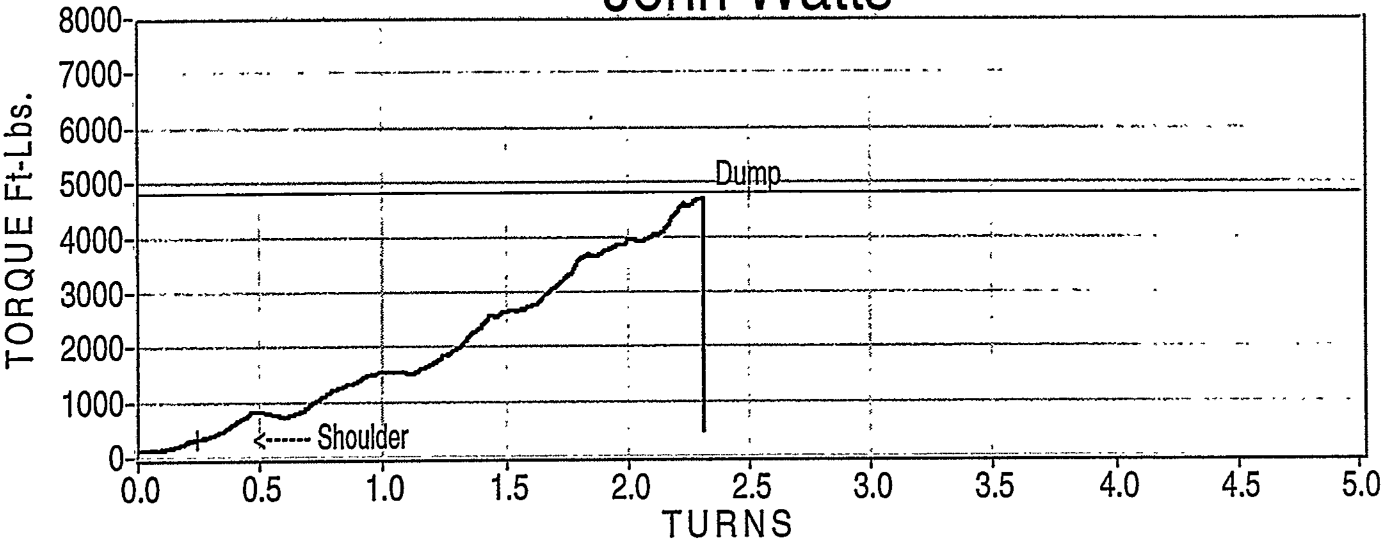
Date : Time of Test
07/08/1999 : 10:42:45 AM

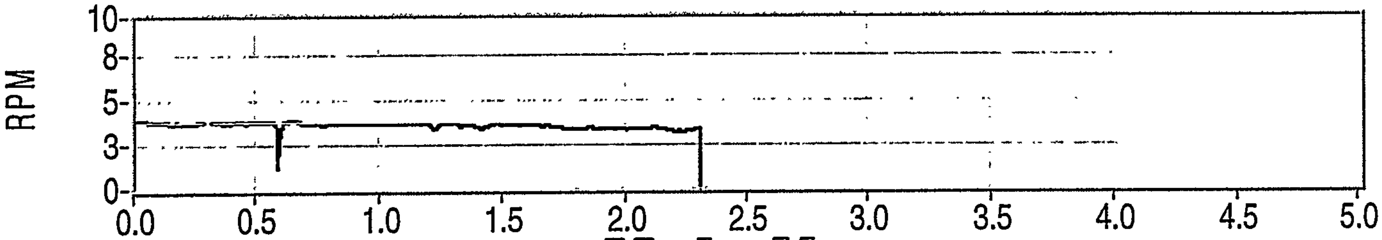
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 3	
Pin Id : 24	Box Id : 21
File Name : TT_0057.dat	

Maximum Torque	4721	Ft-Lbs
Shoulder Torque	323	Ft-Lbs
Delta Torque	4397	Ft-Lbs
Turns @ Max. Torque	2.306	Turns
Shoulder Turns	0.245	Turns
Delta Turns	2.062	Turns
Total Turns	2.308	Turns
Pin Dope	0	Grams
Box Dope	12	Grams

Operator:
Greg Stafford

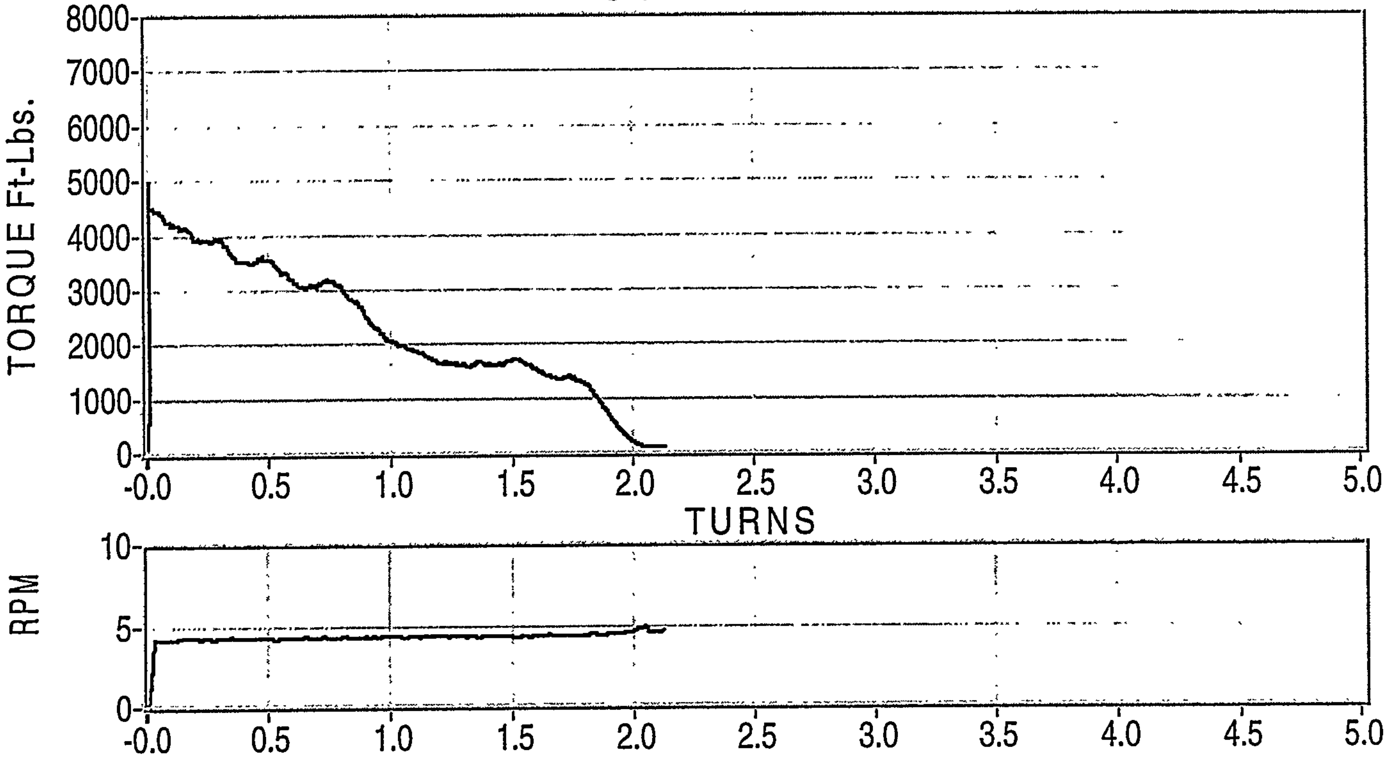
Date:Time of Test
07/08/1999 : 10:52:49 AM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts



BreakOut

BreakOut # 3	
Pin Id : 24	**Box Id : 21**
File Name : TT_0058.dat	
Maximum Torque	**4999 Ft-Lbs**

Operator :
Greg Stafford

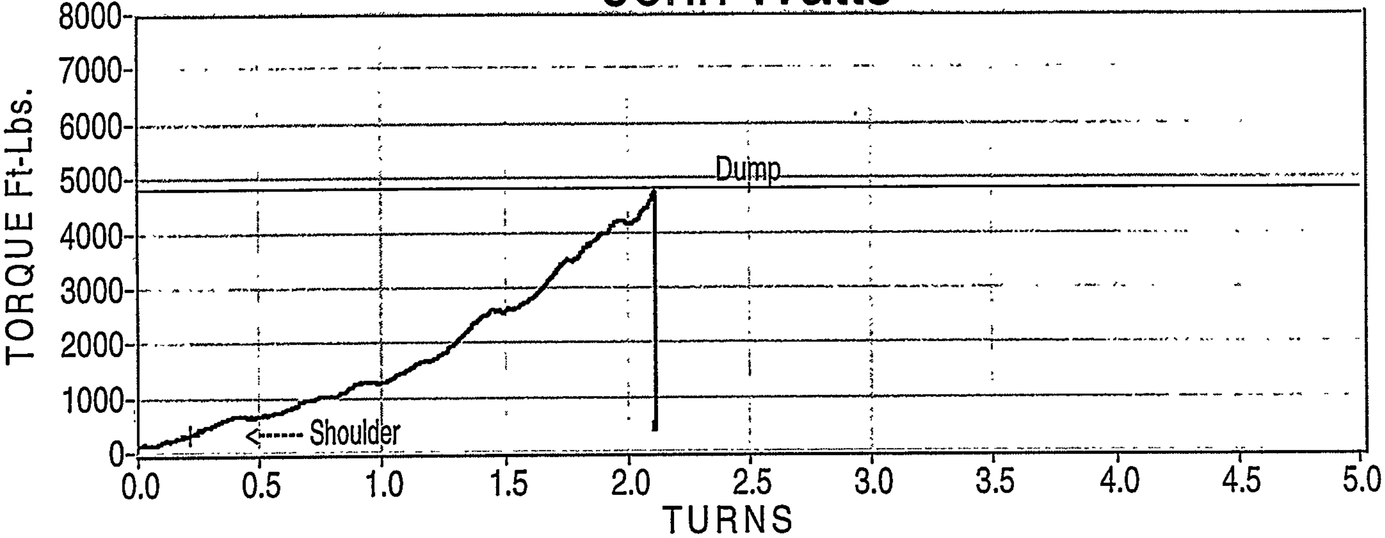
Date : Time of Test
07/08/1999 : 10:54:06 AM

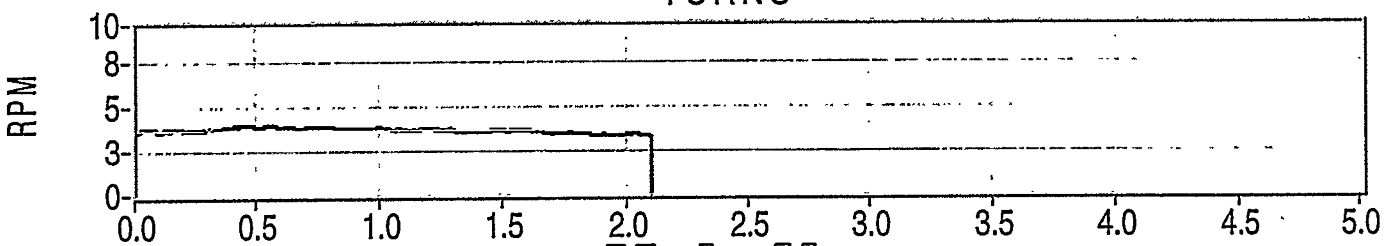
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 4	
Pin Id : 24	**Box Id : 21**
File Name : TT_0059.dat	

Maximum Torque	**4752**	**Ft-Lbs**
Shoulder Torque	**318**	**Ft-Lbs**
Delta Torque	**4434**	**Ft-Lbs**
Turns @ Max. Torque	**2.107**	**Turns**
Shoulder Turns	**0.213**	**Turns**
Delta Turns	**1.894**	**Turns**
Total Turns	**2.108**	**Turns**
Pin Dope	**0**	**Grams**
Box Dope	**19**	**Grams**

Operator:
Greg Stafford

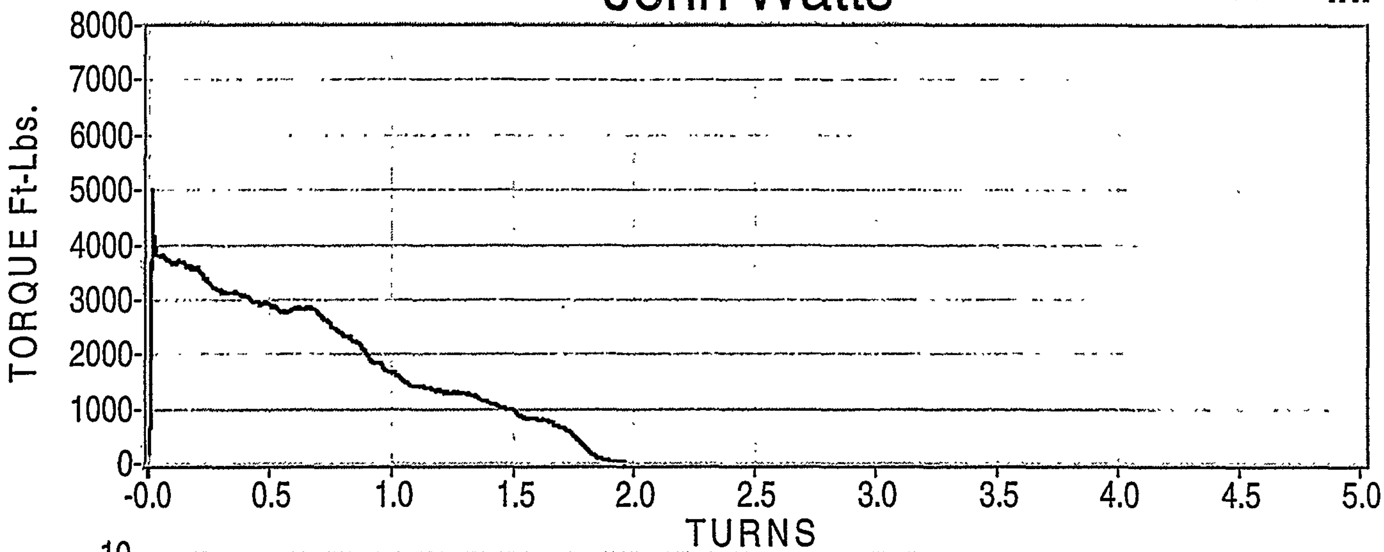
Date:Time of Test
07/08/1999 : 11:10:01 AM

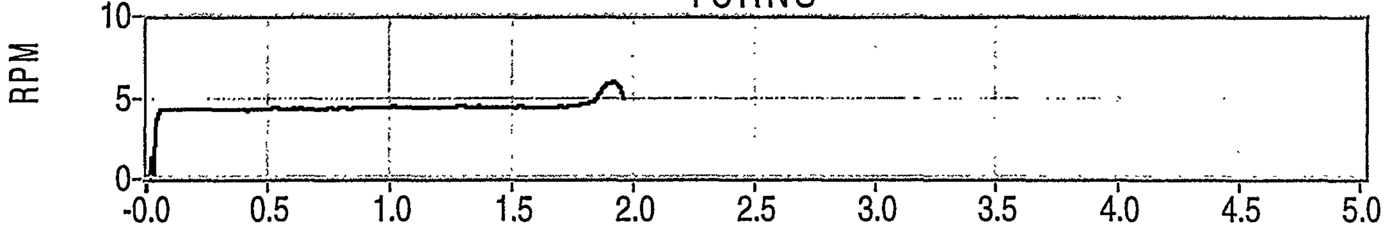
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts





BreakOut

BreakOut # 4	
Pin Id : 24	Box Id : 21
File Name : TT_0060.dat	
Maximum Torque	5053 Ft-Lbs

Operator :
Greg Stafford

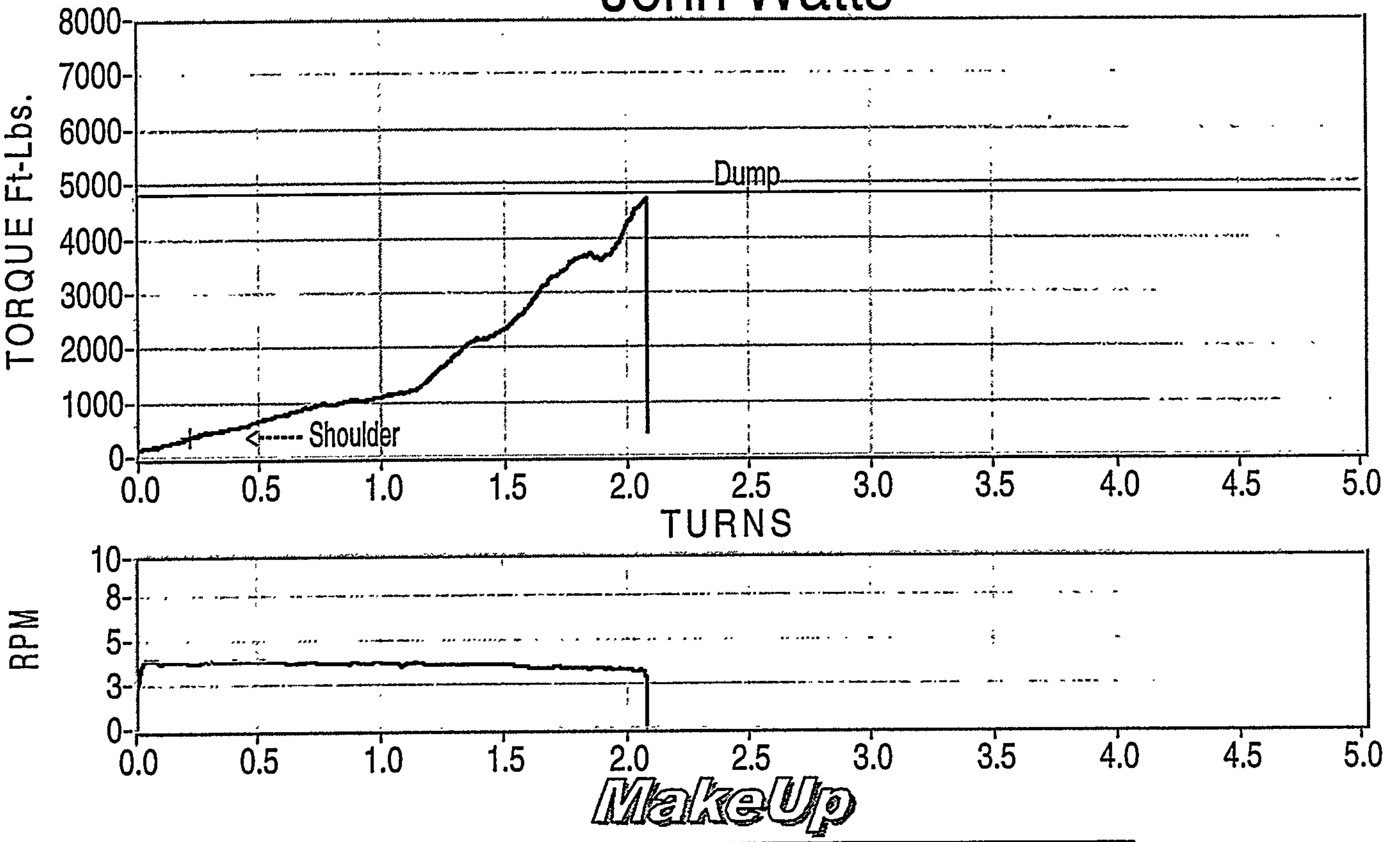
Date : Time of Test
07/08/1999 : 11:11:33 AM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp # 5	
Pin Id : 24	Box Id : 21
File Name : TT_0061.dat	

Maximum Torque	4737	Ft-Lbs
Shoulder Torque	349	Ft-Lbs
Delta Torque	4388	Ft-Lbs
Turns @ Max. Torque	2.081	Turns
Shoulder Turns	0.213	Turns
Delta Turns	1.867	Turns
Total Turns	2.082	Turns
Pin Dope	0	Grams
Box Dope	20	Grams

Operator:
Greg Stafford

Date:Time of Test
07/08/1999 : 11:22:48 AM

APPENDIX F
MAKEUP/BREAKOUT DATA FOR SAMPLES 1 - 6

Stress Engineering Services
Torque Turn
Test Setup Information

Project Number	5806
Client	John Watts
Pipe Size	7.00
Pipe Weight	32 lbs per ft.
Pipe Grade	P-110
Connection	John Watts Casing
Operator	Greg Stafford
Thread Compound	Shell API 72732

	Pin	**Box**
Surface Treatment	Phosphate	Phosphate

Test Setup File

C:_Project\Torque Turn\DATA\5806.su

07/07/1999 12:20 PM

Stress Engineering Services
Torque Turn
Test Setup Information

Project Number	5806
Client	John Watts
Pipe Size	7.00
Pipe Weight	32 lbs per ft.
Pipe Grade	P-110
Connection	John Watts Casing
Operator	Greg Stafford
Thread Compound	Shell API 72732

	Pin	**Box**
Surface Treatment	Phosphate	Phosphate

Test Setup File

C:_Project\Torque Turn\DATA\5806R.su

07/08/1999 6:18 AM

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: 1210

Capacity: 10k Lbs.

Shunt: 7192.00 Lbs.

Power Tong

Casing 32.00 Inches

Daq Gain	Daq Offset
2682.92	-0.130

Ctrl Gain	Ctrl Offset
2683.19	-0.130

Cal time date

07/07/1999 12:14 PM

Calibration File

C:_Project\Torque Turn\5806R.cal

Daq Board

Raw Volts	-0.130	Volts
Load Cell	-0.38	Lbs
Torque	-1.01	Ft Lbs
Gain	2682.92	Ft Lbs/V
Offset	-0.130	Volts

Control Board

Raw Volts	-0.130	Volts
Load Cell	-0.26	Lbs
Torque	-0.68	Ft Lbs
Gain	2683.19	Ft Lbs/V
Offset	-0.130	Volts

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: 1210

Capacity: 10k Lbs.

Shunt: 7192.00 Lbs.

Power Tong

Casing 32.00 Inches

Daq Gain	Daq Offset
2683.02	-0.130

Ctrl Gain	Ctrl Offset
2683.33	-0.130

Cal time date

07/08/1999 6:20 AM

Calibration File

C:_Project\Torque Turn\5806R.cal

Daq Board

Raw Volts	-0.131	Volts
Load Cell	-0.16	Lbs
Torque	-0.43	Ft Lbs
Gain	2683.02	Ft Lbs/V
Offset	-0.130	Volts

Control Board

Raw Volts	-0.130	Volts
Load Cell	0.05	Lbs
Torque	0.12	Ft Lbs
Gain	2683.33	Ft Lbs/V
Offset	-0.130	Volts

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: 1210

Capacity: 10k Lbs.

Shunt: 7192.00 Lbs.

Power Tong

Casing 32.00 Inches

Daq Gain	Daq Offset
2683.02	-0.130

Ctrl Gain	Ctrl Offset
2683.33	-0.130

Cal time date

07/08/1999 6:20 AM

Calibration File

C:_Project\Torque Turn\5806R.cal

Daq Board

Raw Volts	2.551	Volts
Load Cell	7193.24	Lbs
Torque	19181.98	Ft Lbs
Gain	2683.02	Ft Lbs/V
Offset	-0.130	Volts

Control Board

Raw Volts	2.550	Volts
Load Cell	7193.20	Lbs
Torque	19181.88	Ft Lbs
Gain	2683.33	Ft Lbs/V
Offset	-0.130	Volts

STRESS ENGINEERING SERVICES
MAKEUP/BREAKOUT TEST LOG

DATE: 8/11/99
OPERATOR: GS.
CLIENT: JOHN WATTS PIPE SIZE: 7 IN. PN: 5806
PAGE 1 OF ____

TT REC NO.	MU/BO NO.	PIN NO.	BOX NO.	TARGET TORQUE	MAXIMUM		SHOULDER		BREAKOUT TORQUE	COMMENTS	
					TORQUE	TURNS	TORQUE	TURNS			
007	MU1	2A	2A	2.08"	4861	1.918				.240	2.08;
008	MU1	2B	2B	2.23	5224	2.039					

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THREAD COMPOUND APPLICATION LOG

PN 5806 Page 1 of ___

TEST NO. ________ PIPE SIZE 7.0" DATE 8/11/99. BY GS

MAKEUP NO.	PIN END NO.	BOX END NO.	WEIGHT, GRAMS		
			PIN	BOX	TOTAL
1	2A	2A	—	22	22
1	2B	2B	—	22	22

Stress Engineering Services
Torque Turn
Test Setup Information

Project Number	5806
Client	John Watts
Pipe Size	7.00
Pipe Weight	32 lbs per ft.
Pipe Grade	P-110
Connection	John Watts Casing
Operator	gs hd
Thread Compound	Shell API 72732

	Pin	**Box**
Surface Treatment	Phosphate	Phosphate

Test Setup File

C:_Project\Torque Turn\DATA\5806gas.su

08/11/1999 5:07 PM

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: 2428

Capacity: 10k Lbs.

Shunt: 7302.00 Lbs.

Power Tong

Casing 32.00 Inches

Daq Gain	Daq Offset
2704.97	-0.147

Ctrl Gain	Ctrl Offset
2705.25	-0.147

Cal time date

08/11/1999 5:04 PM

Calibration File

C:_Project\Torque Turn\5806.cal

Daq Board

Raw Volts	2.553	Volts
Load Cell	7302.23	Lbs
Torque	19472.62	Ft Lbs
Gain	2704.97	Ft Lbs/V
Offset	-0.147	Volts

Control Board

Raw Volts	2.553	Volts
Load Cell	7302.19	Lbs
Torque	19472.50	Ft Lbs
Gain	2705.25	Ft Lbs/V
Offset	-0.147	Volts

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: 2428

Capacity: 10k Lbs.

Shunt: 7302.00 Lbs.

Power Tong

Casing 32.00 Inches

Daq Gain	Daq Offset
2704.97	-0.147

Ctrl Gain	Ctrl Offset
2705.25	-0.147

Cal time date

08/11/1999 5:04 PM

Calibration File

C:_Project\Torque Turn\5806.cal

Daq Board

Raw Volts	-0.147	Volts
Load Cell	0.07	Lbs
Torque	0.20	Ft Lbs
Gain	2704.97	Ft Lbs/V
Offset	-0.147	Volts

Control Board

Raw Volts	-0.146	Volts
Load Cell	0.07	Lbs
Torque	0.19	Ft Lbs
Gain	2705.25	Ft Lbs/V
Offset	-0.147	Volts

JOHN WATTS TEST SAMPLES

COUPLED SAMPLES

SAMPLE NO.	THEAD INTER.	BOX NO.	COUPLING NO. A - NO. - B	BOX NO.
1	MAX.	1	13	6
2	MAX.	2	14	3
3	MIN.	7	16	11
4	MIN.	9 25	18	12 23
M/B PREL.	MAX.	4	15	5
M/B PREL.	MIN.	8	17	10

"A" SIDE.
3 M/B 7400
4 M/U 6400

CLEAN BEFORE FINAL BOTH ENDS.

"B" SIDE
4 M/B 7400
5 M/U 6400

FLUSHJOINT SAMPLES

SAMPLE NO.	THEAD INTER.	BOX NO.	PIN NO.
5	MAX.	19	22
6	MIN.	20	23
M/B PREL.	MIN.	21	24

B 0.260

5400 M+B

Client JW	Project No. 5806	Page No. of	By WTA	Date 7-8-99
Subject			Checked By	Date

MAKE / BREAK TEST

SAMPLE NO.	THREAD INTER.	END A TORQUE (ONE TIME MU)	END B TORQUE	END B M/B
A 1	MAX.	HIGH	HIGH	2 M/B
B 2	MAX.	LOW	LOW	—
A 3	MIN.	HIGH	HIGH	2 M/B
B 4	MIN.	LOW.	LOW	—
5	MAX.	—	HIGH	2 M/B
6	MIN.	—	LOW	—

	HIGH TORQUE	LOW TORQUE
COUPLED	7400 MIN 7030	6400 MAX 6720
INTEGRAL	5400 MIN 5130	4800 MAX 5040

GRPM — 7200

THREAD COMPOUND APPLICATION LOG

PN 5806 Page 1 of 2

TEST NO. ______ PIPE SIZE 7.00 DATE 7/7/99 BY [illegible]

	MAKEUP NO.	PIN END NO.	BOX END NO.	WEIGHT, GRAMS		
				PIN	BOX	TOTAL
	~~1~~	~~15B~~	~~5~~	~~—~~	~~25~~	~~25~~
	1	15A	4	—	30	30
SHELL 72732	2	15A	4	—	—	RETORQUE
	3	15A	4	—	26	26
	4	15A	4	—	23	23
	5	"	"	—	25	25
	1	15B	5	—	21	21
BOL 2000	2	15B	5	—	18	18
	3	"	"	—	20	20
	4	"	"	—	21	21
	5	"	"	—	22	22
	1	17A	8	—	20	20
	2	17A	8	—	22	22
	3	17A	8	—	+ 1	23
	4	"	"	—	0	0
	5	"	"	—	19	19
	1	17B	10	—	20	20
	2	"	"	—	0	0
	3	"	"	—	0	0
	4	"	"	—	0	0
	5	"	"	—	25	25
	1	24	21	14	12	26
	2	"	"	—	20	20
	3	"	"	—	21	21
	4	"	"	—	19	19

THREAD COMPOUND APPLICATION LOG

PN 5806 Page 2 of 2

TEST NO. ________ PIPE SIZE 7.00 DATE 7/8/99. BY GS

MAKEUP NO.	PIN END NO.	BOX END NO.	WEIGHT, GRAMS			
			PIN	BOX	TOTAL	
5	24	21	—	20	20	
~~1~~	~~23~~	~~20~~	~~9~~	~~14~~	~~23~~	TOO MUCH DOPE
~~1~~	~~22~~	~~19~~	~~10~~	~~15~~	~~25~~	TOO MUCH DOPE
1	22	19	—	19	19	
~~1~~	~~16A~~	~~7~~	~~—~~	~~21~~	~~21~~	CLEAN + REDOPE
1	16B	11	—	20	20	
1	14A	2	—	19	19	
1	14B	3	—	20	20	
1	13A	1	—	21	21	
1	13B	6	—	21	21	
1	18A	9	—	25	25	
1	18B	12	—	23	23	
2	22	19	—	19	19	
3	〃	〃	—	18	18	
1	23	20	—	19	19	
2	16B	11	—	19	19	
3	〃	〃	—	23	23	
1	16A	7	—	19	19	
2	13B	6	—	23	23	
3	〃	〃	—	21	21	

THREAD COMPOUND APPLICATION LOG

PN 5806 Page 1 of __

TEST NO. SHell 72732 PIPE SIZE 7" DATE 7-21-99 BY GS Hd

MAKEUP NO.	PIN END NO.	BOX END NO.	WEIGHT, GRAMS		
			PIN	BOX	TOTAL
2	07	16A	0	23	23
2	11	16B	0	19	19
2	9	18A	0	19	19
2	12	18B	0	20	20

THREAD COMPOUND APPLICATION LOG

PN 5806 Shell 72732 Page 1 of 1

TEST NO. Sample #2 PIPE SIZE 7" DATE 7-18-99 BY GS Ild

MAKEUP NO.	PIN END NO.	BOX END NO.	WEIGHT, GRAMS		
			PIN	BOX	TOTAL
2	2	14A	0	38	38
2	3	14B	0	33	33

STRESS ENGINEERING SERVICES
MAKEUP/BREAKOUT TEST LOG

DATE: 7-7-99
OPERATOR: GS/NH
PN: 5806
PAGE 1 OF 4

CLIENT: JOHN WATTS PIPE SIZE: 7"

TT REC NO.	MU/BO NO.	PIN NO.	BOX NO.	TARGET TORQUE	MAXIMUM		SHOULDER		BREAKOUT TORQUE	COMMENTS
					TORQUE	TURNS	TORQUE	TURNS		
17	MU1	15A	4	3T	7424	3.004	—	—	NO BØ	
18	MU2	15A	4	8400	8522	.028	—	—	—	.002" Feeler
19	BØ1	"	"	—	—	—	—	—	8780	
20	MU3	"	"	8500	8478	2.133	?—	—	—	.002" Feeler
21	BØ3	"	"	—	—	—	—	—	12585	
22	MU4	"	"	10,500	10,691	2.021	?—	?—	—	.002" FEELER NO FIT.
23	BØ4	"	"	—	—	—	—	—	11957	
24	MU5	"	"	12,500	11628	2.185	5201	1.983	—	SAMPLE YIELDED
25	MU1	15B	5	10,000	9013	3.604	5645	2.914	—	SHOULDER YIELDED
26	BØ1	15B	5	—	—	—	—	—	8145	
27	MU2	"	"	7,000	6941	1.820	? —	? —	—	
28	BØ2	"	"	—	—	—	—	—	7564	
29	MU3	"	"	7,000	6975	2.097	—	—		
30	BØ3	"	"	—	—	—	—	—	7855	
31	MU4	"	"	7,000	7003	2.066	—	—		
32	BØ4	"	"	—	—	—	—	—	6681	
33	MU5	"	"	7,000	7028	2.093	—	—		

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STRESS ENGINEERING SERVICES
MAKEUP/BREAKOUT TEST LOG

DATE: 7/7/99
OPERATOR: GS/NH
PN: 5806
PAGE 2 OF 4

CLIENT: JOHN WATTS　　PIPE SIZE: 7"

TT REC NO.	MU/BO NO.	PIN NO.	BOX NO.	TARGET TORQUE	MAXIMUM		SHOULDER		BREAKOUT TORQUE	COMMENTS
					TORQUE	TURNS	TORQUE	TURNS		
134	BØ5	15B	5	—	—	—	—	—	7569	NO GALLING
135	MU1	17A	8	7,000	7143	2.739	6018	2.740	—	
136	BØ1	"	"	—	—	—	—	—	7608	
37	MU2	17A	8	7400	7553	1.986	4862	1.970	—	
38	BØ2	"	"	—	—	—	—	—	7154	NO GALLING
39	MU3	17A	8	7400	7648	1.843	4724	1.827	—	
40	BØ3	"	"	—	—	—	—	—	7400	NO GALLING
41	MU4	"	"	7400	7583	1.764	4544	1.748	—	
42	BØ4	"	"	—	—	—	—	—	8121	
43	MU5	"	"	6400	6665	2.015	5619.37	2.009	—	
44	MU1	17B	10	7400	7521	2.834	5955	2.816	—	
45	BØ1	"	"	—	—	—	—	—	8141	
46	MU2	"	"	7400	7476	1.826	5649	1.814	—	
47	BØ2	"	"	—	—	—	—	—	8027	
48	MU3	"	"	7400	7526	1.967	6354	1.956	—	
49	BØ3	"	"	—	—	—	—	—	8295	
50	MU4	"	"	7400	7473	2.001	6300	2.001	—	

STRESS ENGINEERING SERVICES
MAKEUP/BREAKOUT TEST LOG

DATE: 7/8/99
OPERATOR: GS/NH
PN: 5806
PAGE 3 OF 4

CLIENT: JOHN WATTS PIPE SIZE: 7"

TT REC NO.	MU/BO NO.	PIN NO.	BOX NO.	TARGET TORQUE	MAXIMUM		SHOULDER		BREAKOUT TORQUE	COMMENTS
					TORQUE	TURNS	TORQUE	TURNS		
51	BØ4	17B	10	—	—	—	—	—	8403	DING IN 4TH THD. FROM BACK OF BOX.
52	MU5	"	"	6400	6584	2.362	5436	2.352	—	FIELD REPAIRED.
53	MU1	24	21	3.75 TURNS	4771	3.760	—	—	—	
54	BØ1	"	"	—	—	—	—	—	5771	
55	MU2	"	"	4800	4714	2.242	—	—	—	
56	BØ2	"	"	—	—	—	—	—	4682	
57	MU3	"	"	4800	4721	2.308	—	—	—	
58	BØ3	"	"	—	—	—	—	—	4999	
59	MU4	"	"	4800	4752	2.108	—	—	—	
60	BØ4	"	"	—	—	—	—	—	5053	
61	MU5	"	"	4800	4737	2.082	—	—	—	
62	MU1	22	19	3.560 TURNS	5441	3.570	—	—	—	
63	BØ1	"	"	—	—	—	—	—	6014	
64	MU2	"	"	5400	5348	2.261	—	—	—	
65	BØ2	"	"	—	—	—	—	—	5869	
66	MU3	"	"	5400	5338	2.014	—	—	—	
67	MU1	23	20	4800	4713	3.463	—	—	—	

5438

STRESS ENGINEERING SERVICES
MAKEUP/BREAKOUT TEST LOG

DATE: 7/8/99
OPERATOR: GS/NH
CLIENT: JOHN WATTS PIPE SIZE: 7" PN: 5806
PAGE 4 OF 4

TT REC NO.	MU/BO NO.	PIN NO.	BOX NO.	TARGET TORQUE	MAXIMUM		SHOULDER		BREAKOUT TORQUE	COMMENTS
					TORQUE	TURNS	TORQUE	TURNS		
68	MU1	14B	3	6400	6333	3.017	—	—	—	.0025 FEELER GAGE FITS TIGHT
69	MU1	14A	2	6400	6353	2.653	—	—	—	.0035 GAP WITH FEELER GAGE
70	MU1	18A	9	6400	6499	3.150	4741	3.118	—	
71	MU1	18B	12	6400	6510	2.745	5698	2.728	—	
72	MU1	16B	11	7400	7570	2.820	6115	2.083	—	PLOT HAS WRONG MAKE UP NUMBER
73	BØ1	"	"	—	—	—	—	—	7845	
74	MU2	"	"	7400	7693	2.063	4476	2.042	—	
75	BØ2	"	"	—	—	—	—	—	8163	
76	MU3	"	"	7400	7800	2.151	5190	2.131	—	
77	MU1	16A	7	7400	7570	2.521	5776	2.488	—	
78	MU1	13A	1	7400	7435	3.226	6721	3.180	—	
79	MU1	13B	6	7400	7430	3.235	6783	3.216	—	
80	BØ1	"	"	—	—	—	—	—	8128	
81	MU2	"	"	7400	7670	2.373	6613	2.358	—	
82	BØ2	"	"	—	—	—	—	—	7754	
83	MU3	"	"	7400	7657	2.092	6048	2.064	—	

STRESS ENGINEERING SERVICES
MAKEUP/BREAKOUT TEST LOG

DATE: 7-18-99
OPERATOR: GS-Hd
CLIENT: John Watts PIPE SIZE: 7" PN: 5806
PAGE 1 OF 1
Sample 2 Shell 72732

TT REC NO.	MU/BO NO.	PIN NO.	BOX NO.	TARGET TORQUE	MAXIMUM TORQUE	MAXIMUM TURNS	SHOULDER TORQUE	SHOULDER TURNS	BREAKOUT TORQUE	COMMENTS
105	MU1	2	14A	7000	6946					
106	BO1	3	14B						3125	
107	MU2	3	14B	7000	4794					Yielded

ML [illegible] = OC [illegible]
Do NOT Break graph over
Shell 72732

STRESS ENGINEERING SERVICES
MAKEUP/BREAKOUT TEST LOG

DATE: 7-21-99
OPERATOR: GS Hd
PN: 5806
PAGE 1 OF

CLIENT: John Watts

PIPE SIZE: 7" 32#/soft P-110

TT REC NO.	MU/BO NO.	PIN NO.	BOX NO.	TARGET TORQUE	MAXIMUM		SHOULDER		BREAKOUT TORQUE	COMMENTS
					TORQUE	TURNS	TORQUE	TURNS		
115	BO 1	16A	07	—	—	—	—	—	23741	
#3 116	MU 2	07	16A	1.89	5024	1.669	4174	1.647	—	(.184+.005)10=1.89
117	BO 1	11	16B	—	—	—	—	—	22501	
118	MU 2	11	16B	2.08	6327	2.085	6191	2.065	—	(2.03+.005)10=2.08
119	BO1	09	18A	—	—	—	—	—	20425	
120	MU2	09	18A	1.65	4358	1.662	3984	1.629	—	(.160+.005)10=1.65
121	BO 1	12	18B	—	—	—	—	—	14906	
122	MU2	12	18B	1.62	9159	1.622	3962	1.558	—	(.157+.005)10=1.62
123	BO2	3	14B	—	—	—	—	—	16500	Yielded Side
124	BO2	2	14A	—	—	—	—	—	5906	—
125	BO2	1	13A	—	—	—	—	—	11383	—
126	BO2	6	13B	—	—	—	—	—	6910	

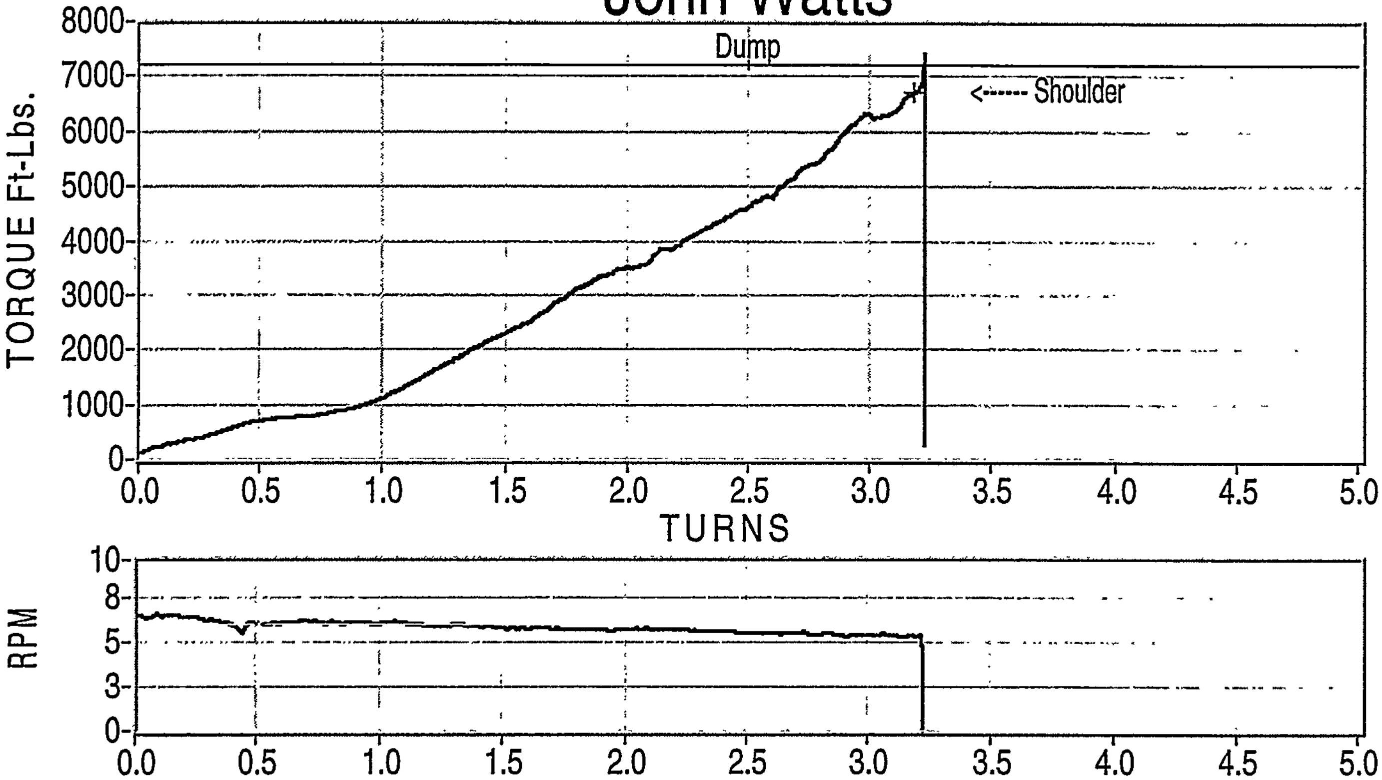
SAMPLE 1A

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp

MakeUp # 1	
Pin Id : 13A	Box Id : 1
File Name : TT_0078.dat	

#1A

Maximum Torque	7435	Ft-Lbs
Shoulder Torque	6722	Ft-Lbs
Delta Torque	713	Ft-Lbs
Turns @ Max. Torque	3.225	Turns
Shoulder Turns	3.180	Turns
Delta Turns	0.045	Turns
Total Turns	3.226	Turns
Pin Dope	0	Grams
Box Dope	21	Grams

Operator:
Greg Stafford

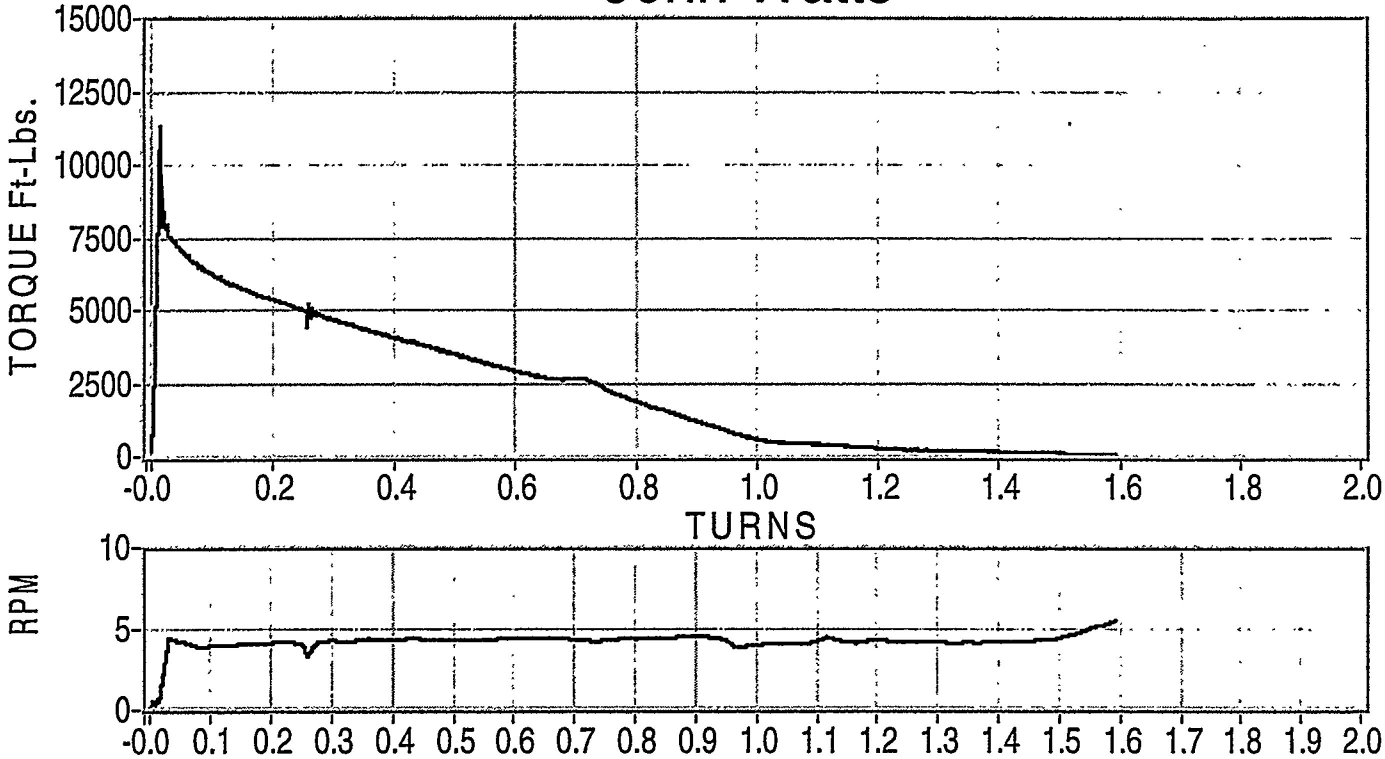
Date:Time of Test
07/08/1999 : 4:35:42 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size 7.000 in.

John Watts



BreakOut

BreakOut # 2	
Pin Id : 1	Box Id : 13a
File Name : TT_0125.dat	
Maximum Torque	11383 Ft-Lbs

1A

Operator :
Greg Stafford - hd

Date : Time of Test
07/21/1999 : 6:29:25 PM

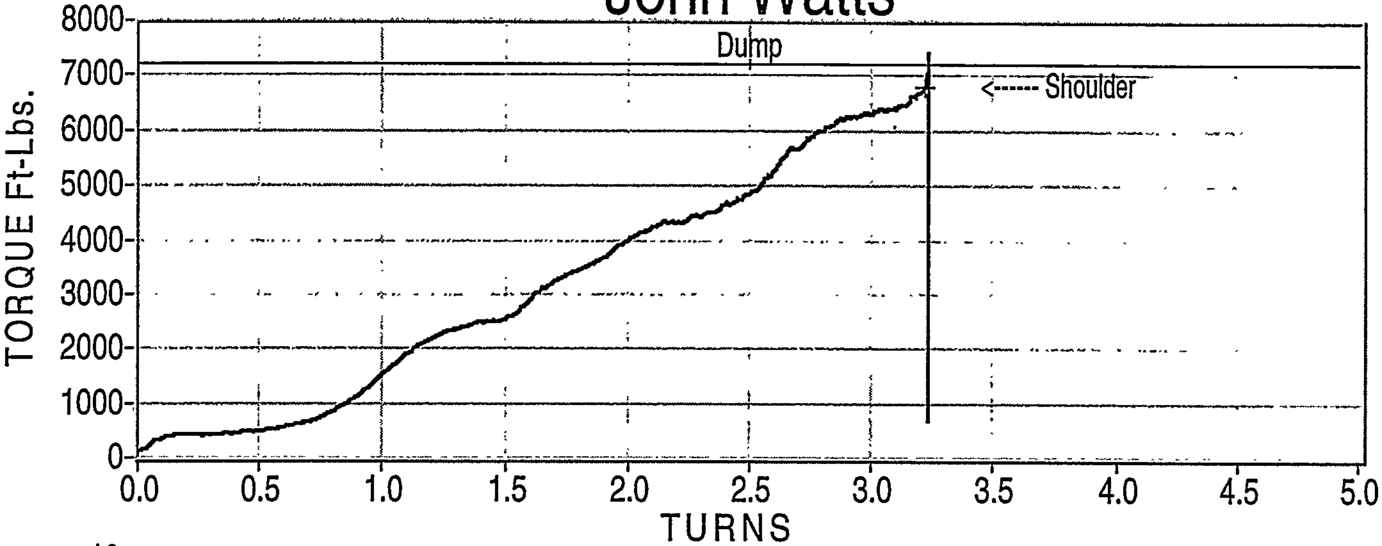
SAMPLE 1B

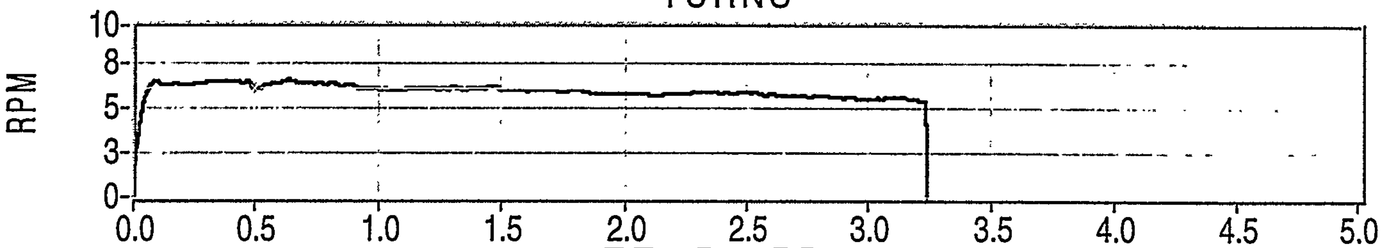
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 1		
Pin Id : 13B	Box Id : 6	
File Name : TT_0079.dat		
Maximum Torque	7430	Ft-Lbs
Shoulder Torque	6783	Ft-Lbs
Delta Torque	646	Ft-Lbs
Turns @ Max. Torque	3.234	Turns
Shoulder Turns	3.216	Turns
Delta Turns	0.018	Turns
Total Turns	3.235	Turns
Pin Dope	0	Grams
Box Dope	21	Grams

1B

Operator:
Greg Stafford

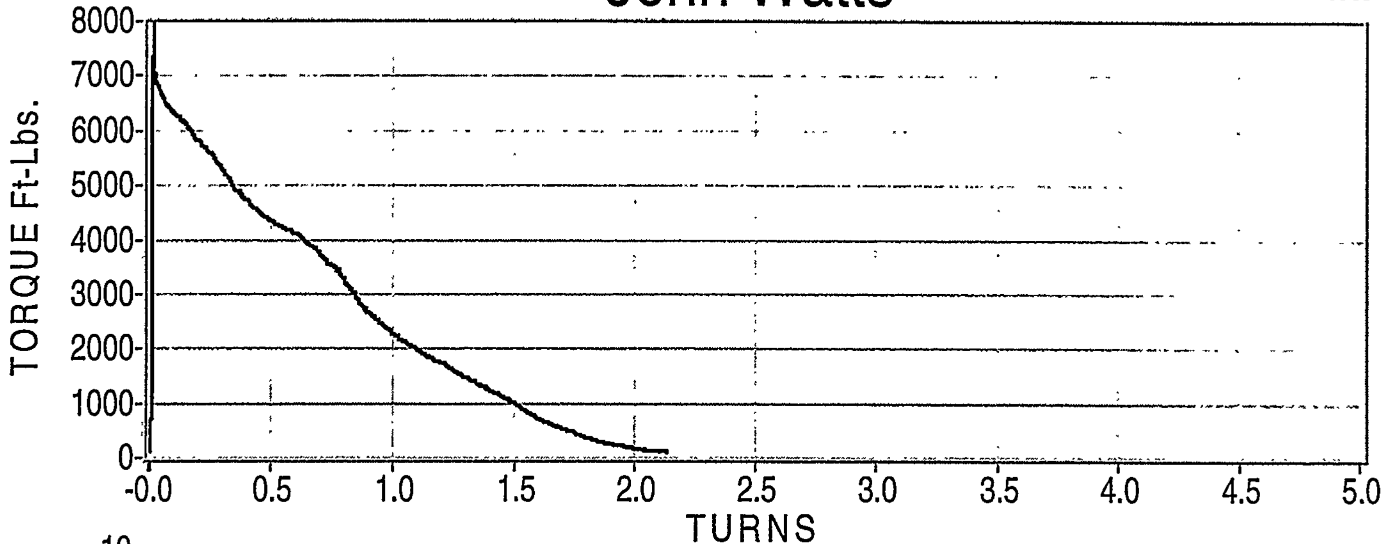
Date:Time of Test
07/08/1999 : 4:44:15 PM

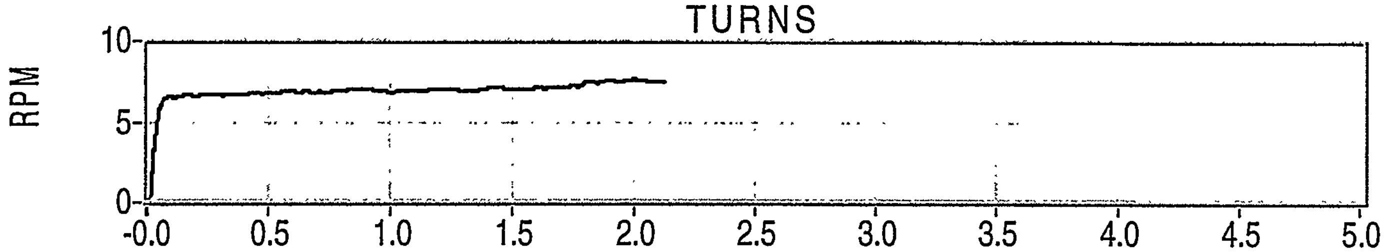
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts





BreakOut

BreakOut # 1	
Pin Id : 13B	Box Id : 6
File Name : TT_0080.dat	
Maximum Torque	8128 Ft-Lbs

1B

Operator :
Greg Stafford

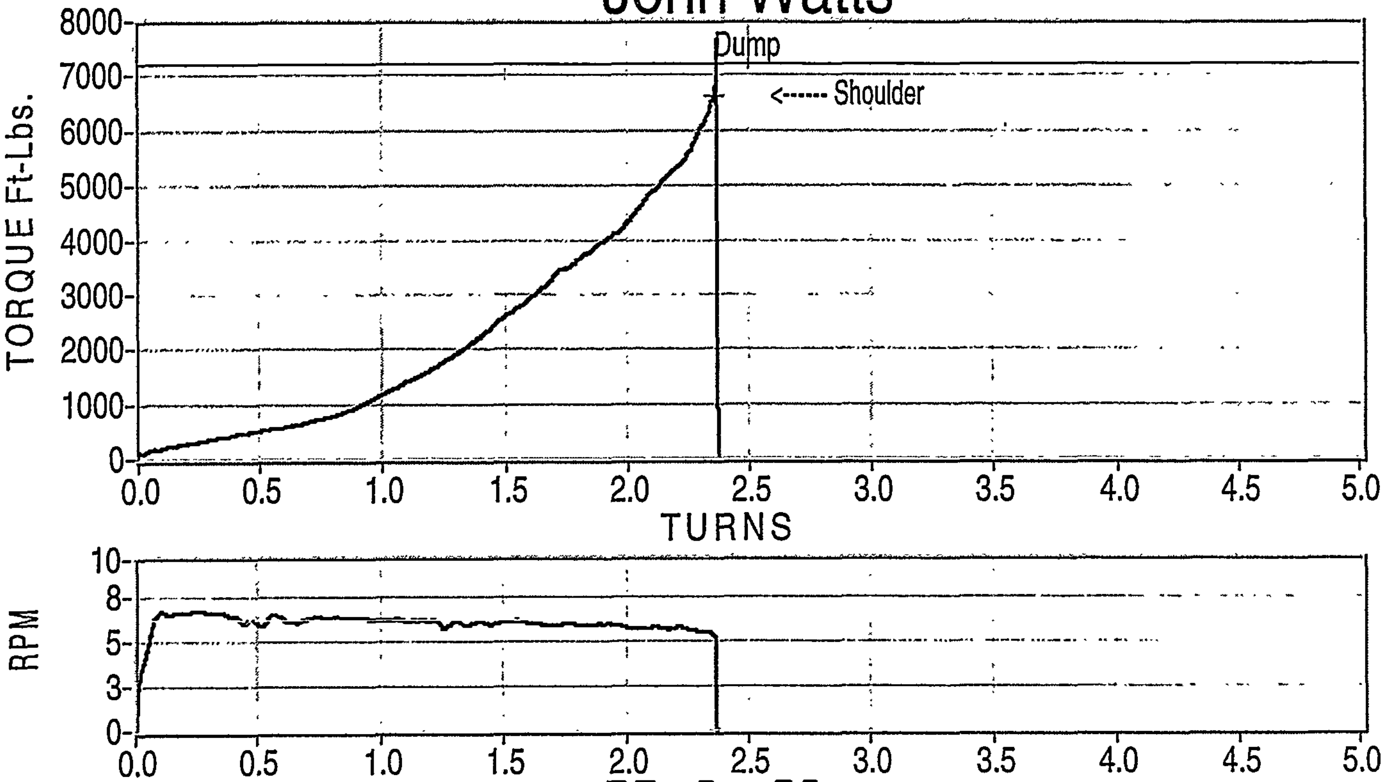
Date : Time of Test
07/08/1999 : 4:45:52 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size 7.000 in.

John Watts



MakeUp

MakeUp # 2	
Pin Id : 13B	Box Id : 6
File Name : TT_0081.dat	

1B

Maximum Torque	7670	Ft-Lbs
Shoulder Torque	6613	Ft-Lbs
Delta Torque	1056	Ft-Lbs
Turns @ Max. Torque	2.371	Turns
Shoulder Turns	2.358	Turns
Delta Turns	0.013	Turns
Total Turns	2.373	Turns
Pin Dope	0	Grams
Box Dope	23	Grams

Operator:
Greg Stafford

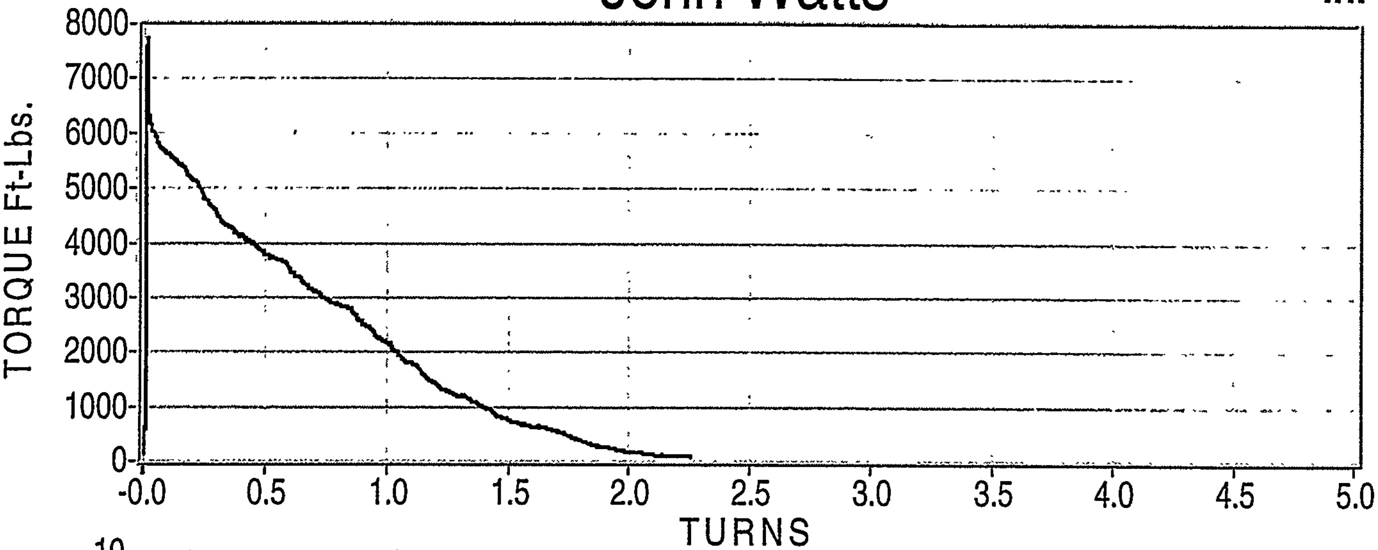
Date:Time of Test
07/08/1999 : 4:54:57 PM

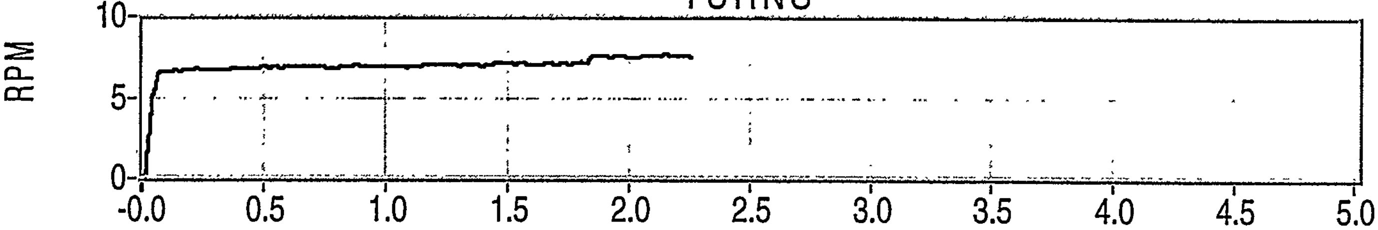
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts





BreakOut

BreakOut # 2	
Pin Id : 13B	Box Id : 6
File Name : TT_0082.dat	
Maximum Torque	7754 Ft-Lbs

1B

Operator :
Greg Stafford

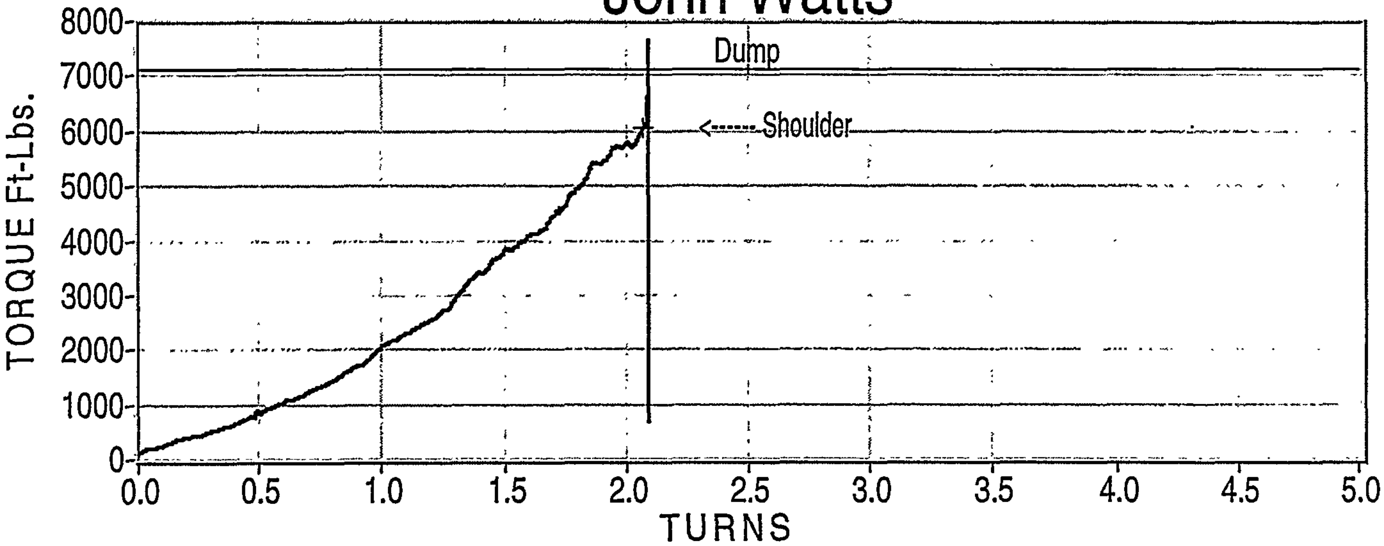
Date : Time of Test
07/08/1999 : 4:56:31 PM

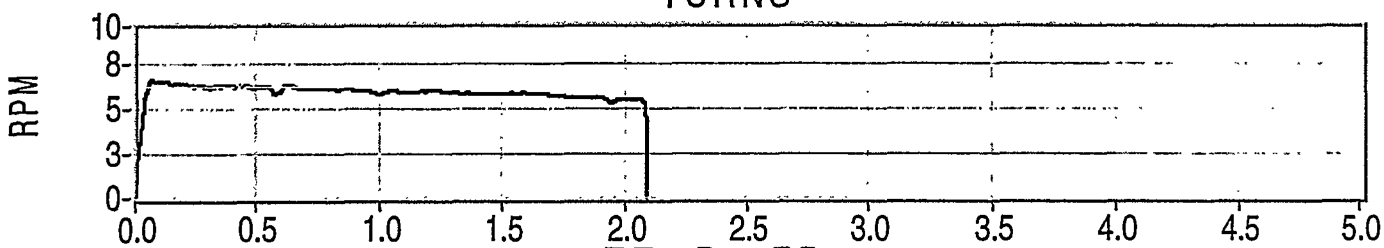
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 3	
Pin Id : 13B	**Box Id : 6**
File Name : TT_0083.dat	

#1B

Maximum Torque	**7657**	**Ft-Lbs**
Shoulder Torque	**6048**	**Ft-Lbs**
Delta Torque	**1608**	**Ft-Lbs**
Turns @ Max. Torque	**2.091**	**Turns**
Shoulder Turns	**2.064**	**Turns**
Delta Turns	**0.027**	**Turns**
Total Turns	**2.092**	**Turns**
Pin Dope	**0**	**Grams**
Box Dope	**21**	**Grams**

Operator:
Greg Stafford

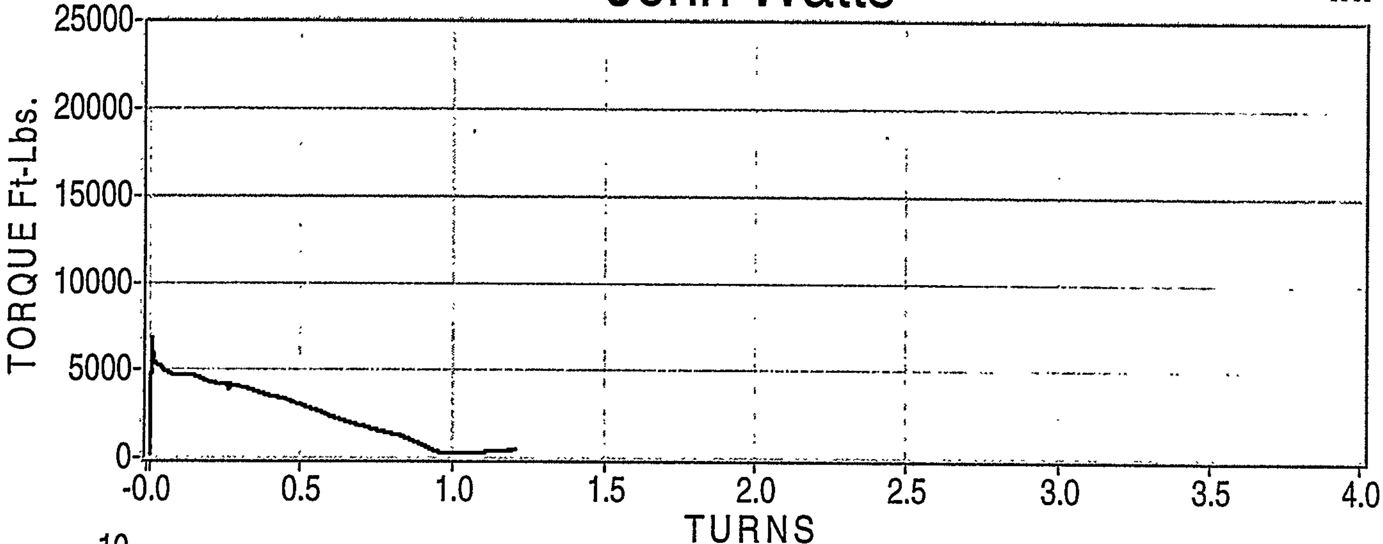
Date:Time of Test
07/08/1999 : 5:10:47 PM

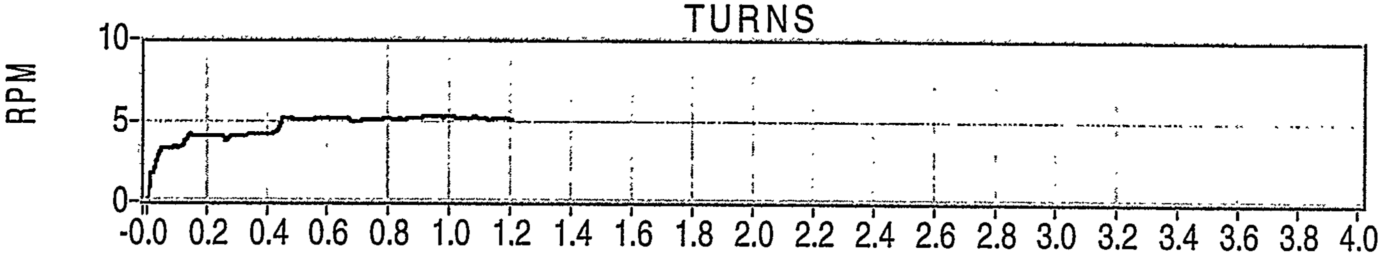
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts





BreakOut

BreakOut # 3	
Pin Id : 6	**Box Id :** 13b
File Name : TT_0126.dat	
Maximum Torque	6910 Ft-Lbs

1B

Operator :
Greg Stafford - hd

Date : Time of Test
07/21/1999 : 6:42:34 PM

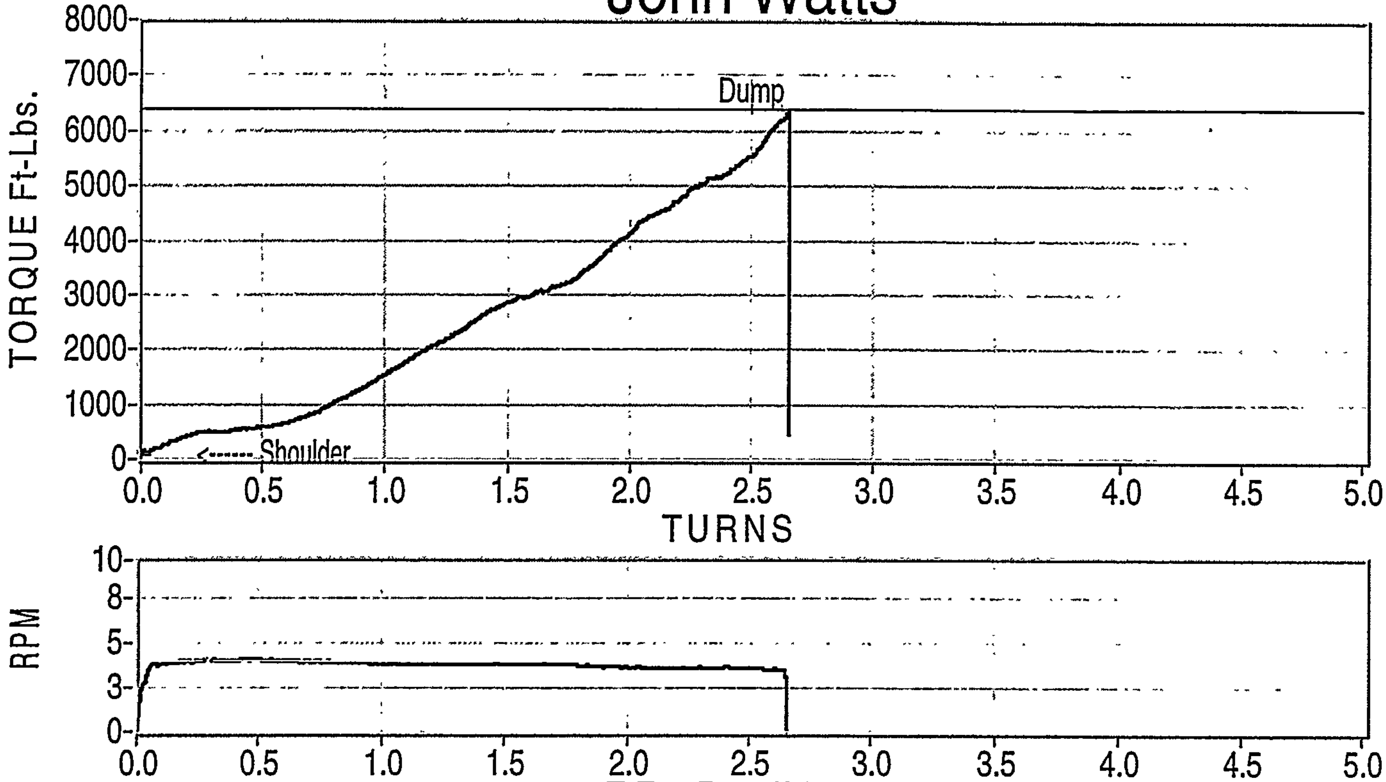
SAMPLE 2A

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size 7.000 in.

John Watts



MakeUp

MakeUp # 1	
Pin Id : 14A	Box Id : 2
File Name : TT_0069.dat	

Maximum Torque	6353	Ft-Lbs
Shoulder Torque	81	Ft-Lbs
Delta Torque	6272	Ft-Lbs
Turns @ Max. Torque	2.652	Turns
Shoulder Turns	0.000	Turns
Delta Turns	2.652	Turns
Total Turns	2.653	Turns
Pin Dope	0	Grams
Box Dope	19	Grams

#2A

Operator:
Greg Stafford

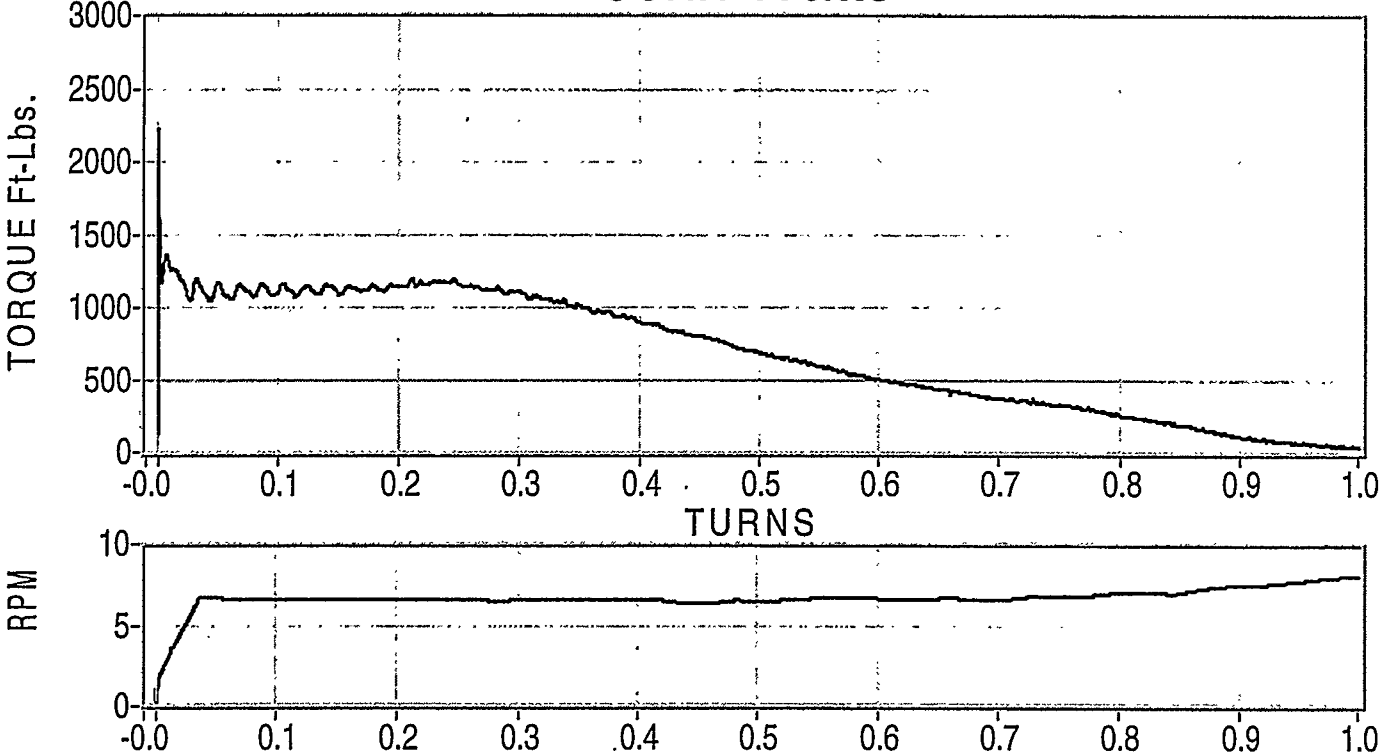
Date:Time of Test
07/08/1999 : 3:02:26 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts



BreakOut

BreakOut # 1	
Pin Id : ~~2~~ 14A	Box Id : 2~~1~~
File Name : TT_0100.dat	
Maximum Torque	2233 Ft-Lbs

2A

Operator :
hd

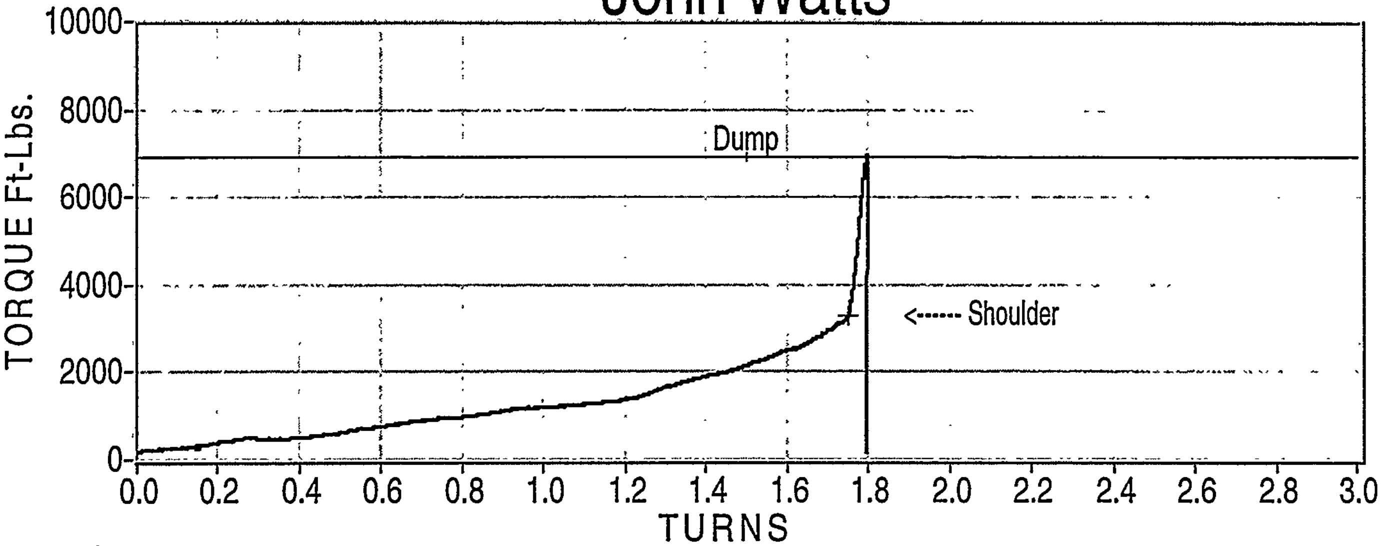
Date : Time of Test
07/19/1999 : 12:00:45 PM

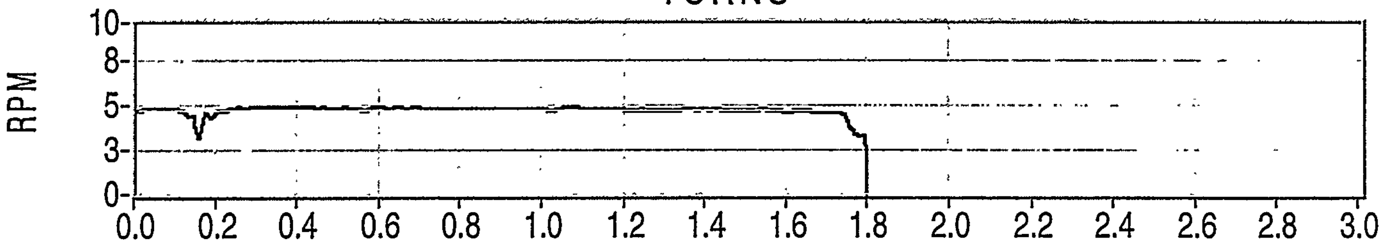
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 2	
Pin Id : 2	Box Id : 14a
File Name : TT_0105.dat	
Maximum Torque	6946 Ft-Lbs
Shoulder Torque	3283 Ft-Lbs
Delta Torque	3663 Ft-Lbs
Turns @ Max. Torque	1.797 Turns
Shoulder Turns	1.750 Turns
Delta Turns	0.047 Turns
Total Turns	1.797 Turns
Pin Dope	0 Grams
Box Dope	38 Grams

2A

Operator:
hd

Date:Time of Test
07/19/1999 : 5:45:12 PM

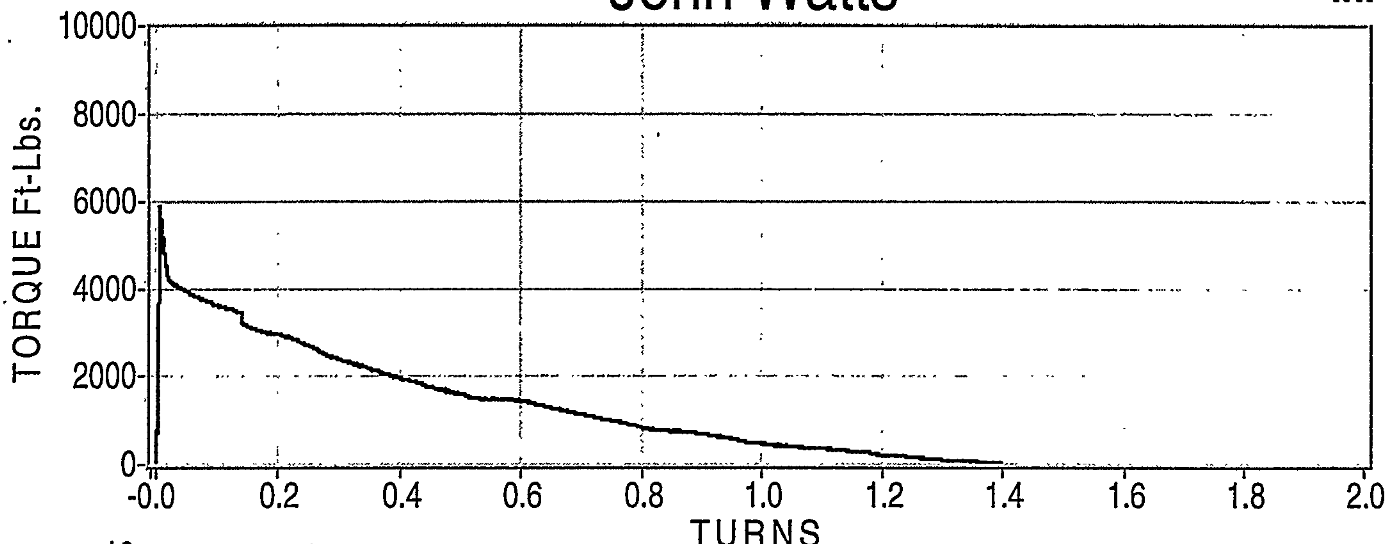
281- 463- 2312

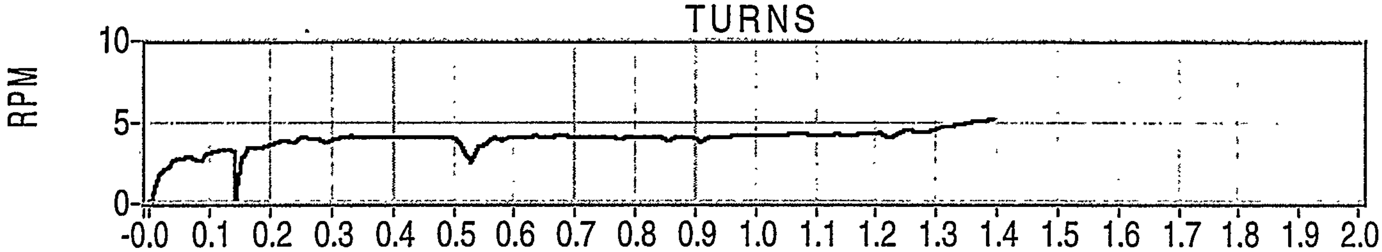
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts





BreakOut

BreakOut # 2	
Pin Id : 2	**Box Id : 14a**
File Name : TT_0124.dat	
Maximum Torque	**5906 Ft-Lbs**

2A

Operator :
Greg Stafford - hd

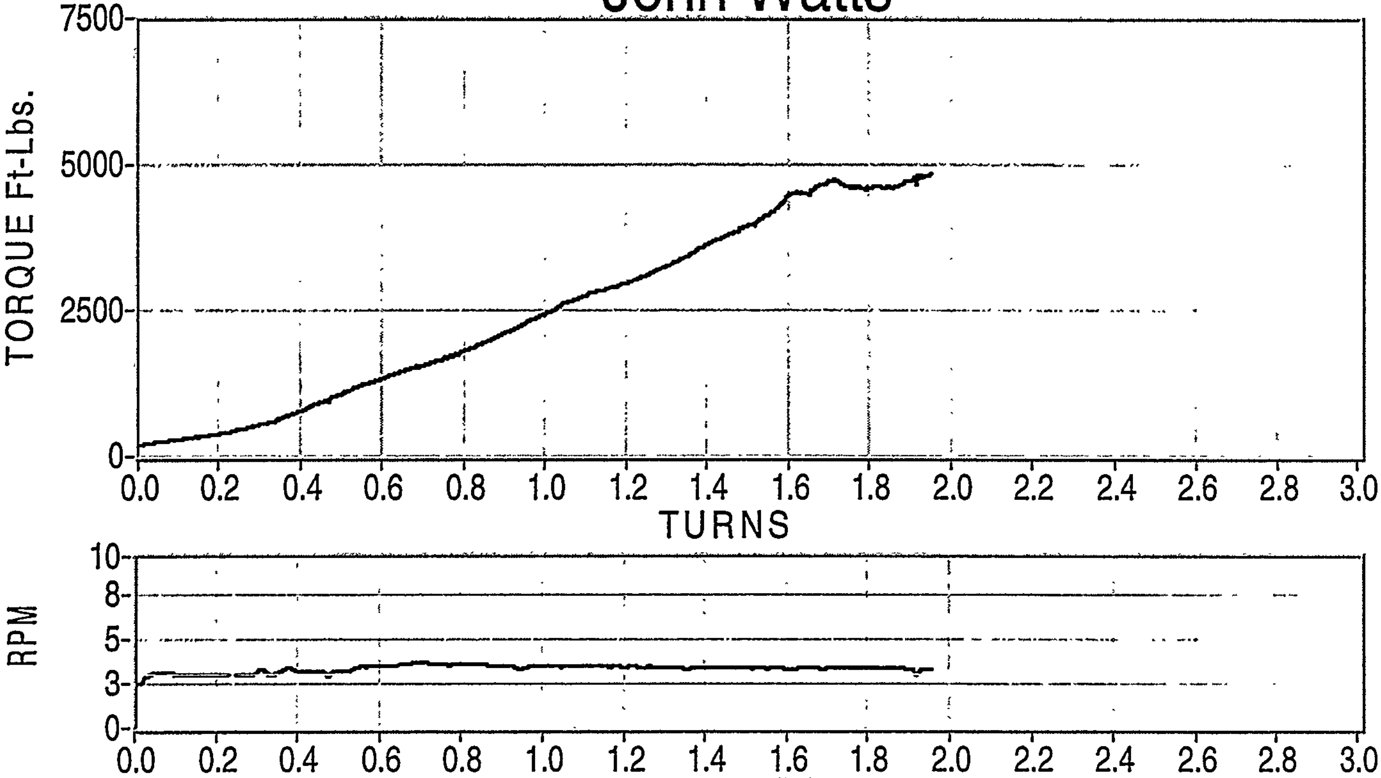
Date : Time of Test
07/21/1999 : 6:05:09 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp

MakeUp # 1		
Pin Id : 2a	Box Id : 2a	
File Name : TT_0007.dat		
Maximum Torque	4861	Ft-Lbs
Shoulder Torque	347	Ft-Lbs
Delta Torque	4514	Ft-Lbs
Turns @ Max. Torque	1.918	Turns
Shoulder Turns	0.174	Turns
Delta Turns	1.745	Turns
Total Turns	1.955	Turns
Pin Dope	0	Grams
Box Dope	22	Grams

Operator:
gs hd

Date:Time of Test
08/11/1999 : 5:18:36 PM

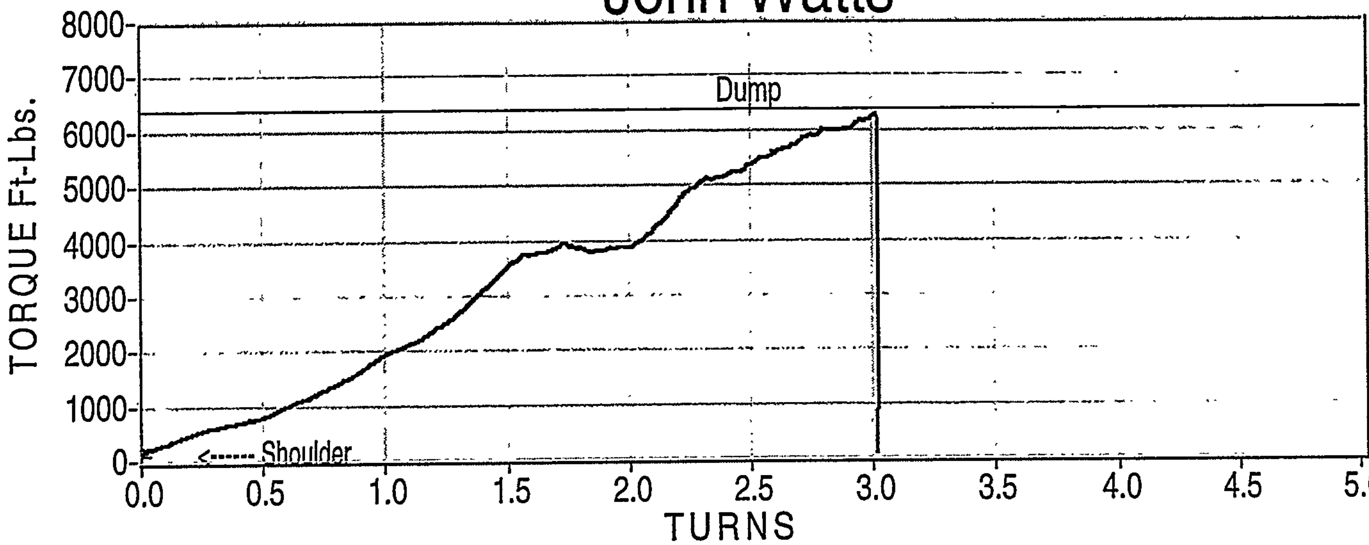
SAMPLE 2B

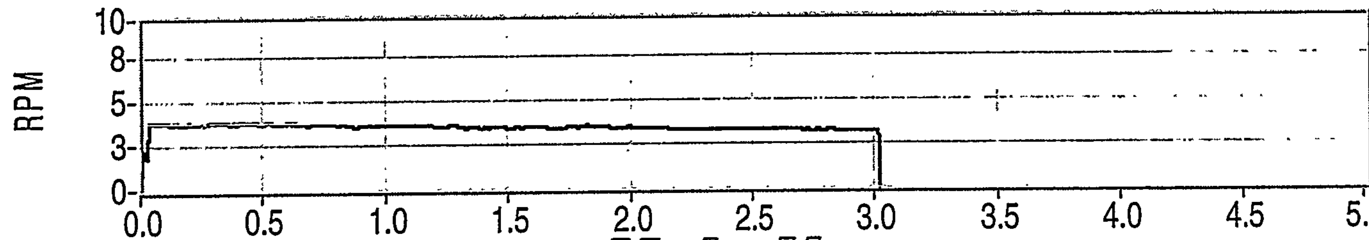
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 1		
Pin Id : 14B	Box Id : 3	
File Name : TT_0068.dat		
Maximum Torque	6333	Ft-Lbs
Shoulder Torque	114	Ft-Lbs
Delta Torque	6219	Ft-Lbs
Turns @ Max. Torque	3.014	Turns
Shoulder Turns	0.000	Turns
Delta Turns	3.014	Turns
Total Turns	3.017	Turns
Pin Dope	0	Grams
Box Dope	20	Grams

#2B

Operator:
Greg Stafford

Date:Time of Test
07/08/1999 : 2:42:15 PM

Stress Engineering Services
Torque Turn
Test Setup Information

Project Number	5806
Client	John Watts
Pipe Size	7.00
Pipe Weight	32 lbs per ft.
Pipe Grade	P-110
Connection	John Watts Casing
Operator	hd
Thread Compound	Shell API 72732

	Pin	Box
Surface Treatment	Phosphate	Phosphate

Test Setup File

C:_Project\Torque Turn\DATA\5806s2.su

07/19/1999

5:39 PM

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: 1210

Capacity: 10k Lbs.

Shunt: 7192.00 Lbs.

Power Tong

Casing 32.00 Inches

Daq Gain	Daq Offset
2681.52	-0.129

Ctrl Gain	Ctrl Offset
2681.76	-0.129

Cal time date

07/19/1999 11:58 AM

Calibration File

C:_Project\Torque Turn\5608s2.cal

Daq Board

Raw Volts	2.552	Volts
Load Cell	7190.37	Lbs
Torque	19174.33	Ft Lbs
Gain	2681.52	Ft Lbs/V
Offset	-0.129	Volts

Control Board

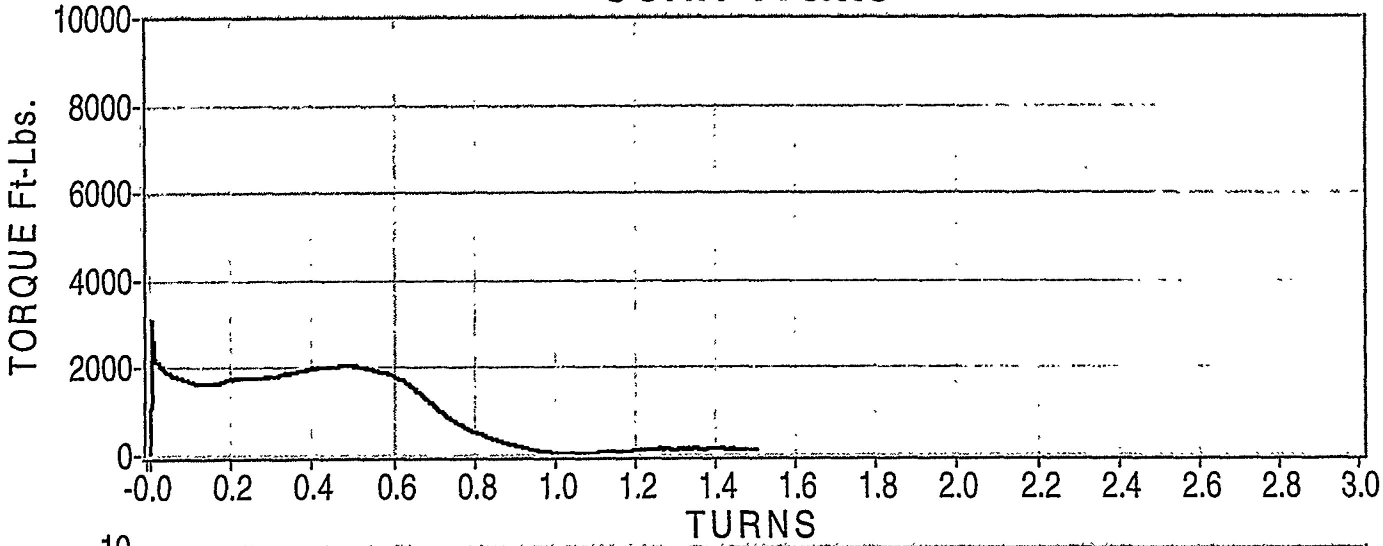
Raw Volts	2.552	Volts
Load Cell	7189.99	Lbs
Torque	19173.30	Ft Lbs
Gain	2681.76	Ft Lbs/V
Offset	-0.129	Volts

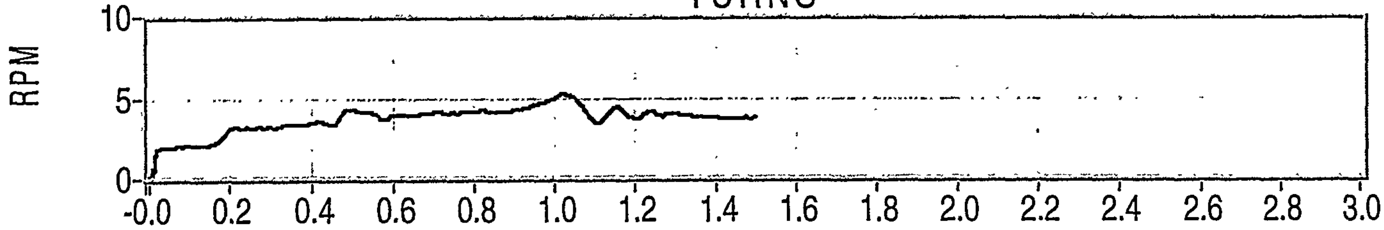
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts





BreakOut

BreakOut # 1	
Pin Id : 3	**Box Id : 14b**
File Name : TT_0106.dat	
Maximum Torque	**3125 Ft-Lbs**

2B

Operator :
hd

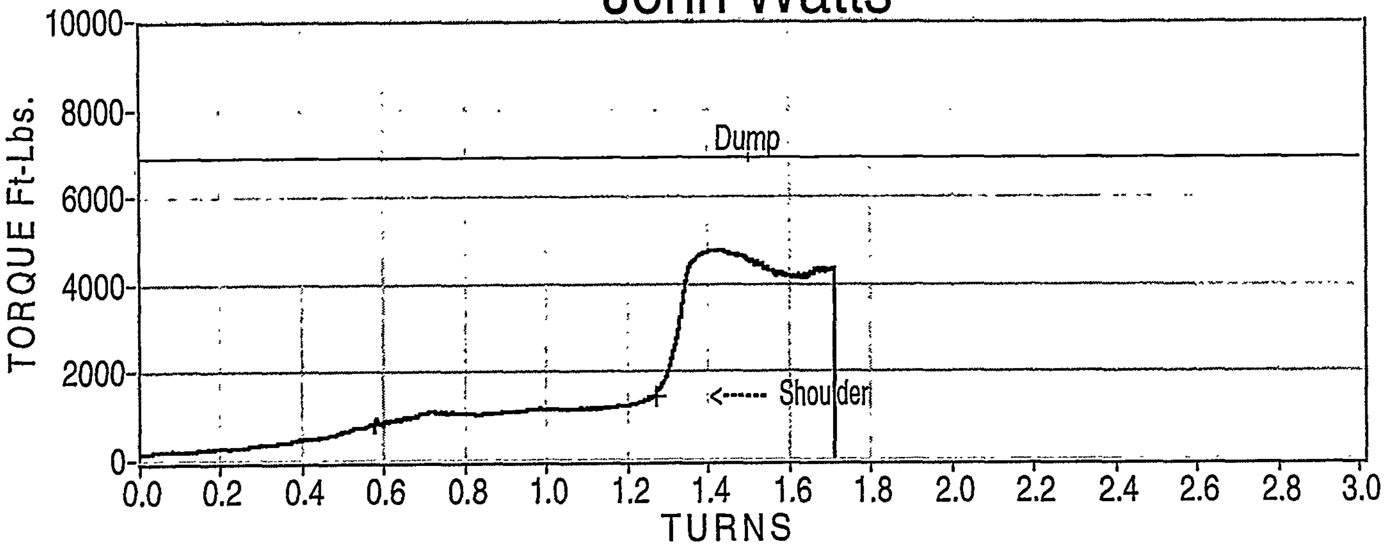
Date : Time of Test
07/19/1999 : 5:55:23 PM

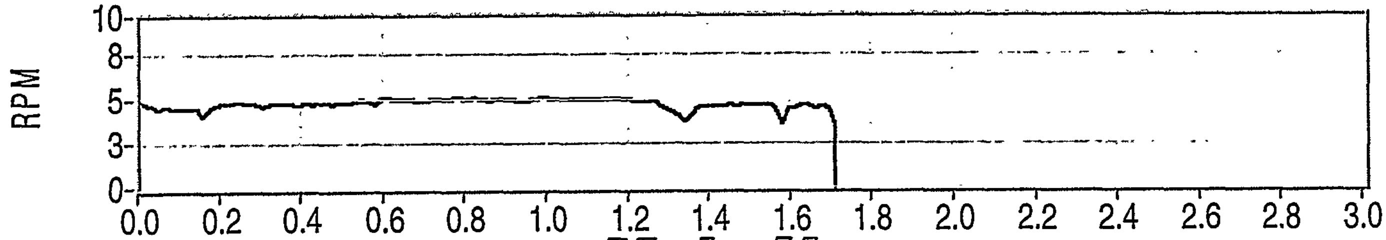
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 2		
Pin Id : 3	**Box Id : 14b**	
File Name : TT_0107.dat		
Maximum Torque	**4794**	**Ft-Lbs**
Shoulder Torque	**1452**	**Ft-Lbs**
Delta Torque	**3342**	**Ft-Lbs**
Turns @ Max. Torque	**1.430**	**Turns**
Shoulder Turns	**1.270**	**Turns**
Delta Turns	**0.160**	**Turns**
Total Turns	**1.712**	**Turns**
Pin Dope	**0**	**Grams**
Box Dope	**33**	**Grams**

2B

Operator:
hd

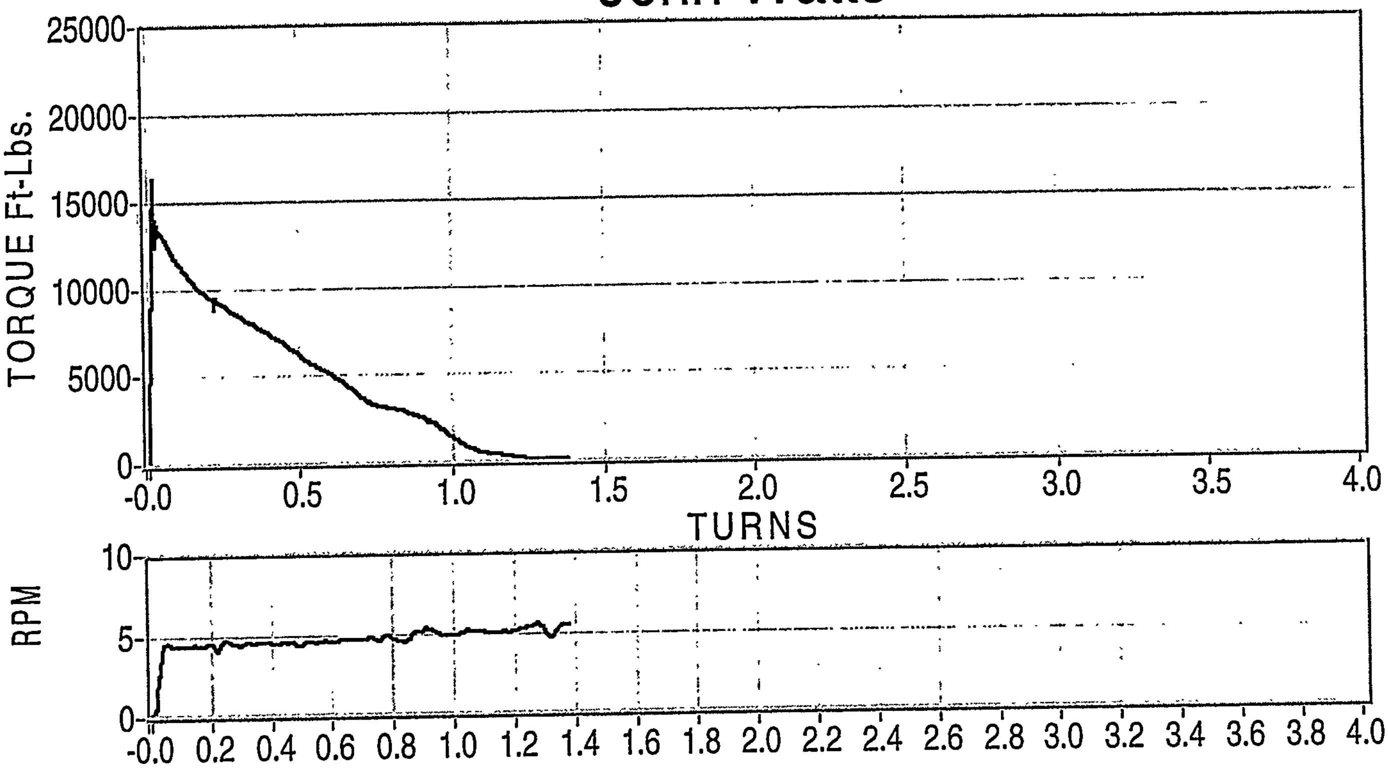
Date:Time of Test
07/19/1999 : 6:16:31 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts



BreakOut

BreakOut # 2	
Pin Id : 3	**Box Id :** 14b
File Name : TT_0123.dat	
Maximum Torque	16500 Ft-Lbs

2B

Operator :
Greg Stafford - hd

Date : Time of Test
07/21/1999 : 5:56:24 PM

Client JVI	Project No. 5806	Page No. of	By WTA	Date 8/11/99
Subject			Checked By	Date

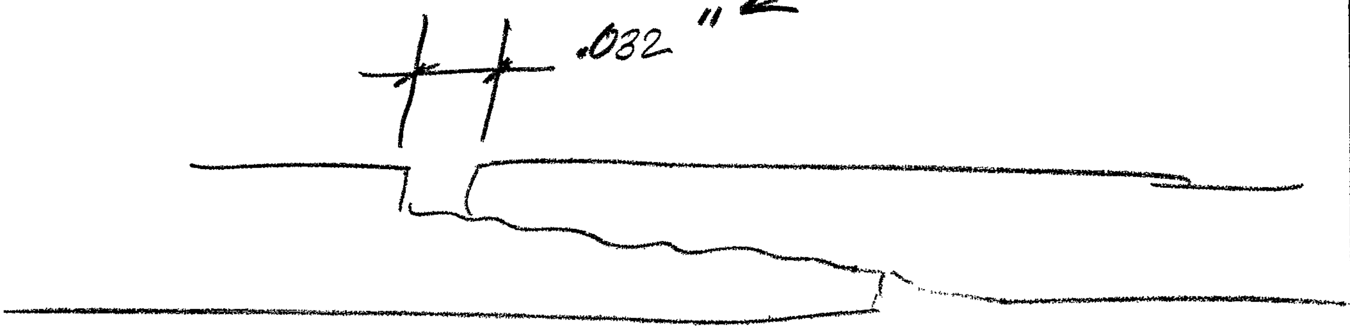
SAMPLE #2 REMAKE AFTER REDUCING CREST HEIGHT

SHELL 72732 DOPE

BOX – 22 grams

PIN – NONE

MAKEUP – .032" STANDOFF

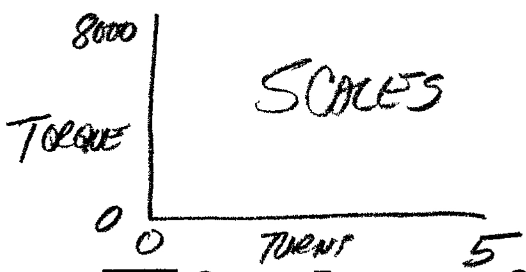


MAKEUP TO HAND TITE USING CHAIN WRENCH

MEASURE SHOULDER STANDOFF – "SØ"

MAKEUP TO TURNS —

TURNS = 10 × (SØ – .032")

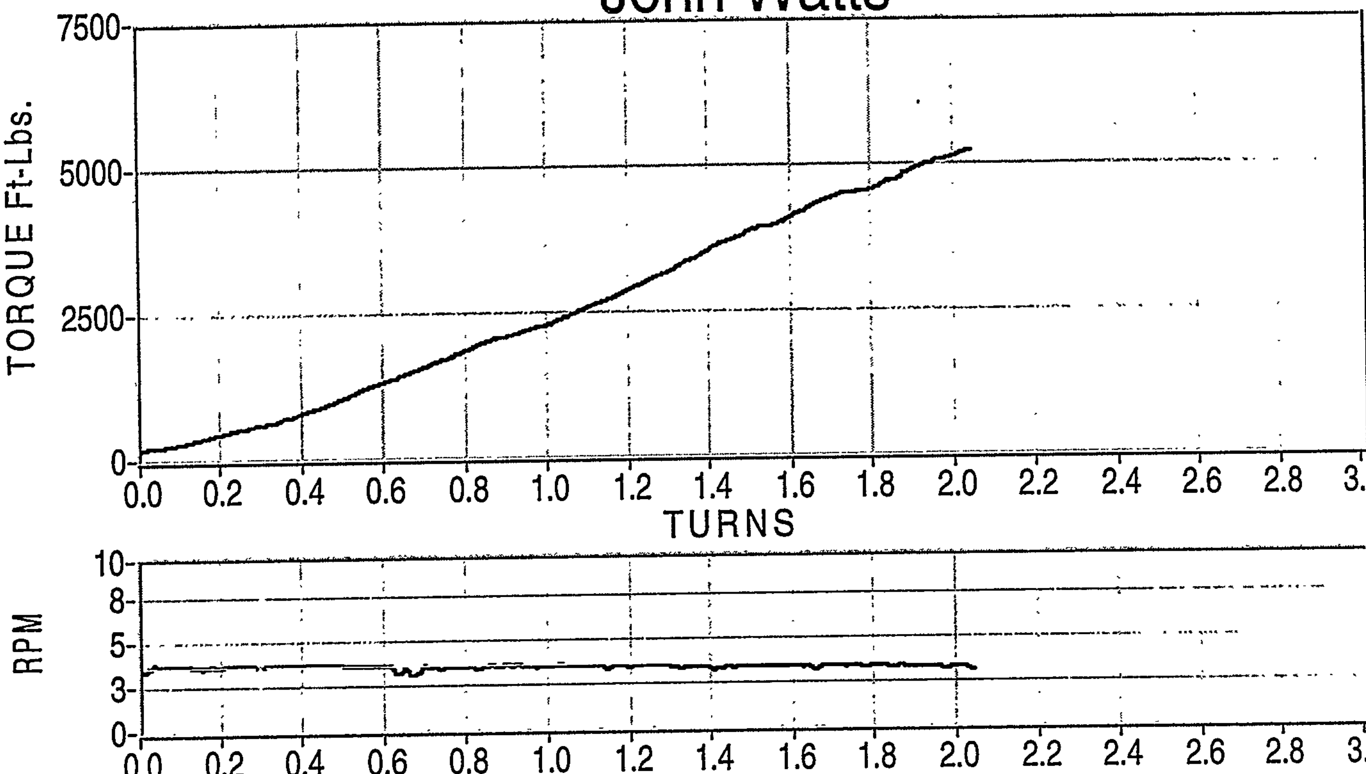


Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp

MakeUp # 1		
Pin Id : 2b	Box Id : 2b	
File Name : TT_0008.dat		
Maximum Torque	5224	Ft-Lbs
Shoulder Torque	453	Ft-Lbs
Delta Torque	4771	Ft-Lbs
Turns @ Max. Torque	2.039	Turns
Shoulder Turns	0.214	Turns
Delta Turns	1.825	Turns
Total Turns	2.045	Turns
Pin Dope	0	Grams
Box Dope	22	Grams

Operator:
gs hd

Date:Time of Test
08/11/1999 : 5:29:30 PM

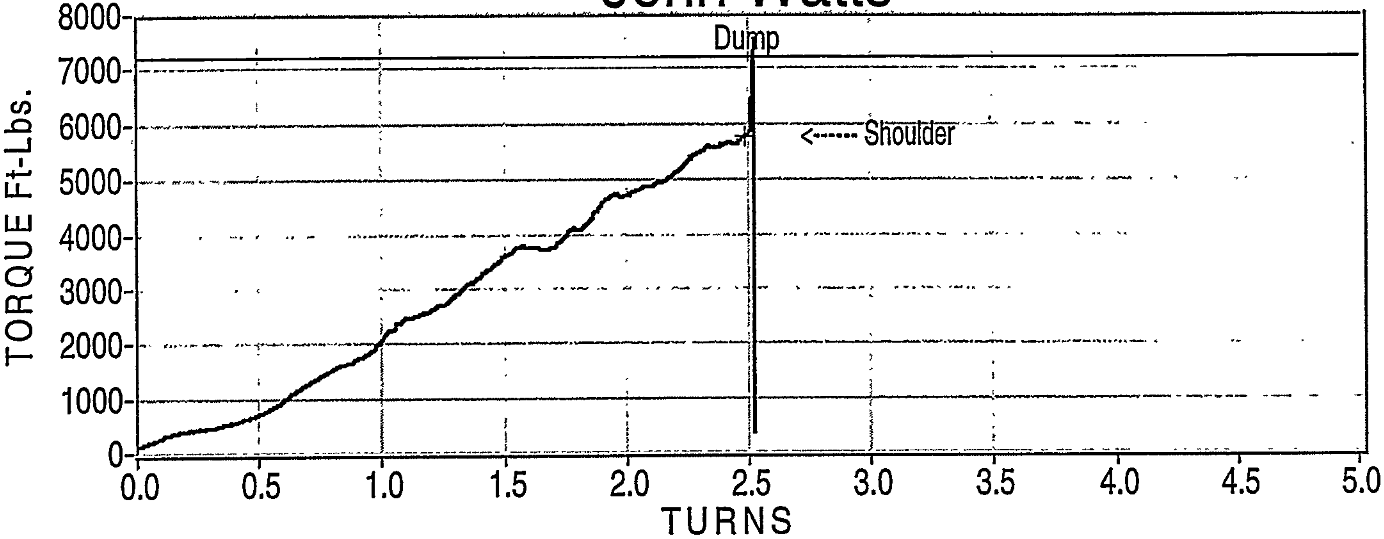
SAMPLE 3A

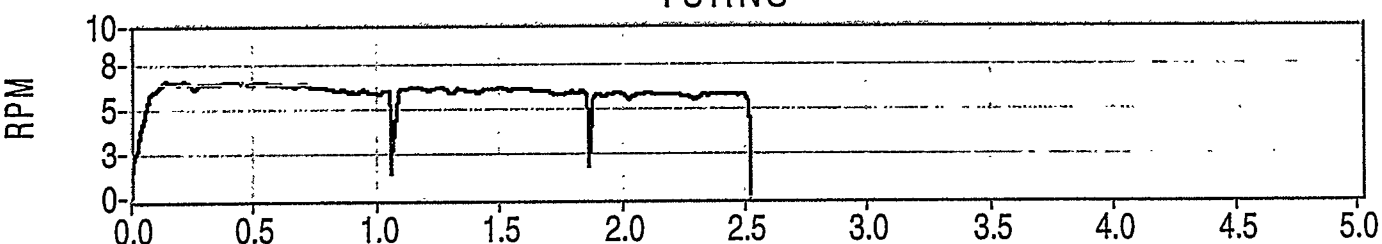
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 1	
Pin Id : 16A	Box Id : 7
File Name : TT_0077.dat	

#3A

Maximum Torque	7570	Ft-Lbs
Shoulder Torque	5777	Ft-Lbs
Delta Torque	1793	Ft-Lbs
Turns @ Max. Torque	2.520	Turns
Shoulder Turns	2.488	Turns
Delta Turns	0.032	Turns
Total Turns	2.521	Turns
Pin Dope	0	Grams
Box Dope	19	Grams

Operator:
Greg Stafford

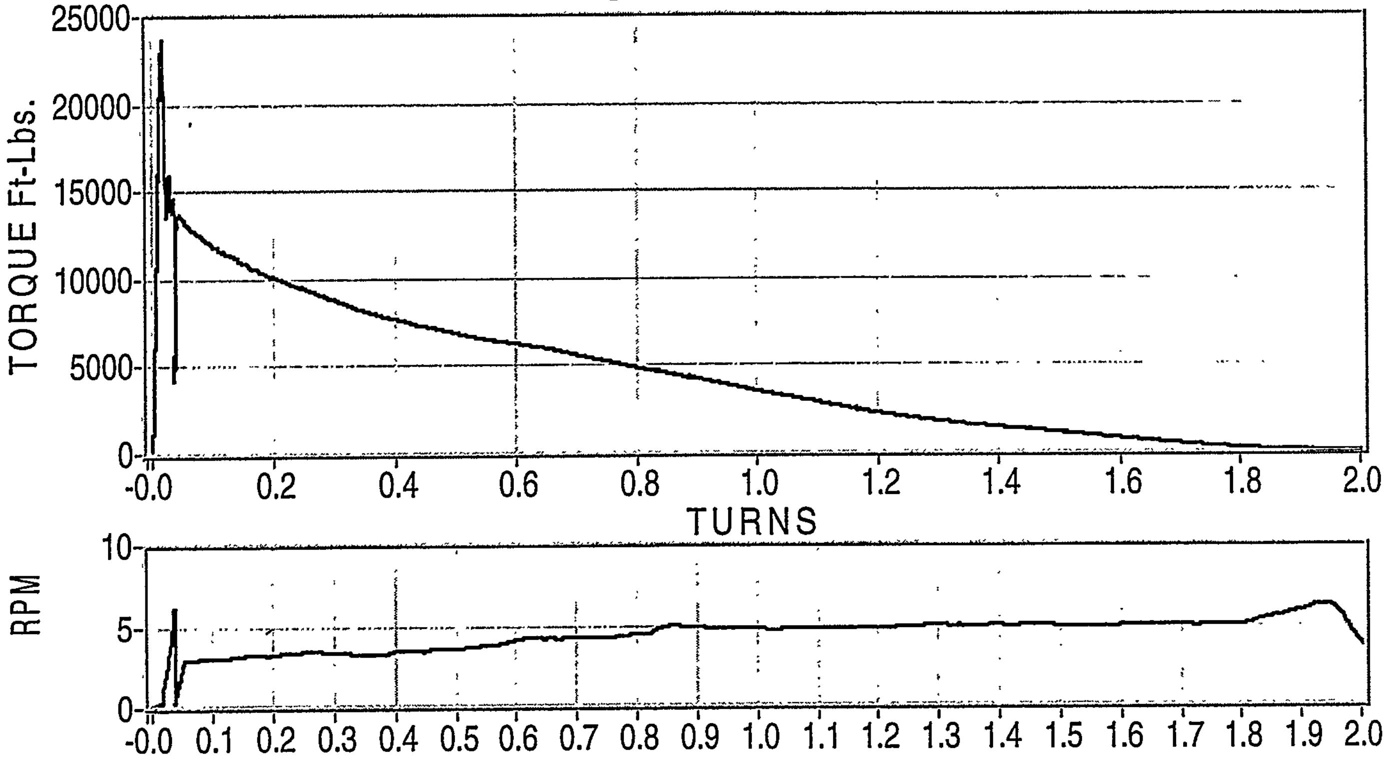
Date:Time of Test
07/08/1999 : 4:26:16 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts



BreakOut

3A

BreakOut # 1	
Pin Id : 16a	**Box Id :** 07
File Name : TT_0115.dat	
Maximum Torque	23741 Ft-Lbs

Operator :
Greg Stafford - hd

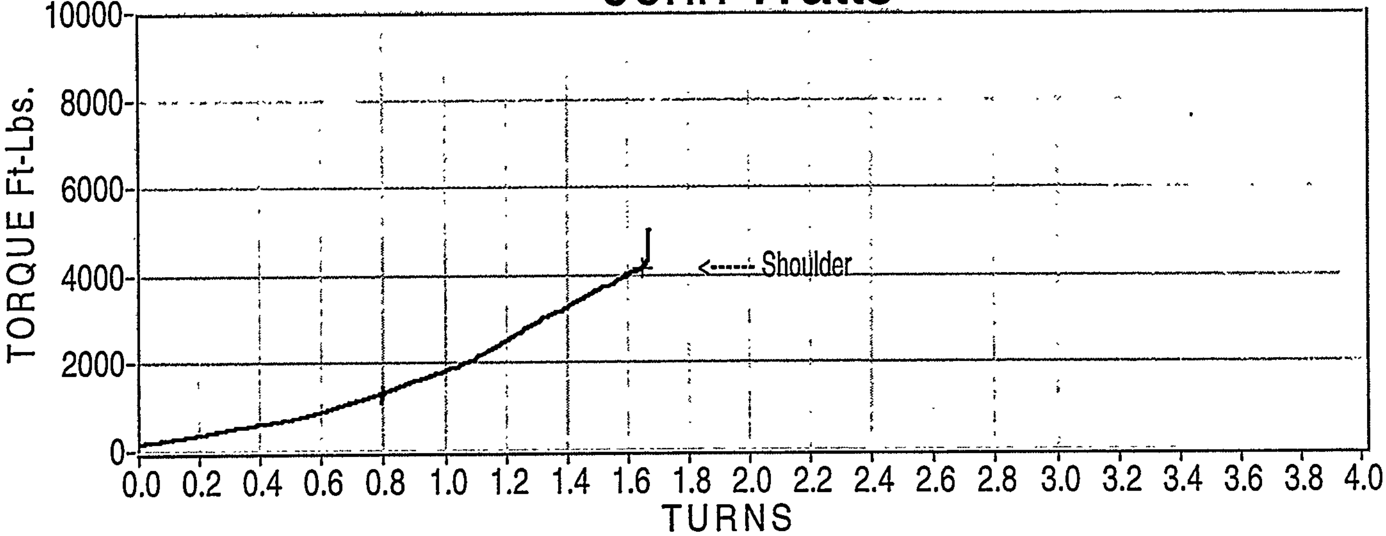
Date : Time of Test
07/21/1999 : 1:09:03 PM

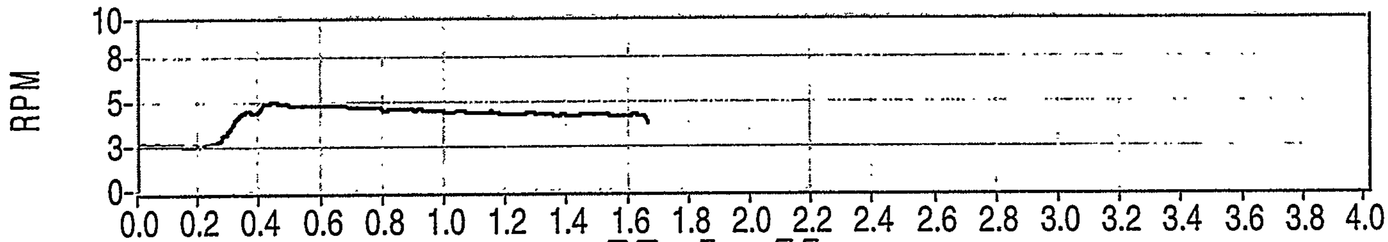
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

3A

API Dope

MakeUp # 2		
Pin Id : 07	**Box Id : 16a**	
File Name : TT_0116.dat		
Maximum Torque	**5024**	**Ft-Lbs**
Shoulder Torque	**4175**	**Ft-Lbs**
Delta Torque	**849**	**Ft-Lbs**
Turns @ Max. Torque	**1.669**	**Turns**
Shoulder Turns	**1.647**	**Turns**
Delta Turns	**0.021**	**Turns**
Total Turns	**1.669**	**Turns**
Pin Dope	**0**	**Grams**
Box Dope	**23**	**Grams**

Operator:
Greg Stafford - hd

Date:Time of Test
07/21/1999 : 1:31:08 PM

Stress Engineering Services
Torque Turn
Test Setup Information

Project Number	5806
Client	John Watts
Pipe Size	7.00
Pipe Weight	32 lbs per ft.
Pipe Grade	P-110
Connection	John Watts Casing
Operator	hd
Thread Compound	Shell API 72732

	Pin	Box
Surface Treatment	Phosphate	Phosphate

Test Setup File

C:_Project\Torque Turn\DATA\5806s3.su

07/29/1999 8:12 AM

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: REVERE877019

Capacity: 5K **Lbs.**

Shunt: 2926.00 **Lbs.**

Power Tong

Casing 36.00 **Inches**

Daq Gain	Daq Offset
1358.56	-0.137

Ctrl Gain	Ctrl Offset
1358.73	-0.137

Cal time date

07/29/1999 8:24 AM

Calibration File

C:_Project\Torque Turn\5608s3.cal

Daq Board

Raw Volts	2.016	**Volts**
Load Cell	2925.87	**Lbs**
Torque	8777.61	**Ft Lbs**
Gain	1358.56	**Ft Lbs/V**
Offset	-0.137	**Volts**

Control Board

Raw Volts	2.016	**Volts**
Load Cell	2925.81	**Lbs**
Torque	8777.44	**Ft Lbs**
Gain	1358.73	**Ft Lbs/V**
Offset	-0.137	**Volts**

Stress Engineering Services
Torque Turn
Calibration

Load Cell

S/N: REVERE877019

Capacity: 5K Lbs.

Shunt: 2926.00 Lbs.

Power Tong

Casing 36.00 Inches

Daq Gain	Daq Offset
1358.56	-0.137

Ctrl Gain	Ctrl Offset
1358.73	-0.137

Cal time date

07/29/1999 8:24 AM

Calibration File

C:_Project\Torque Turn\5608s3.cal

Daq Board

Raw Volts	-0.139	Volts
Load Cell	-2.48	Lbs
Torque	-7.45	Ft Lbs
Gain	1358.56	Ft Lbs/V
Offset	-0.137	Volts

Control Board

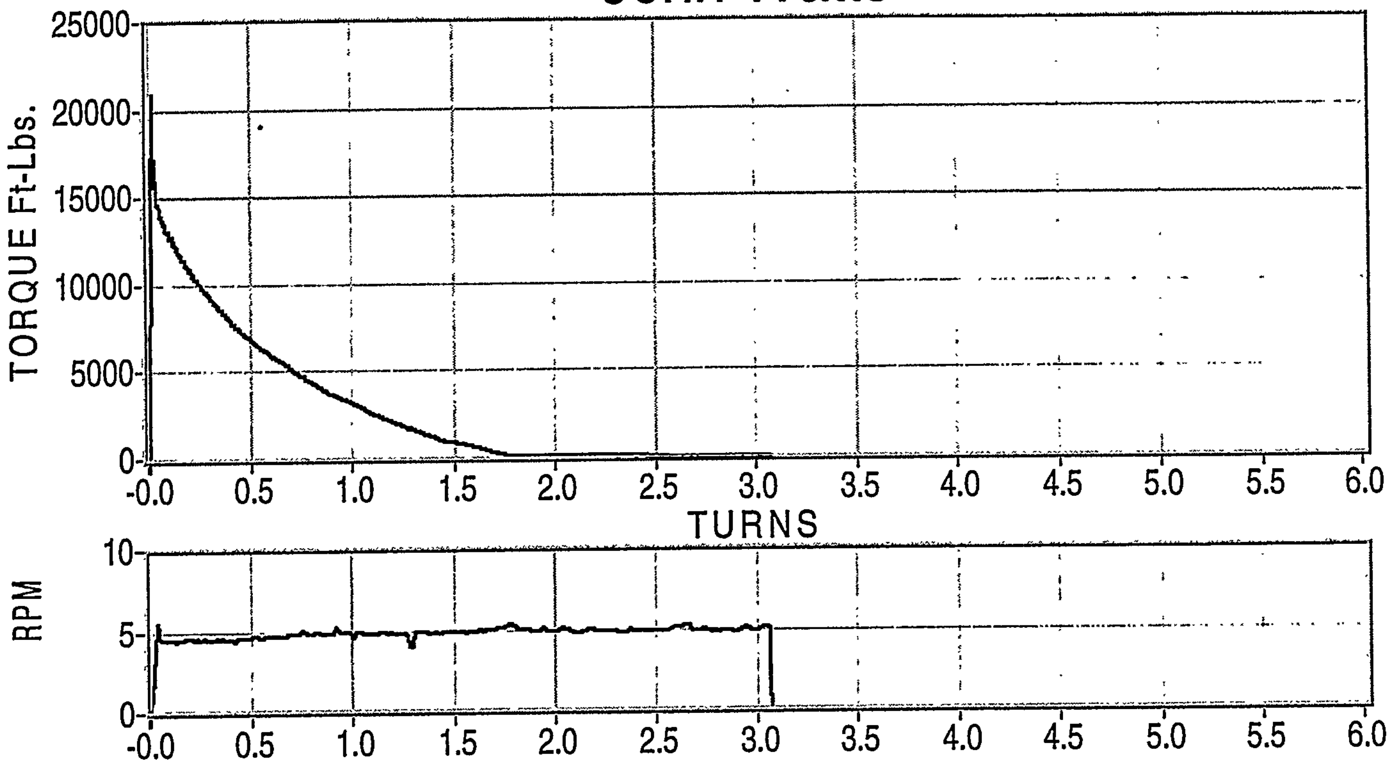
Raw Volts	-0.137	Volts
Load Cell	-0.28	Lbs
Torque	-0.84	Ft Lbs
Gain	1358.73	Ft Lbs/V
Offset	-0.137	Volts

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size 7.000 in.

John Watts



BreakOut

BreakOut # 1	
Pin Id : 9	Box Id : 14A
File Name : TT_0183.dat	
Maximum Torque	20937 Ft-Lbs

16A

3A

Operator :
hd

Date : Time of Test
07/29/1999 : 9:13:32 AM

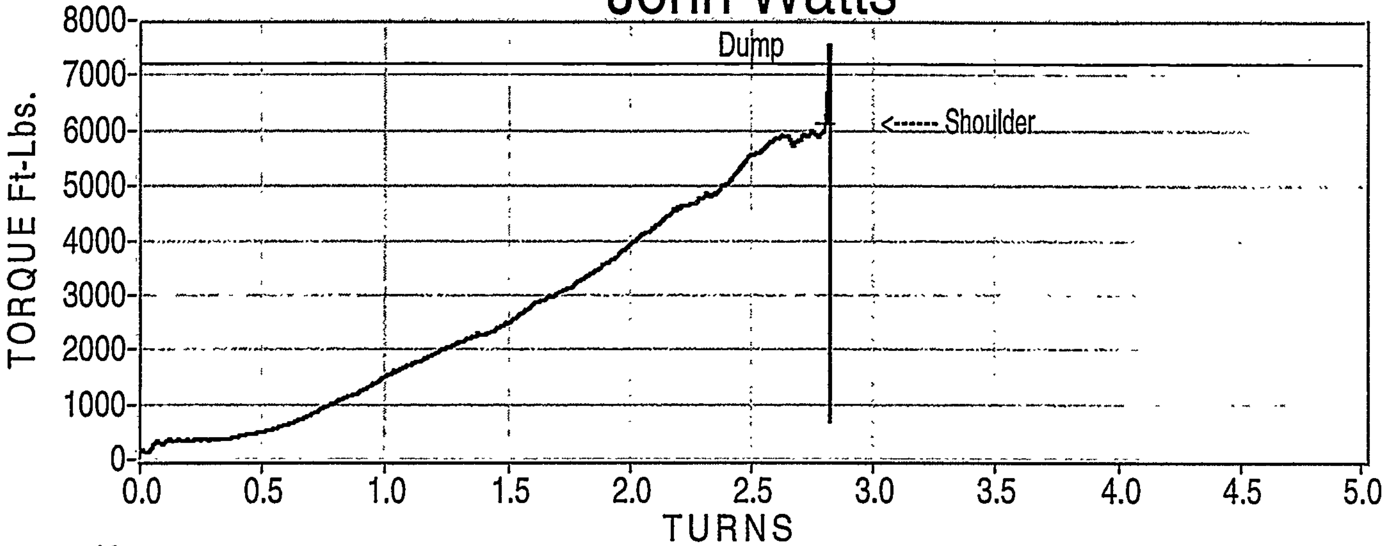
SAMPLE 3B

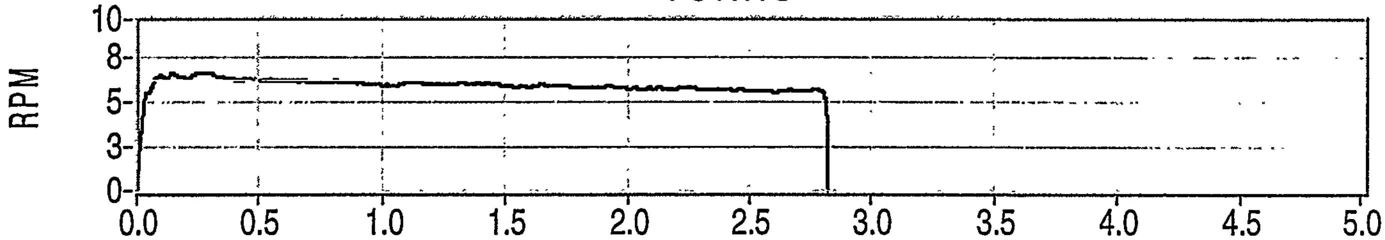
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # ~~2~~1	
Pin Id : 16B	**Box Id : 11**
File Name : TT_0072.dat	

3B

Maximum Torque	7570	Ft-Lbs
Shoulder Torque	6115	Ft-Lbs
Delta Torque	1455	Ft-Lbs
Turns @ Max. Torque	2.819	Turns
Shoulder Turns	2.803	Turns
Delta Turns	0.016	Turns
Total Turns	2.820	Turns
Pin Dope	0	Grams
Box Dope	20	Grams

Operator:
Greg Stafford

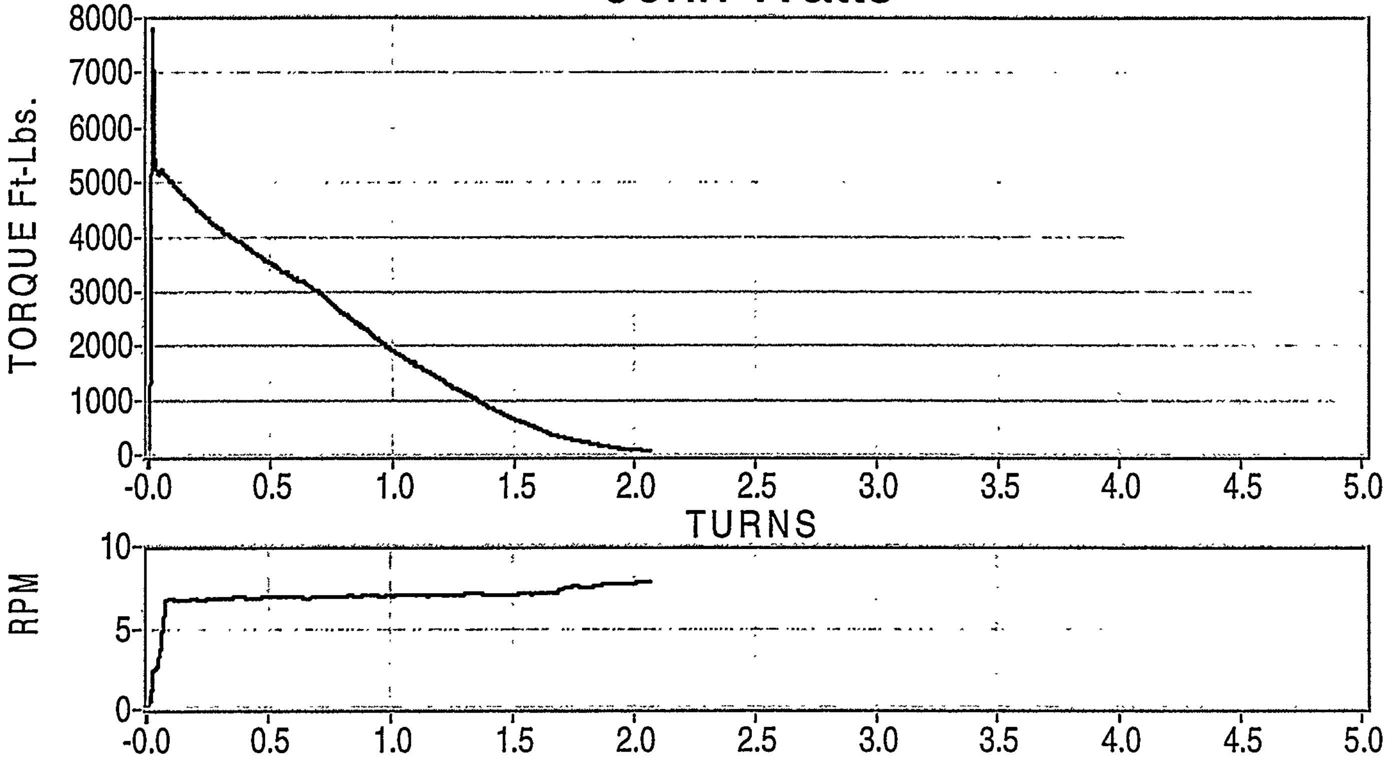
Date:Time of Test
07/08/1999 : 3:38:13 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts



BreakOut

BreakOut # 1	
Pin Id : 16B	Box Id : 11
File Name : TT_0073.dat	
Maximum Torque	7845 Ft-Lbs

3B

Operator :
Greg Stafford

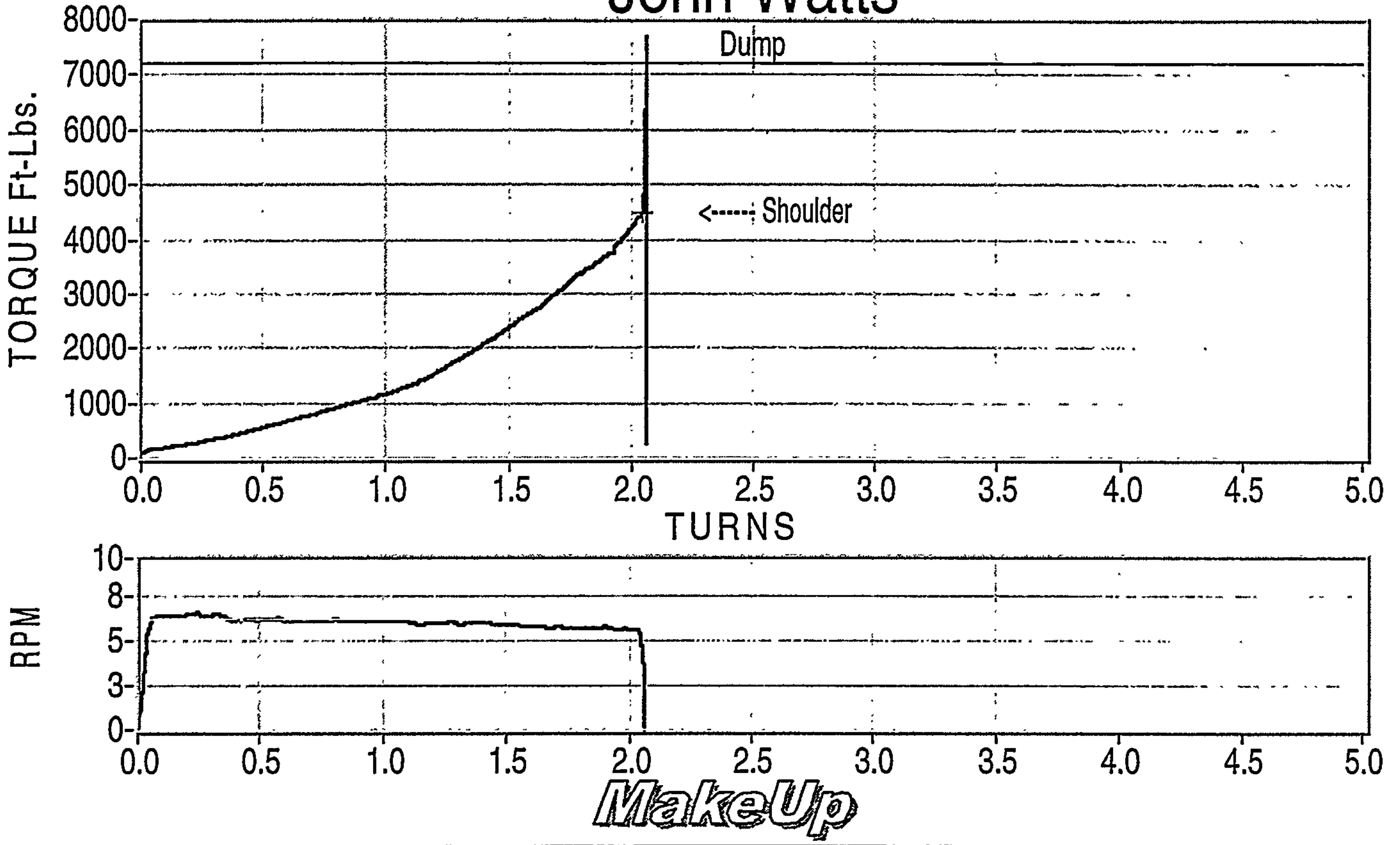
Date : Time of Test
07/08/1999 : 3:43:25 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp # 2	
Pin Id : 16B	**Box Id : 11**
File Name : TT_0074.dat	

3B

Maximum Torque	**7693**	**Ft-Lbs**
Shoulder Torque	**4476**	**Ft-Lbs**
Delta Torque	**3217**	**Ft-Lbs**
Turns @ Max. Torque	**2.063**	**Turns**
Shoulder Turns	**2.042**	**Turns**
Delta Turns	**0.021**	**Turns**
Total Turns	**2.063**	**Turns**
Pin Dope	**0**	**Grams**
Box Dope	**19**	**Grams**

Operator:
Greg Stafford

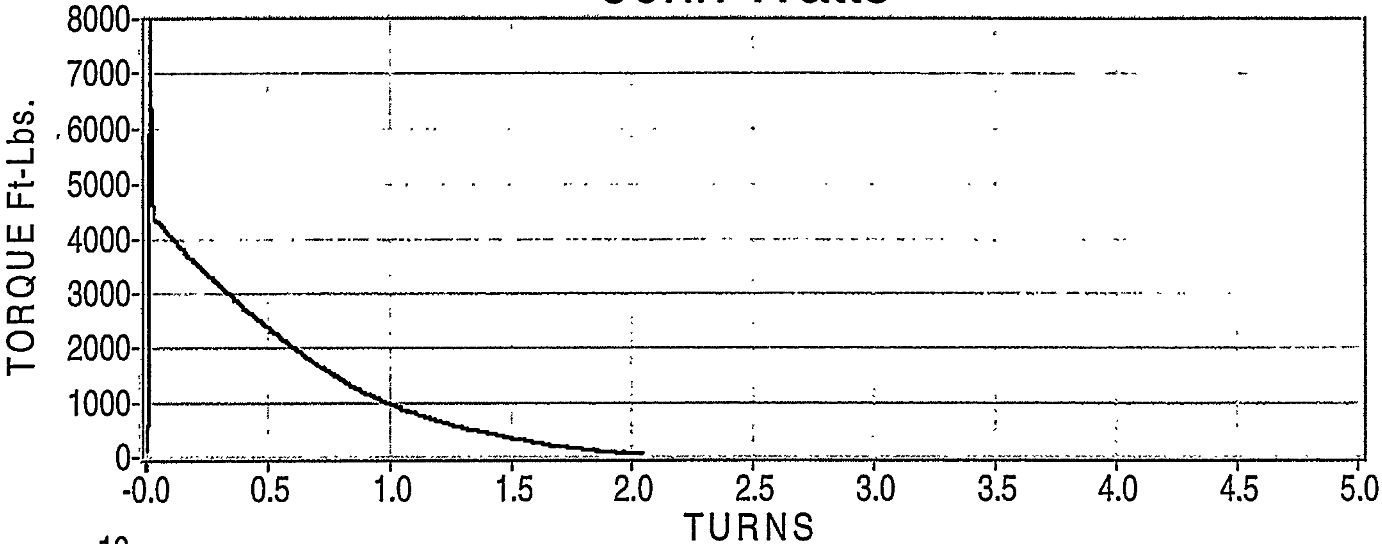
Date:Time of Test
07/08/1999 : 3:56:00 PM

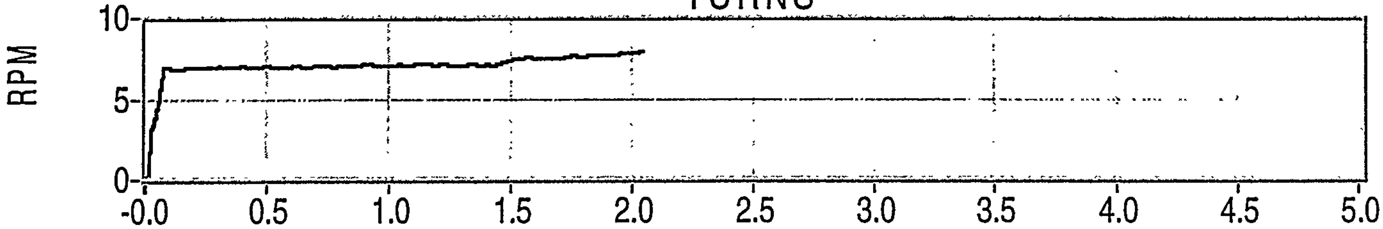
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts





BreakOut

BreakOut # 2	
Pin Id : 16B	**Box Id :** 11
File Name : TT_0075.dat	
Maximum Torque	8163 Ft-Lbs

3B

Operator :
Greg Stafford

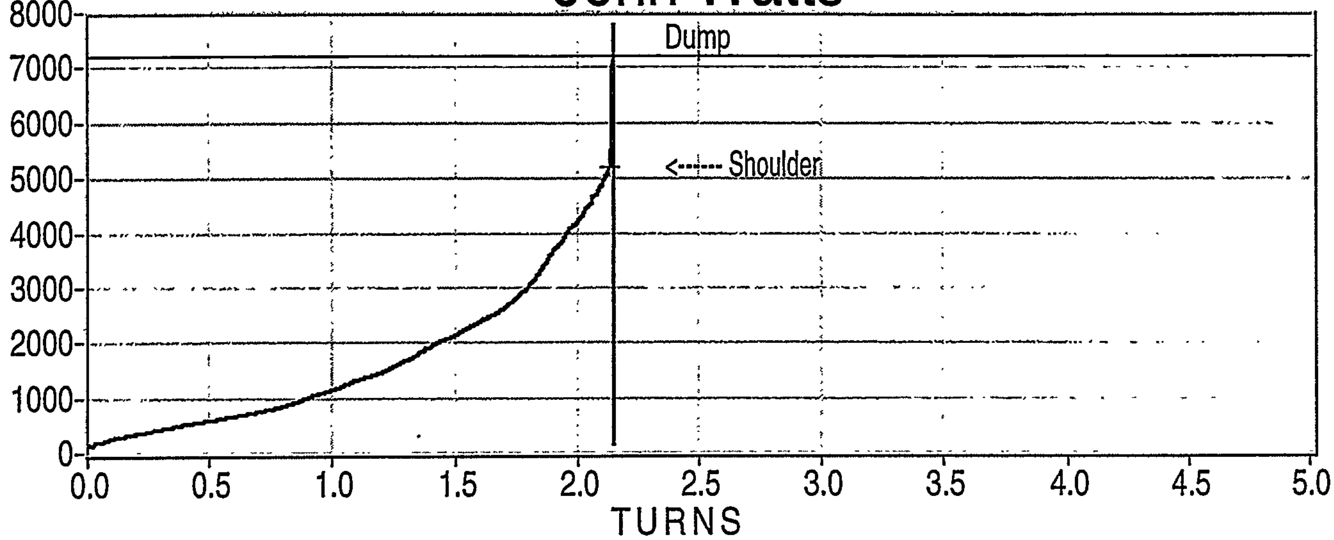
Date : Time of Test
07/08/1999 : 3:58:22 PM

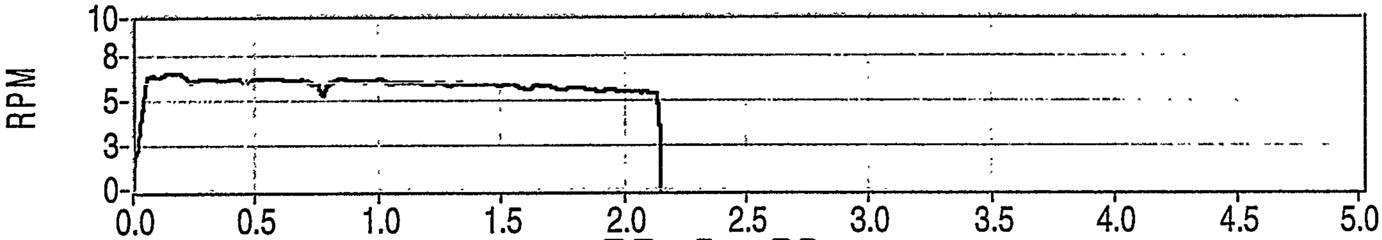
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

#3B

MakeUp # 3		
Pin Id : 16B	Box Id : 11	
File Name : TT_0076.dat		
Maximum Torque	7800	Ft-Lbs
Shoulder Torque	5191	Ft-Lbs
Delta Torque	2609	Ft-Lbs
Turns @ Max. Torque	2.146	Turns
Shoulder Turns	2.131	Turns
Delta Turns	0.016	Turns
Total Turns	2.151	Turns
Pin Dope	0	Grams
Box Dope	23	Grams

Operator:
Greg Stafford

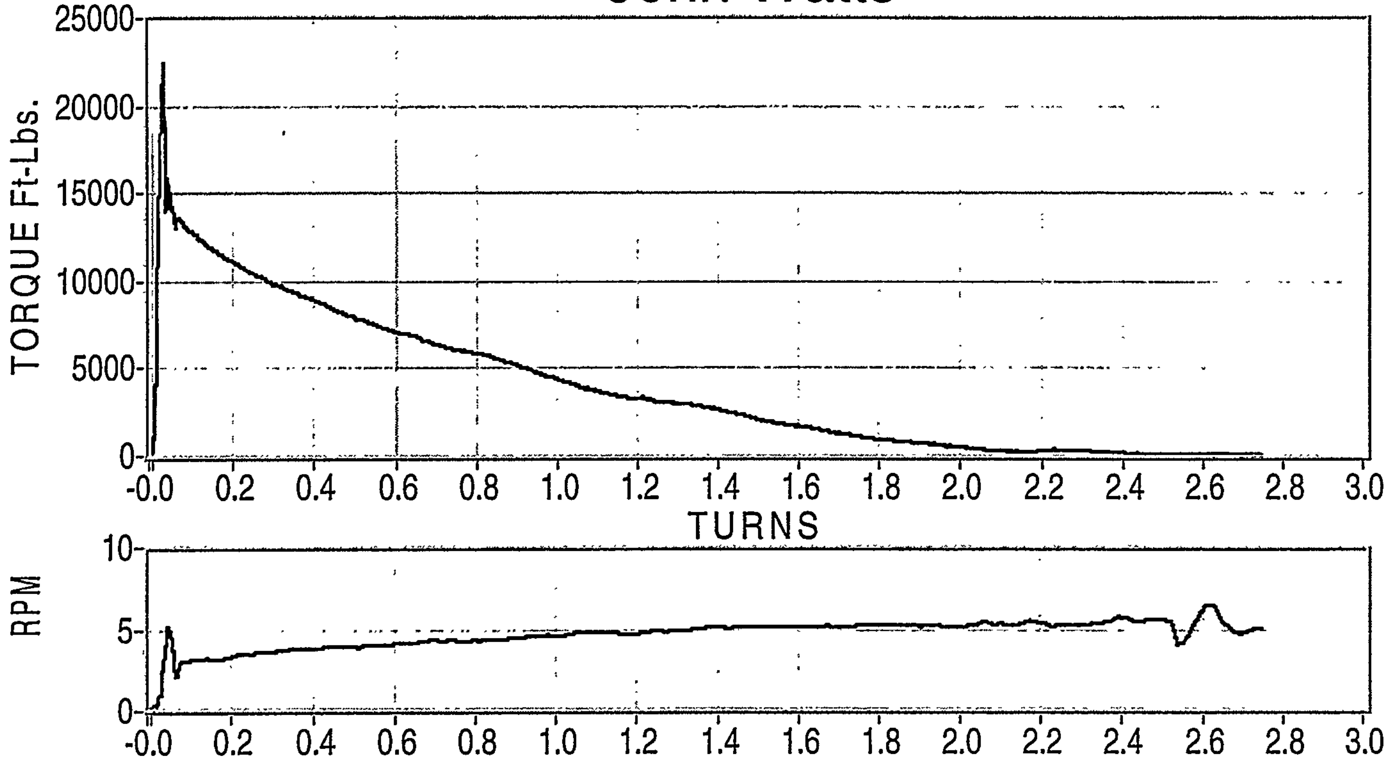
Date:Time of Test
07/08/1999 : 4:10:02 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts



BreakOut

3b

BreakOut # 3	
Pin Id : 11	**Box Id : 16b**
File Name : TT_0117.dat	
Maximum Torque	**22501 Ft-Lbs**

Operator :
Greg Stafford - hd

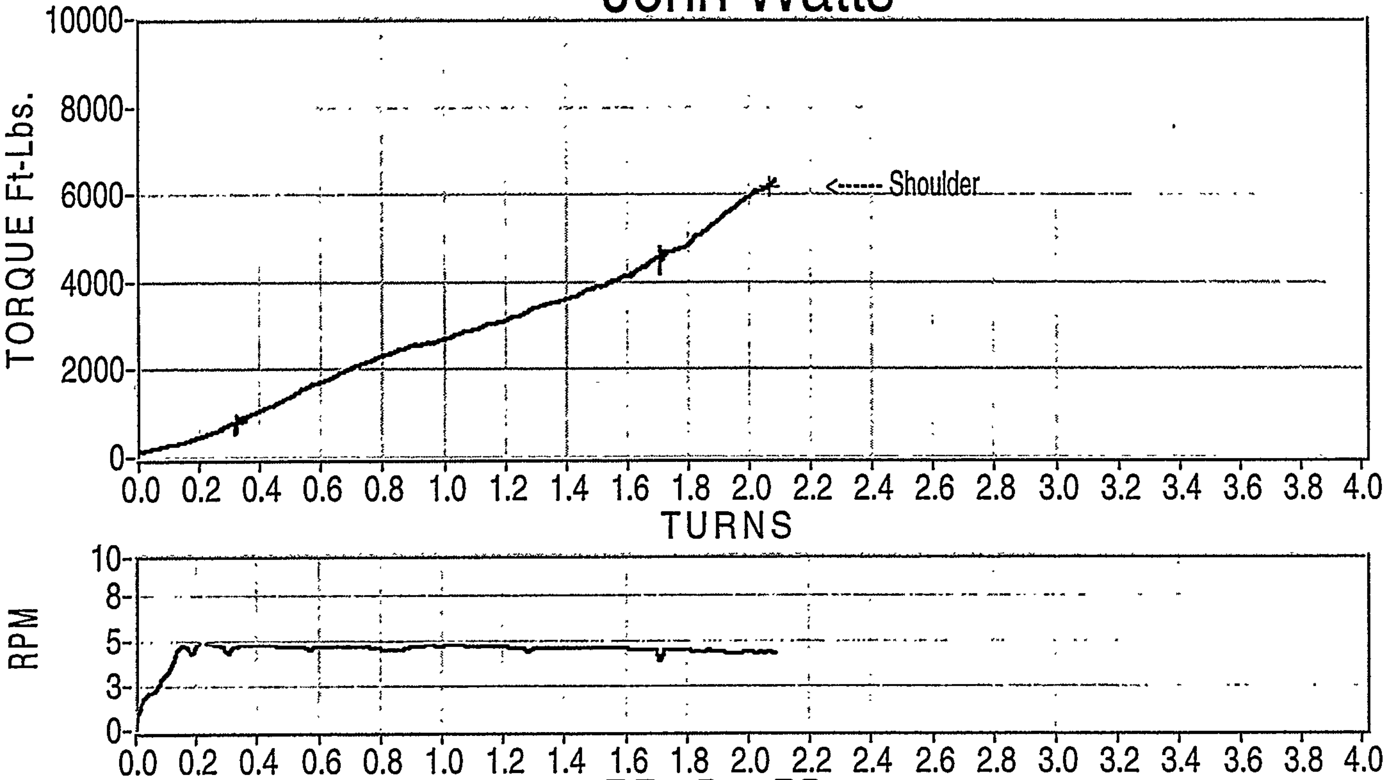
Date : Time of Test
07/21/1999 : 1:43:54 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp

MakeUp # ~~[illegible]~~ 4		
Pin Id : 11	**Box Id : 16b**	
File Name : TT_0118.dat		
Maximum Torque	**6327**	**Ft-Lbs**
Shoulder Torque	**6192**	**Ft-Lbs**
Delta Torque	**135**	**Ft-Lbs**
Turns @ Max. Torque	**2.085**	**Turns**
Shoulder Turns	**2.065**	**Turns**
Delta Turns	**0.020**	**Turns**
Total Turns	**2.085**	**Turns**
Pin Dope	**0**	**Grams**
Box Dope	**19**	**Grams**

3B
API
Dope

Operator:
Greg Stafford - hd

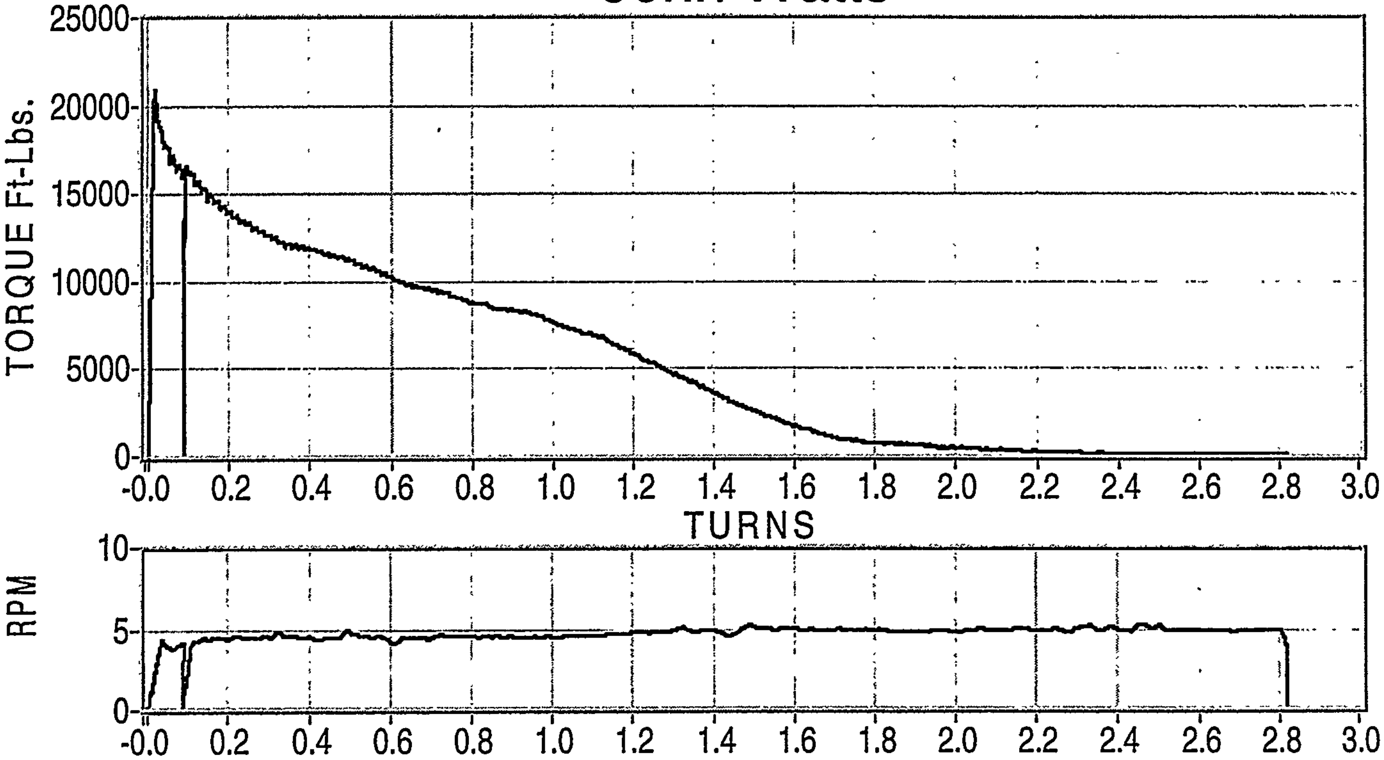
Date:Time of Test
07/21/1999 : 2:53:04 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts



BreakOut

16B

BreakOut # 4	
Pin Id : 3	**Box Id : 14b**
File Name : TT_0182.dat	
Maximum Torque	**20937 Ft-Lbs**

3B

Operator :
hd

Date : Time of Test
07/29/1999 : 8:53:30 AM

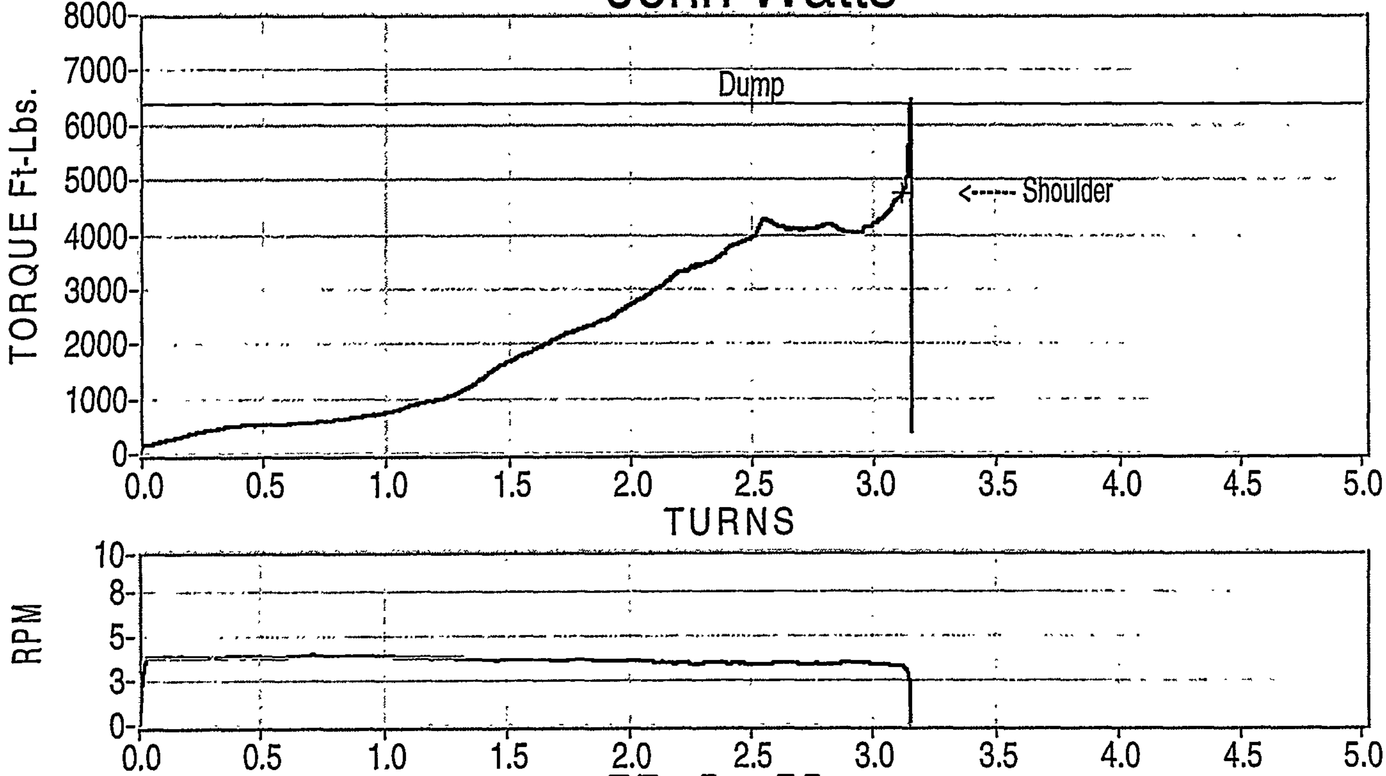
SAMPLE 4A

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp

MakeUp # 1		
Pin Id : 18A	Box Id : 9	
File Name : TT_0070.dat		
Maximum Torque	6499	Ft-Lbs
Shoulder Torque	4741	Ft-Lbs
Delta Torque	1758	Ft-Lbs
Turns @ Max. Torque	3.150	Turns
Shoulder Turns	3.118	Turns
Delta Turns	0.032	Turns
Total Turns	3.150	Turns
Pin Dope	0	Grams
Box Dope	25	Grams

#4A

Operator:
Greg Stafford

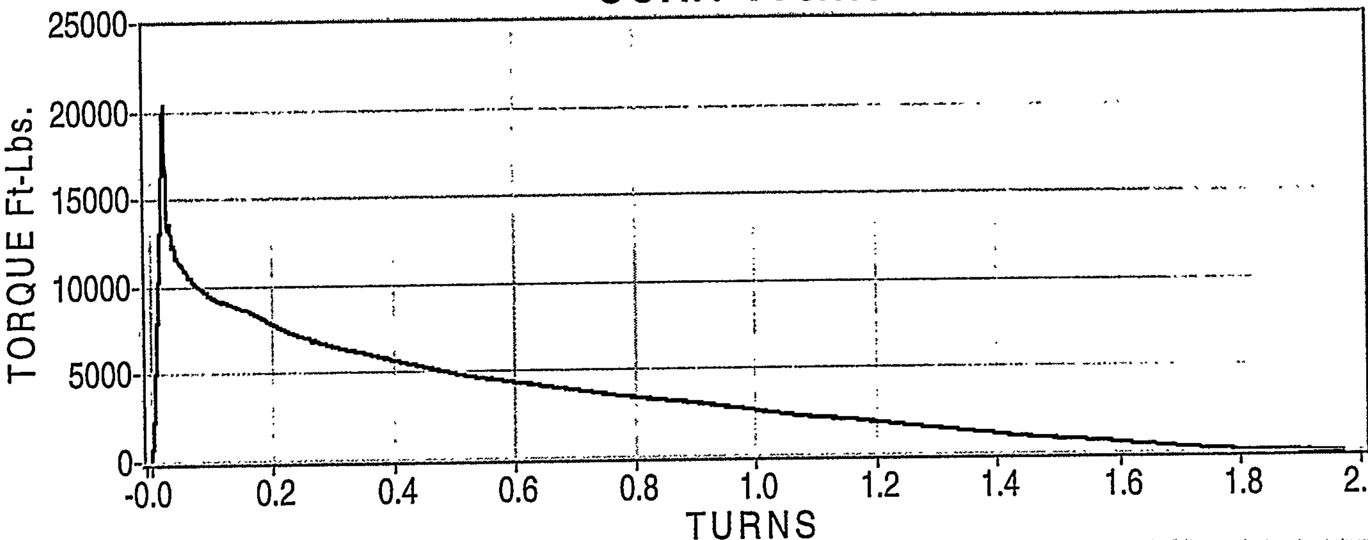
Date:Time of Test
07/08/1999 : 3:16:31 PM

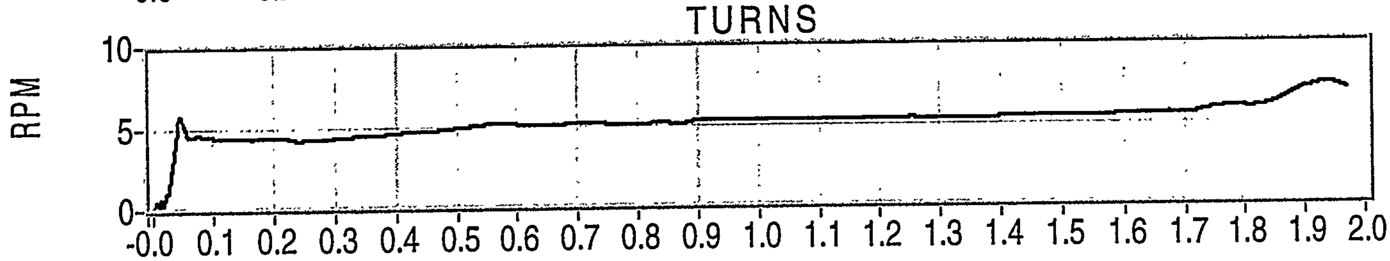
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts





BreakOut

BreakOut # 1	
Pin Id : ~~13~~ 9	**Box Id :** ~~16b~~ 18A
File Name : TT_0119.dat	
Maximum Torque	20425 Ft-Lbs

4A

Operator :
Greg Stafford - hd

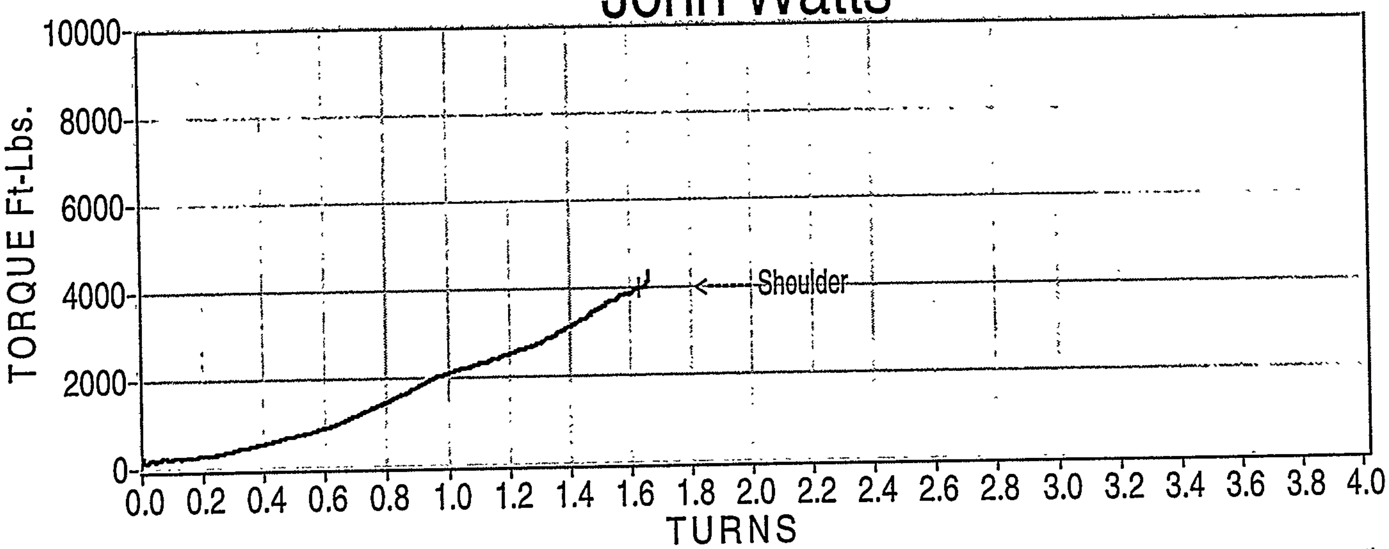
Date : Time of Test
07/21/1999 : 3:05:03 PM

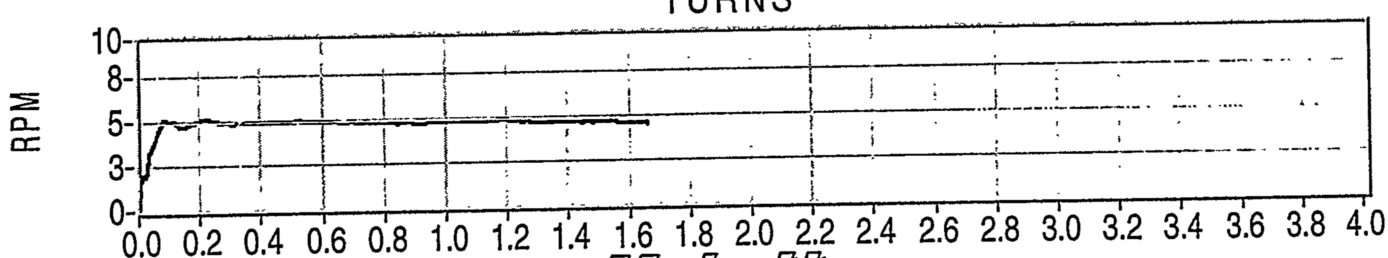
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 2		
Pin Id : 9	Box Id : 18a	
File Name : TT_0120.dat		
Maximum Torque	4358	Ft-Lbs
Shoulder Torque	3984	Ft-Lbs
Delta Torque	373	Ft-Lbs
Turns @ Max. Torque	1.662	Turns
Shoulder Turns	1.629	Turns
Delta Turns	0.033	Turns
Total Turns	1.662	Turns
Pin Dope	0	Grams
Box Dope	19	Grams

4A

Operator:
Greg Stafford - hd

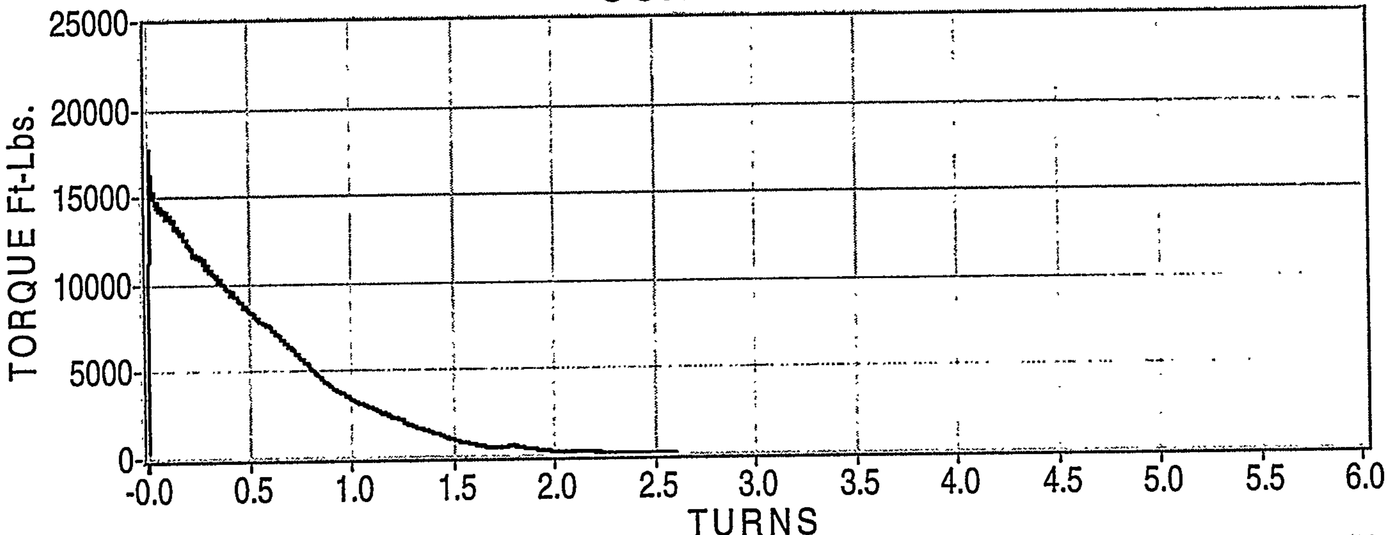
Date:Time of Test
07/21/1999 : 3:22:47 PM

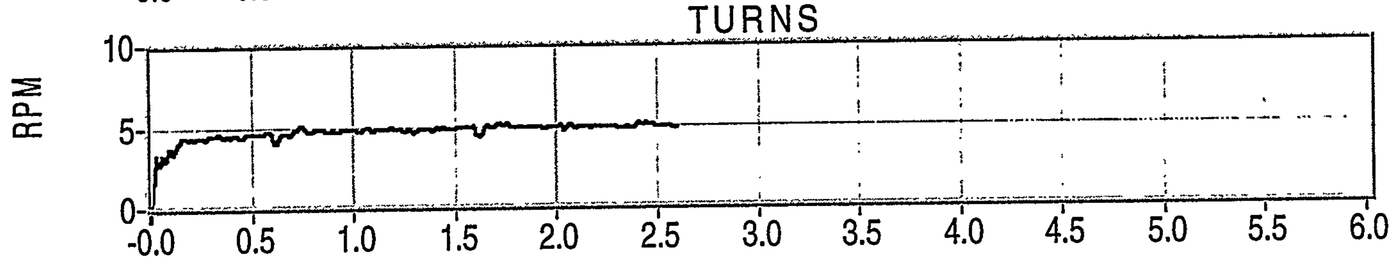
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size 7.000 in.

John Watts





BreakOut

BreakOut # 1	
Pin Id : 9	**Box Id :** 18A
File Name : TT_0184.dat	
Maximum Torque	17762 Ft-Lbs

4A

Operator :
hd

Date : Time of Test
07/29/1999 : 10:20:11 AM

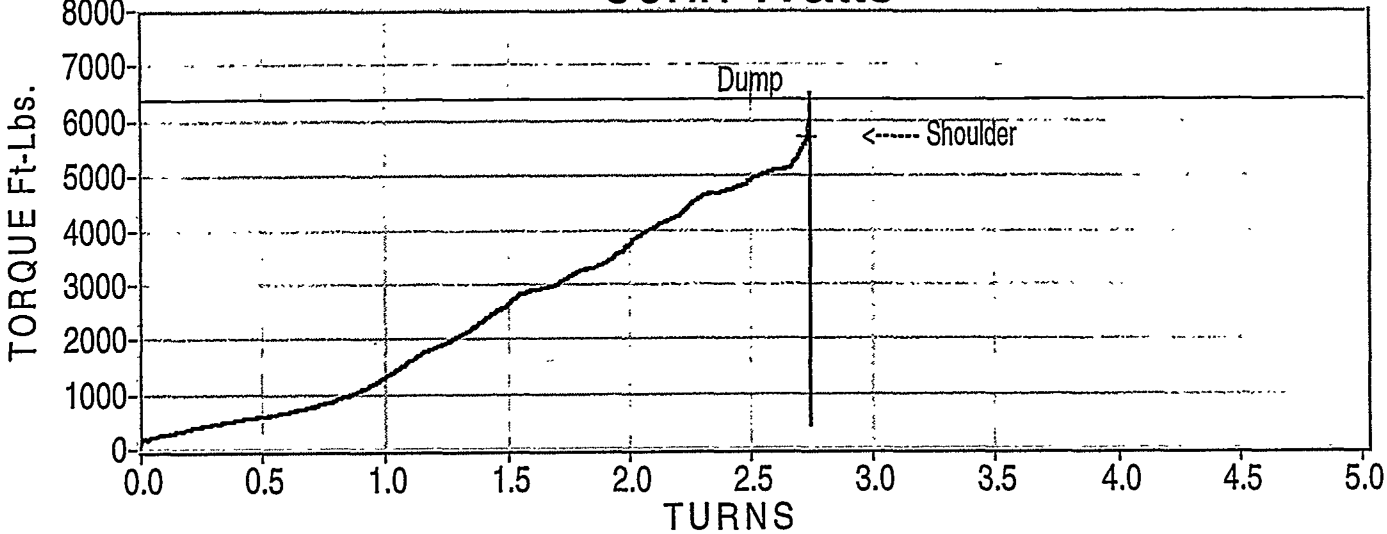
SAMPLE 4B

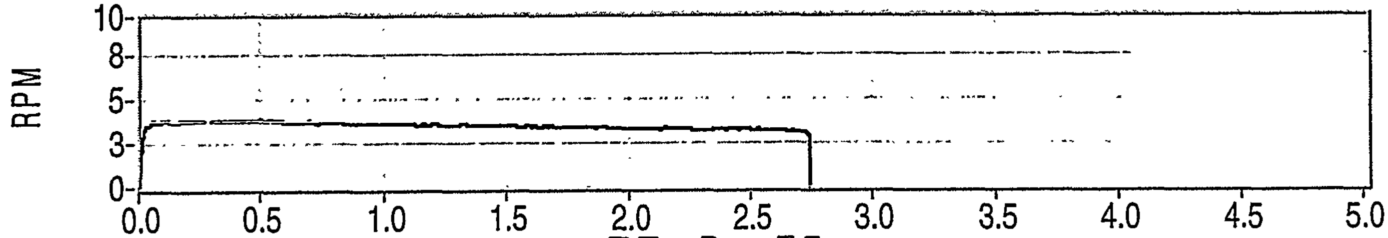
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 1		
Pin Id : 18B	Box Id : 12	
File Name : TT_0071.dat		
Maximum Torque	6510	Ft-Lbs
Shoulder Torque	5699	Ft-Lbs
Delta Torque	811	Ft-Lbs
Turns @ Max. Torque	2.744	Turns
Shoulder Turns	2.728	Turns
Delta Turns	0.016	Turns
Total Turns	2.745	Turns
Pin Dope	0	Grams
Box Dope	23	Grams

#4B

Operator:
Greg Stafford

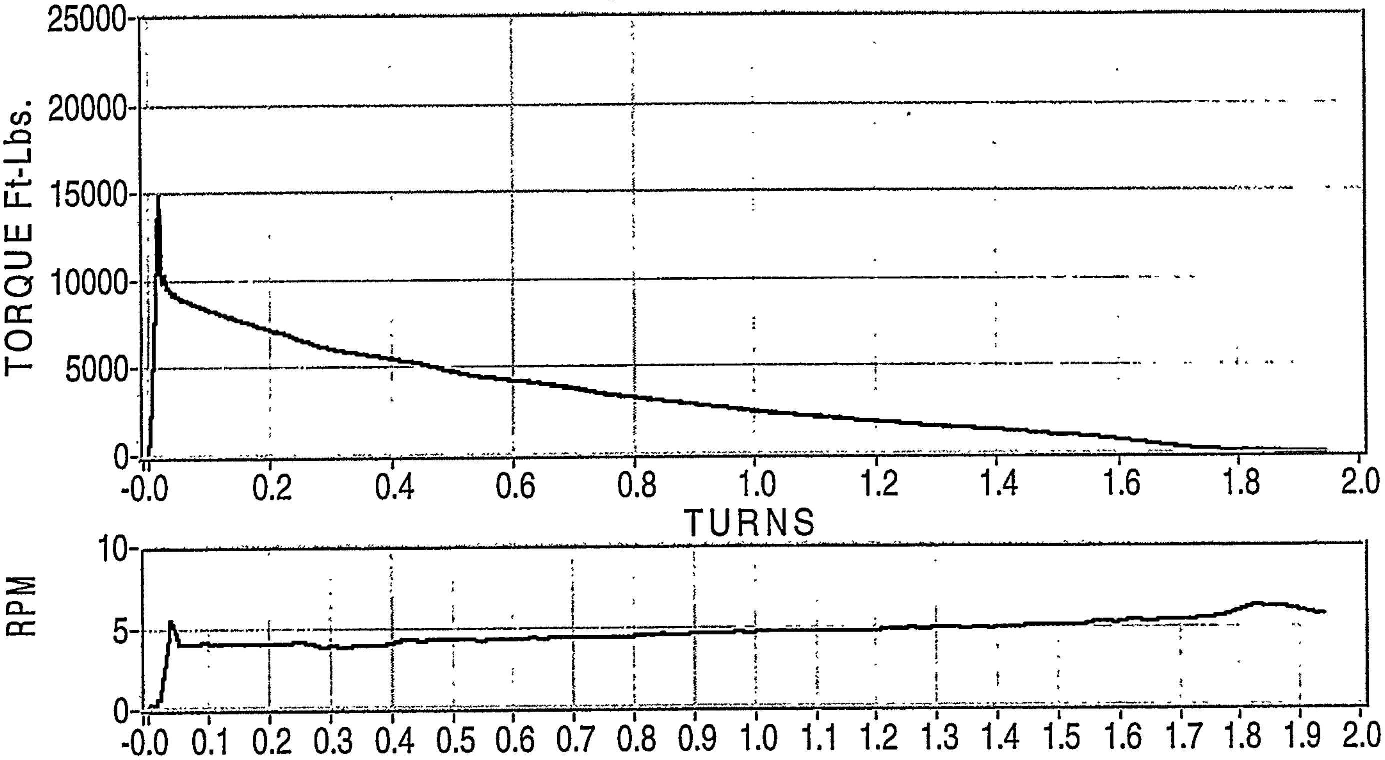
Date:Time of Test
07/08/1999 : 3:24:49 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts



BreakOut

BreakOut # 1	
Pin Id : 12	Box Id : 18b
File Name : TT_0121.dat	
Maximum Torque	14906 Ft-Lbs

43

Operator :
Greg Stafford - hd

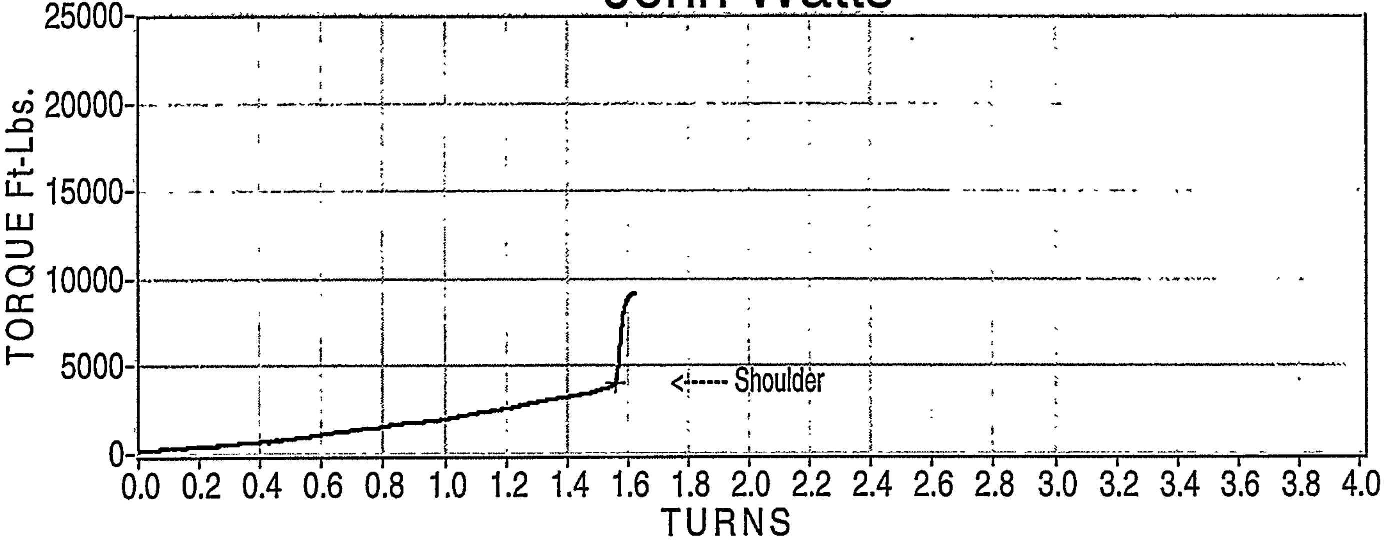
Date : Time of Test
07/21/1999 : 3:32:42 PM

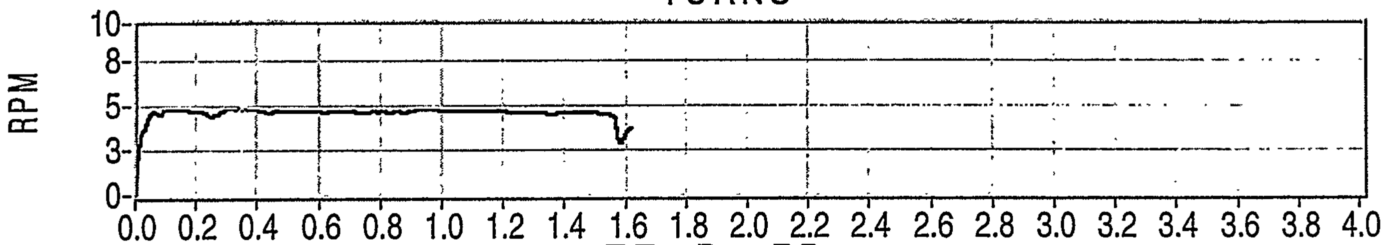
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 2		
Pin Id : 12	Box Id : 18b	
File Name : TT_0122.dat		
Maximum Torque	9159	Ft-Lbs
Shoulder Torque	3963	Ft-Lbs
Delta Torque	5196	Ft-Lbs
Turns @ Max. Torque	1.622	Turns
Shoulder Turns	1.558	Turns
Delta Turns	0.064	Turns
Total Turns	1.622	Turns
Pin Dope	0	Grams
Box Dope	20	Grams

4B

Operator:
Greg Stafford - hd

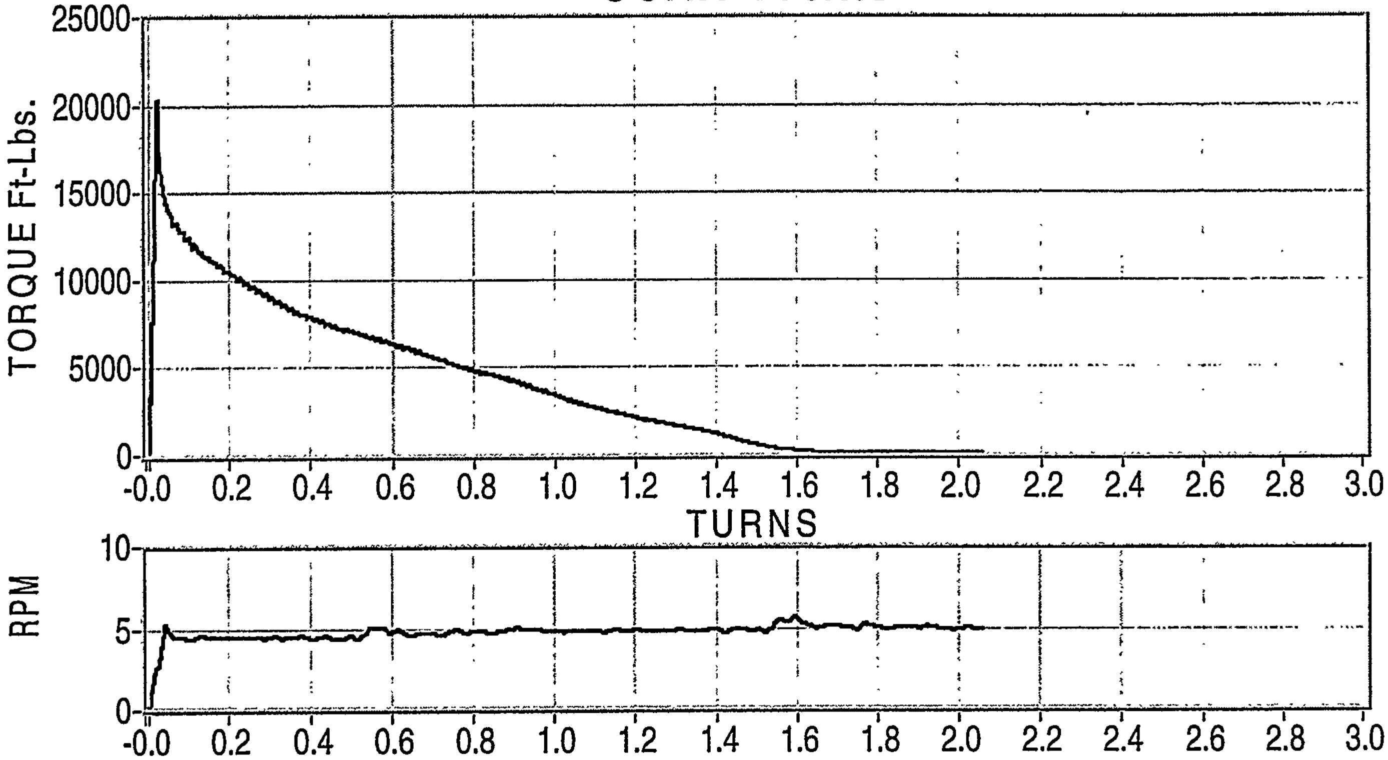
Date:Time of Test
07/21/1999 : 3:56:30 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size 7.000 in.

John Watts



BreakOut

BreakOut # 1	
Pin Id : 12	Box Id : 18B
File Name : TT_0185.dat	
Maximum Torque	20353 Ft-Lbs

4B

Operator :
hd

Date : Time of Test
07/29/1999 : 10:29:00 AM

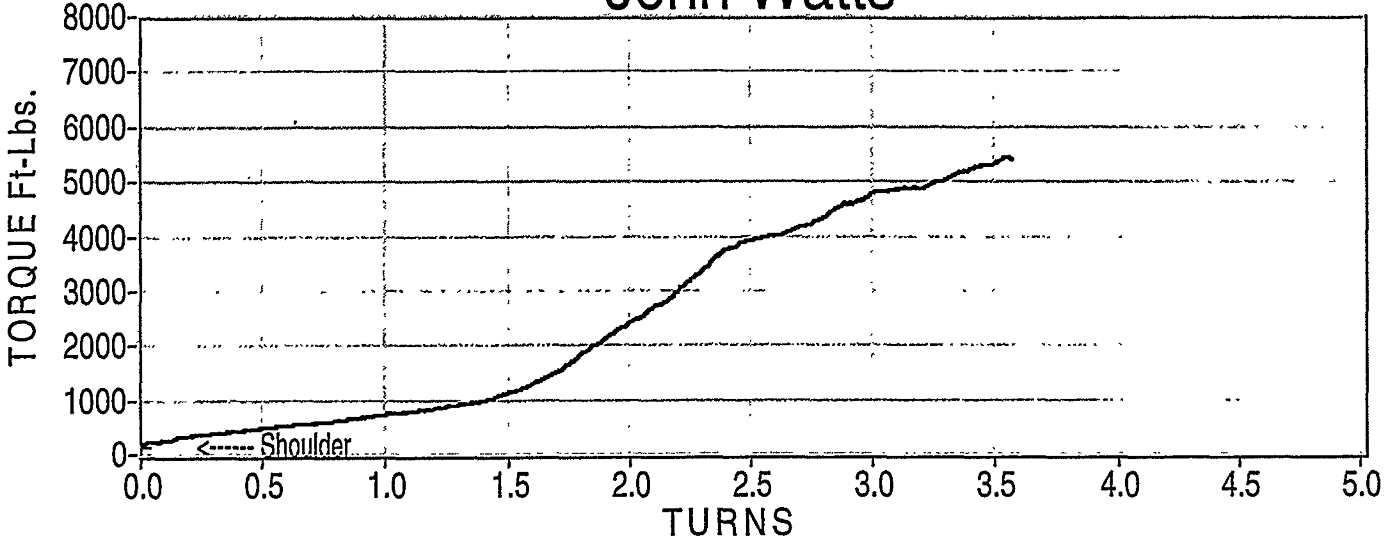
SAMPLE 5

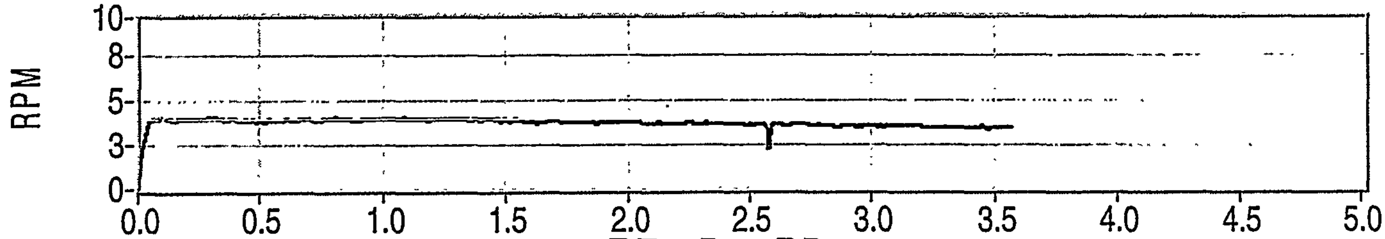
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size 7.000 in.

John Watts





MakeUp

MakeUp # 1		
Pin Id : 22	Box Id : 19	
File Name : TT_0062.dat		
Maximum Torque	5441	Ft-Lbs
Shoulder Torque	144	Ft-Lbs
Delta Torque	5297	Ft-Lbs
Turns @ Max. Torque	3.540	Turns
Shoulder Turns	0.000	Turns
Delta Turns	3.540	Turns
Total Turns	3.570	Turns
Pin Dope	0	Grams
Box Dope	19	Grams

5

Operator:
Greg Stafford

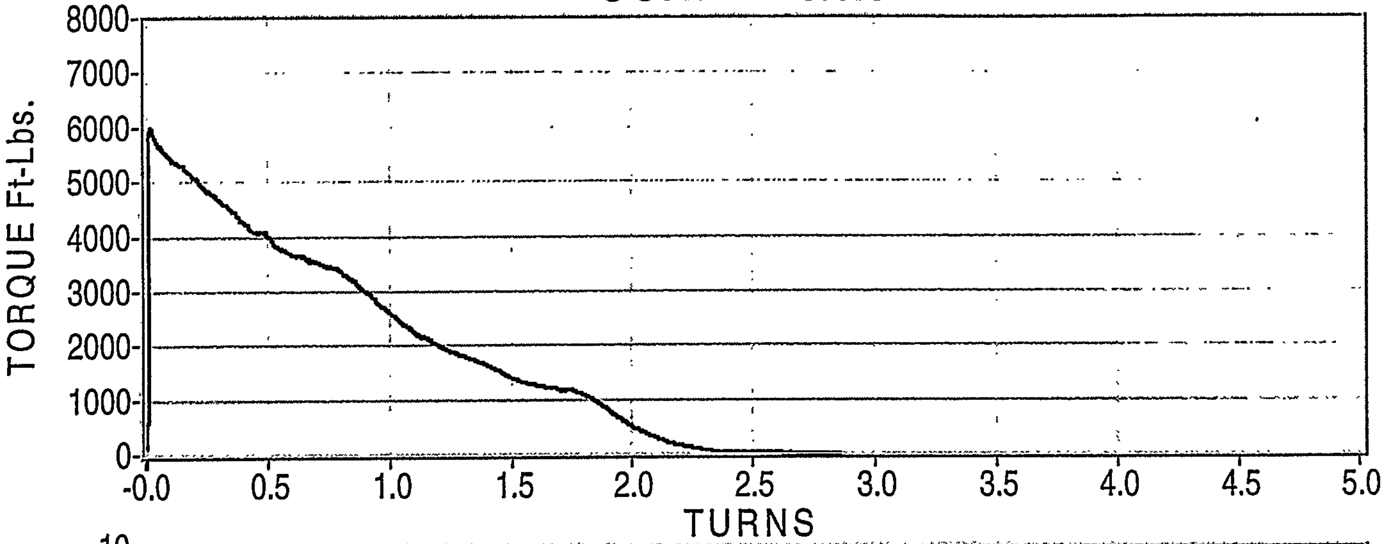
Date:Time of Test
07/08/1999 : 1:36:22 PM

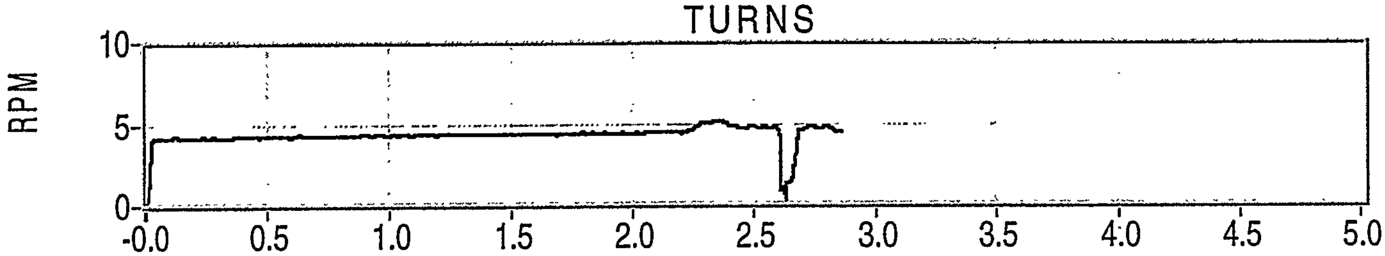
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts





BreakOut

BreakOut # 1	
Pin Id : 22	Box Id : 19
File Name : TT_0063.dat	
Maximum Torque	6014 Ft-Lbs

5

Operator :
Greg Stafford

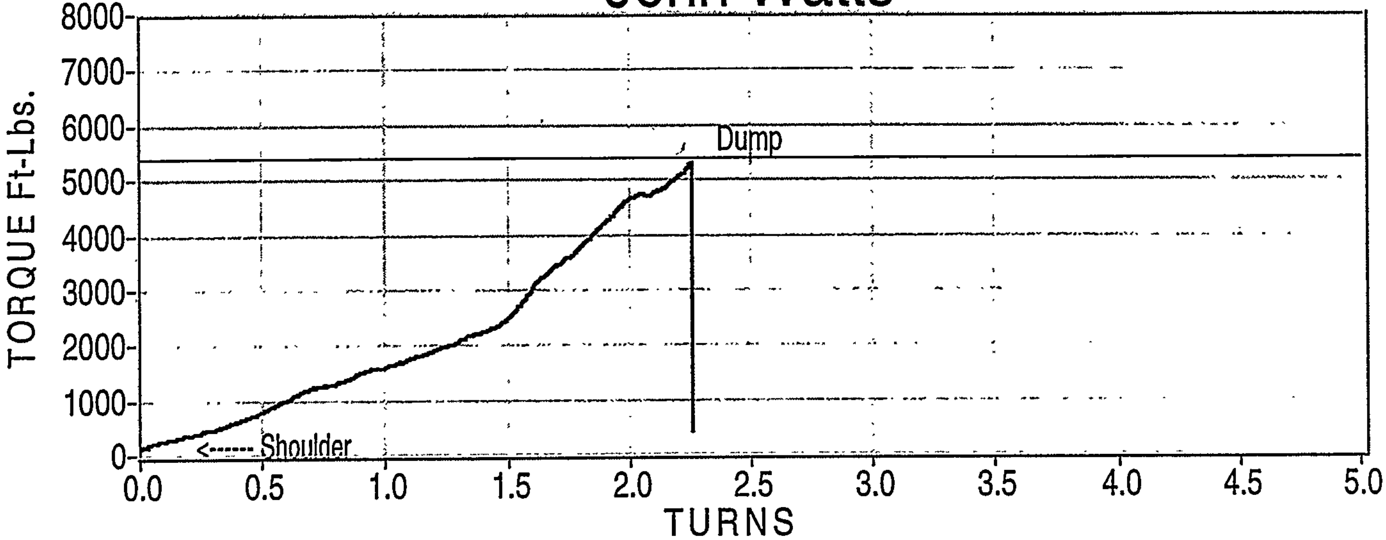
Date : Time of Test
07/08/1999 : 1:39:26 PM

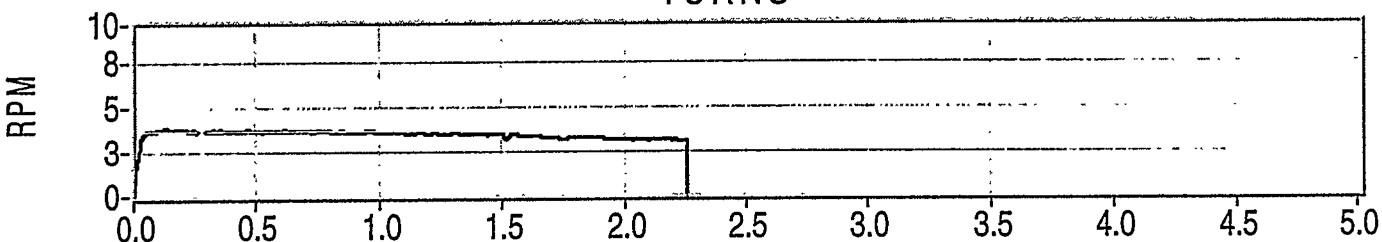
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts





MakeUp

MakeUp # 2	
Pin Id : 22	Box Id : 19
File Name : TT_0064.dat	

5

Maximum Torque	5348	Ft-Lbs
Shoulder Torque	125	Ft-Lbs
Delta Torque	5222	Ft-Lbs
Turns @ Max. Torque	2.260	Turns
Shoulder Turns	0.000	Turns
Delta Turns	2.260	Turns
Total Turns	2.261	Turns
Pin Dope	0	Grams
Box Dope	19	Grams

Operator:
Greg Stafford

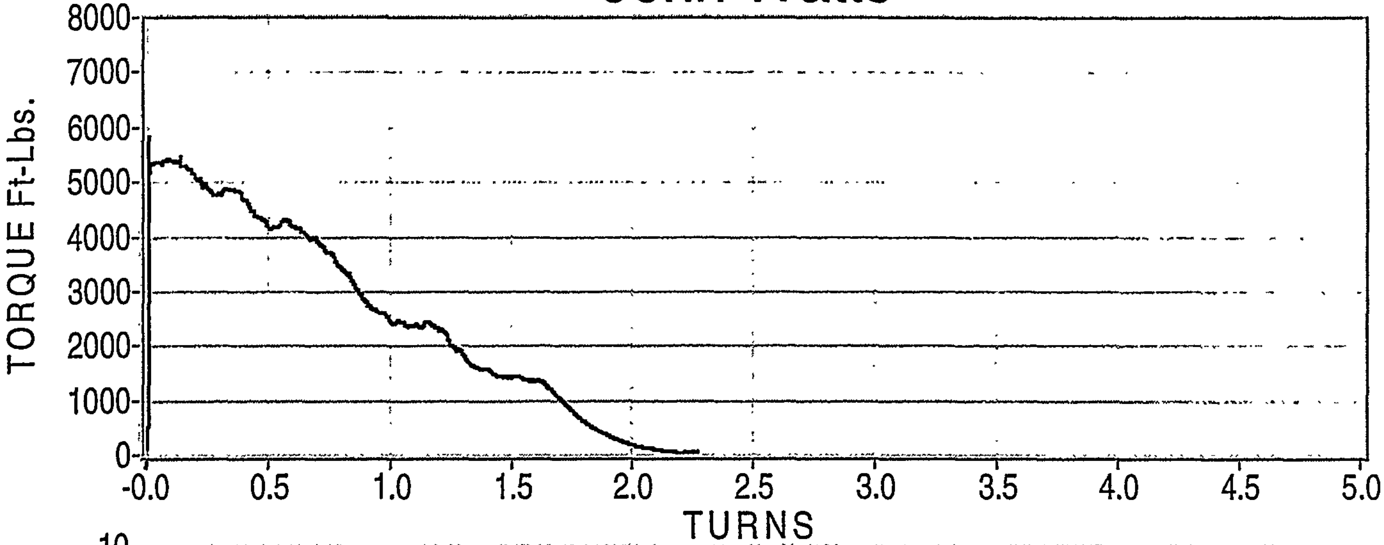
Date:Time of Test
07/08/1999 : 1:50:03 PM

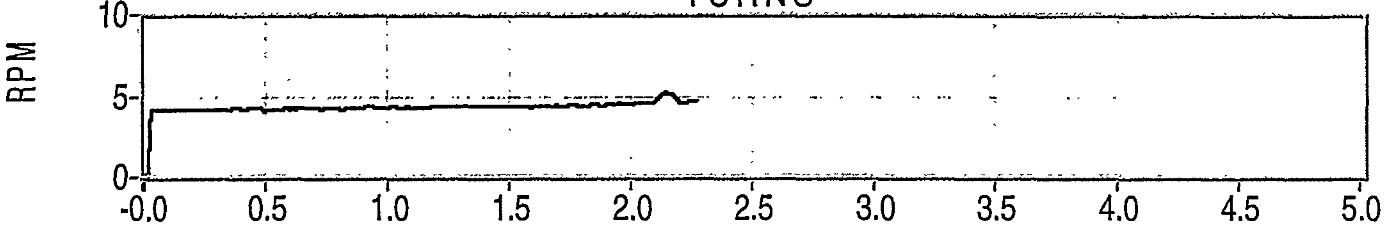
Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number: 5806

Pipe Size
7.000 in.

John Watts





BreakOut

BreakOut # 2	
Pin Id : 22	**Box Id : 19**
File Name : TT_0065.dat	
Maximum Torque	**5869 Ft-Lbs**

5

Operator :
Greg Stafford

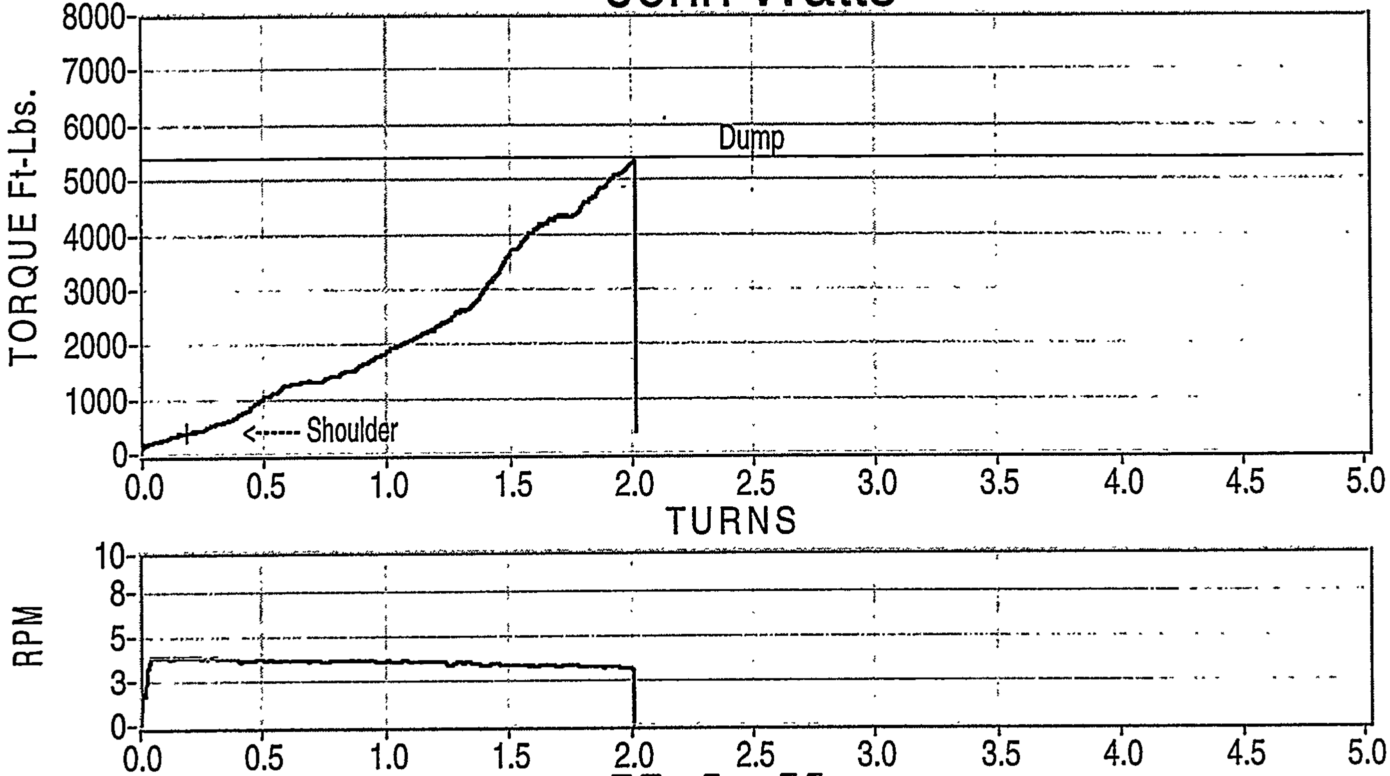
Date : Time of Test
07/08/1999 : 1:53:08 PM

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp

MakeUp # 3			
Pin Id : 22	Box Id : 19		
File Name : TT_0066.dat			
Maximum Torque		5338	Ft-Lbs
Shoulder Torque		389	Ft-Lbs
Delta Torque		4949	Ft-Lbs
Turns @ Max. Torque		2.008	Turns
Shoulder Turns		0.187	Turns
Delta Turns		1.821	Turns
Total Turns		2.014	Turns
Pin Dope		0	Grams
Box Dope		18	Grams

5

Operator:
Greg Stafford

Date:Time of Test
07/08/1999 : 2:08:09 PM

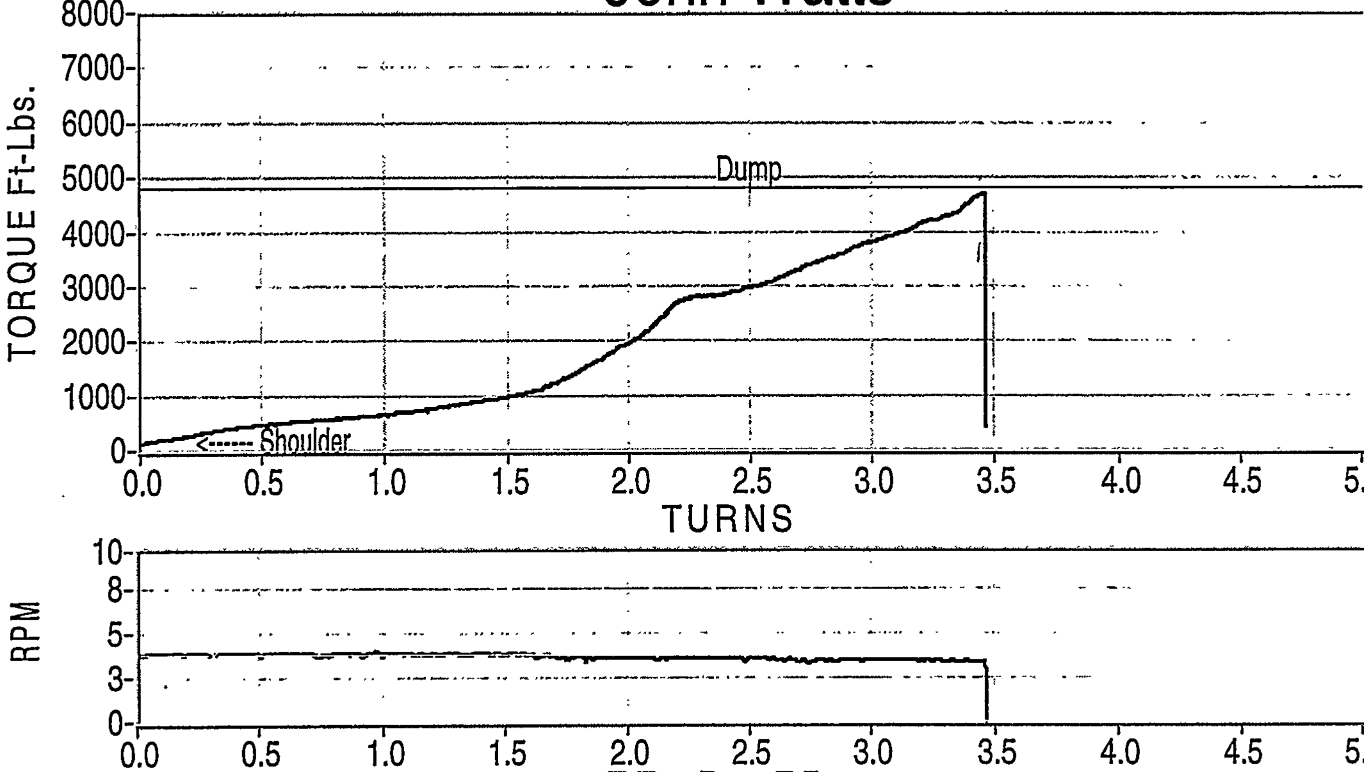
SAMPLE 6

Stress Engineering Services
Torque vs Turns Plot
RPM vs Turns Plot

Project Number : 5806

Pipe Size
7.000 in.

John Watts



MakeUp

MakeUp # 1	
Pin Id : 23	**Box Id : 20**
File Name : TT_0067.dat	

Maximum Torque	4713	Ft-Lbs
Shoulder Torque	132	Ft-Lbs
Delta Torque	4581	Ft-Lbs
Turns @ Max. Torque	3.452	Turns
Shoulder Turns	0.000	Turns
Delta Turns	3.452	Turns
Total Turns	3.463	Turns
Pin Dope	0	Grams
Box Dope	19	Grams

6

Operator:
Greg Stafford

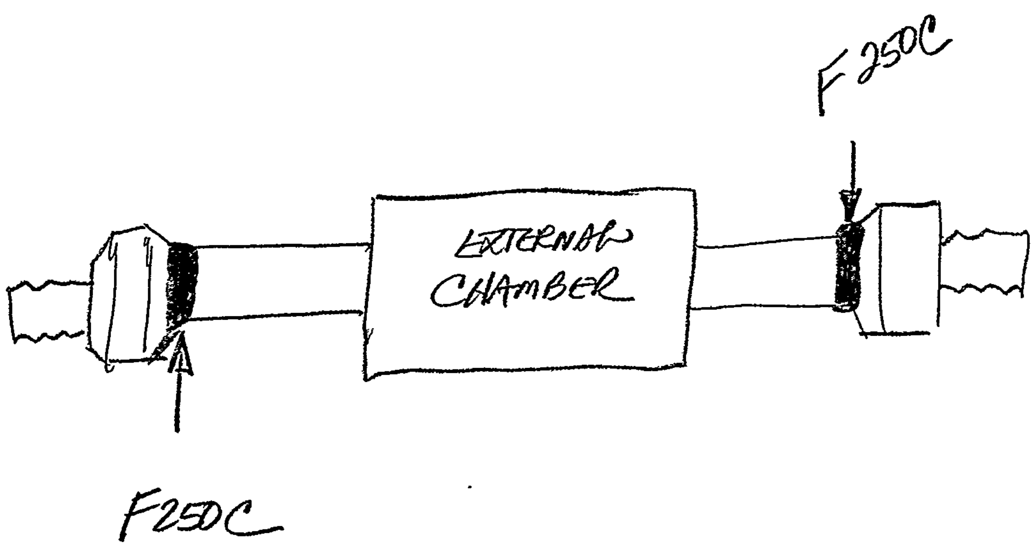
Date:Time of Test
07/08/1999 : 2:25:05 PM

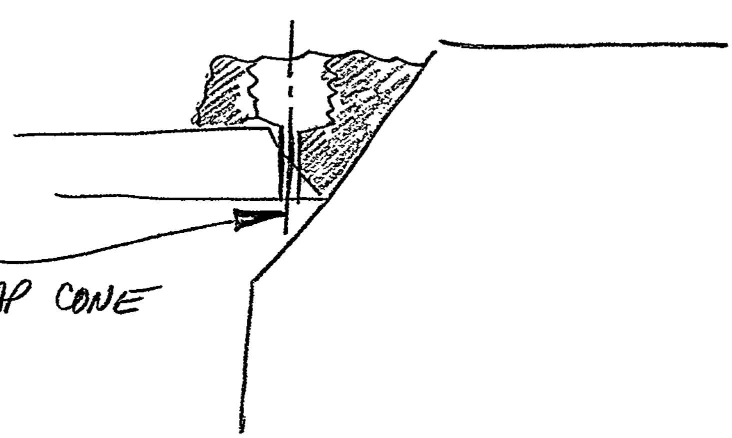
APPENDIX G
SAMPLE PREPARATION INFORMATION

Client JW	Project No. 5806	Page No. of	By WTA	Date 7/14/99
Subject			Checked By	Date

JW 7" SAMPLES 1 & 3

- END CAP WELDS TO INCLUDE ONE AE F250C CONNECTION.
- ONE PER WELD, LOCATED 180° APART.
- # 140 each





LOCATE HOLE ADJACENT END CAP CONE

Client STW	Project No. 5806	Page No. of	By WTA	Date 7-9-99
Subject			Checked By	Date

JOHN WATTS SAMPLES

7" X .453" WALL PIPE

P-110 MATERIAL — .27 C

1.02 Mn
.11 Ni
.36 Cr
.05 Mo

little alloy

WELDING —

300° MIN. PREHEAT

K 111 B FILLER

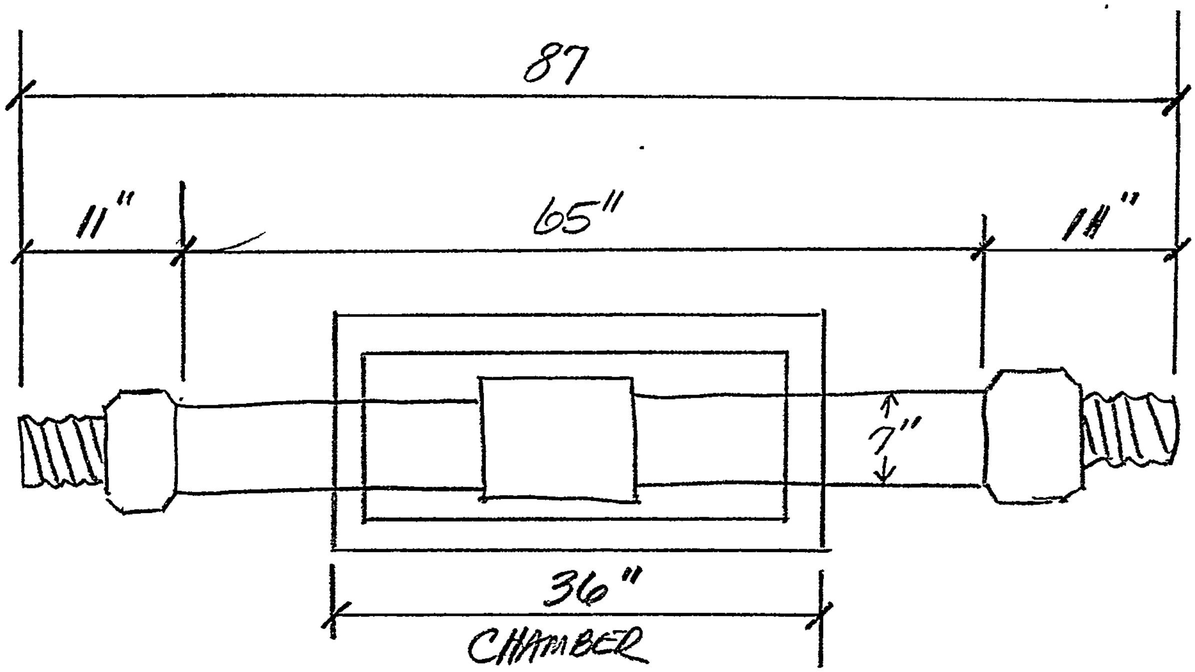
600° NEUTRALIZE

NO STRESS RELIEF

6 SAMPLES TOTAL

Client JW	Project No.	Page No. of	By WTA	Date 7-9-99
Subject			Checked By	Date

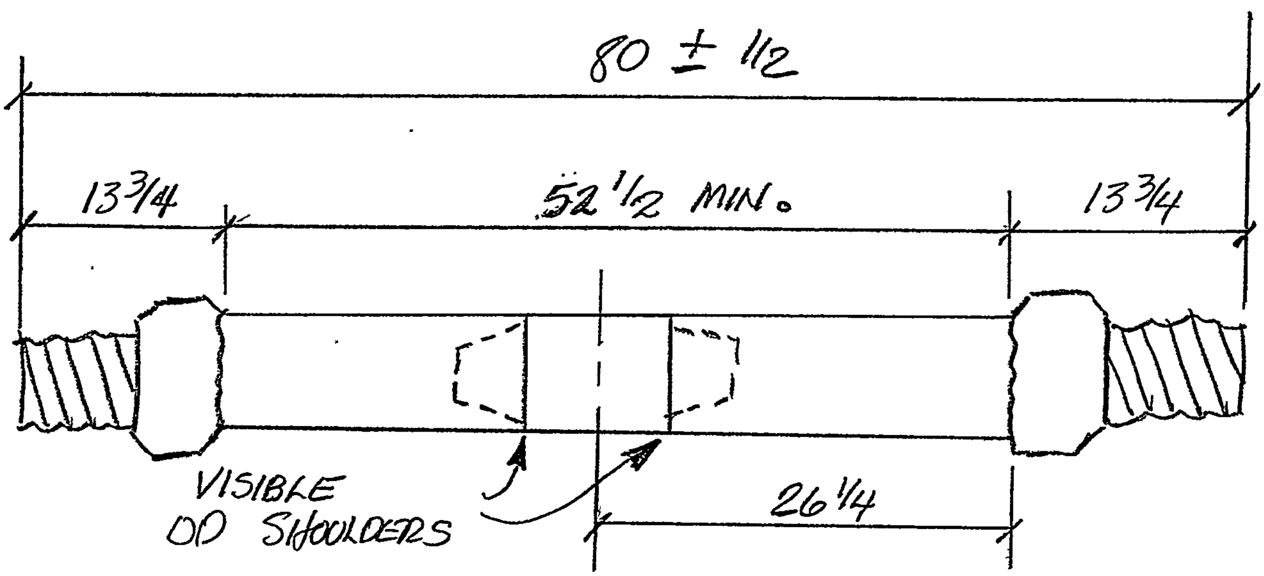
7" SAMPLES #1 & 3



INSTALL FILLER BAR = 5½" to 5¾" DIA.

Client JW	Project No. 5806	Page No. of	By WTA	Date 7-9-99
Subject			Checked By	Date

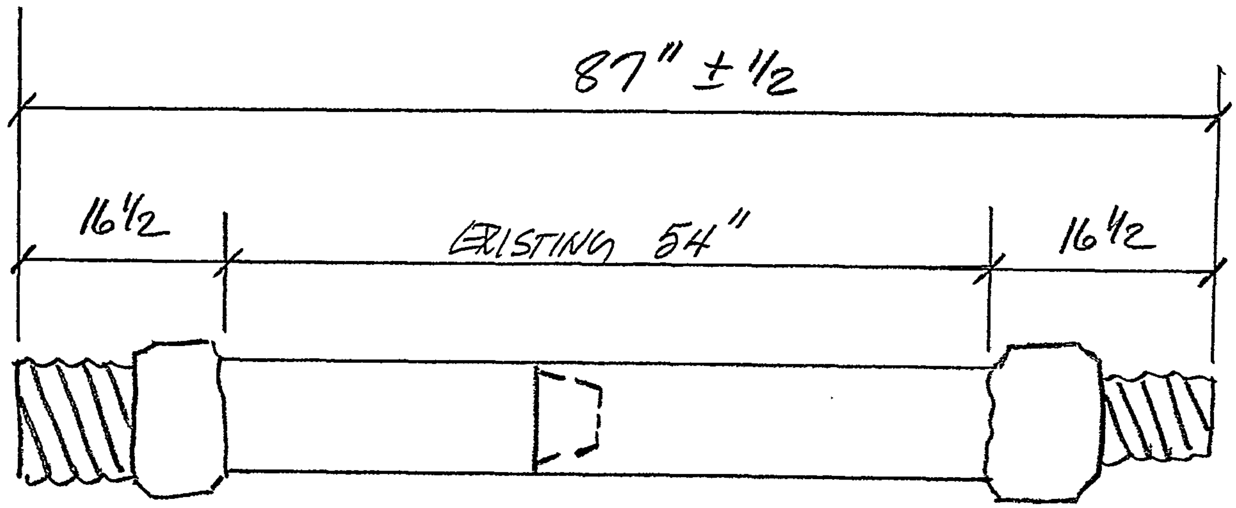
7" SAMPLES # 2 & 4



INSTALL FILLER BAR WITH DIA = 5 1/2" to 5 3/4"

Client JW	Project No. 5806	Page No. of	By WPA	Date 7-9-99
Subject			Checked By	Date

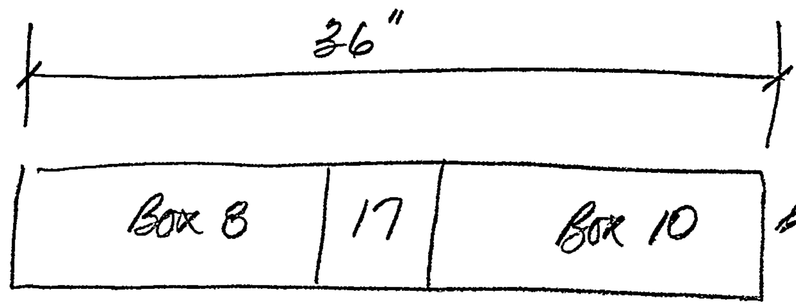
7" SAMPLES 5 & 6



INSTALL FILLER BAR — 5 1/2" to 5 3/4" DIA.

Client	Project No.	Page No. of	By	Date 7-9-99
Subject			Checked By	Date

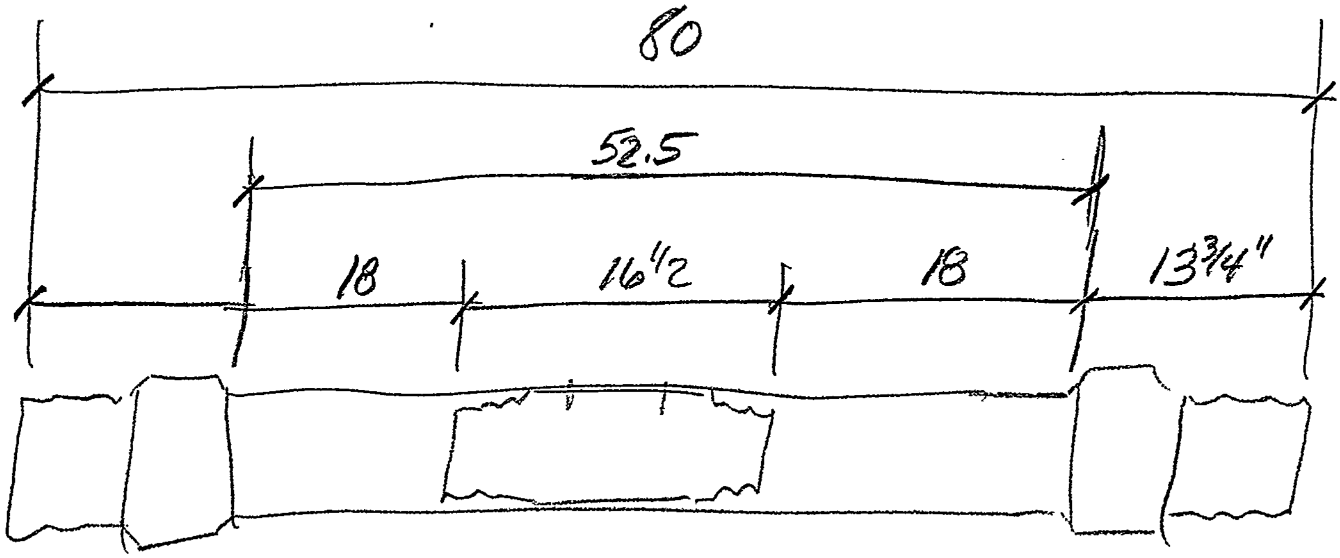
COMPRESSION TEST (MORE)



ENDS SQUARED

MINIMUM INTERFERENCE

Client	Project No.	Page No. of	By	Date
Subject			Checked By	Date



FILLER BAR = 5 1/2" DIA.

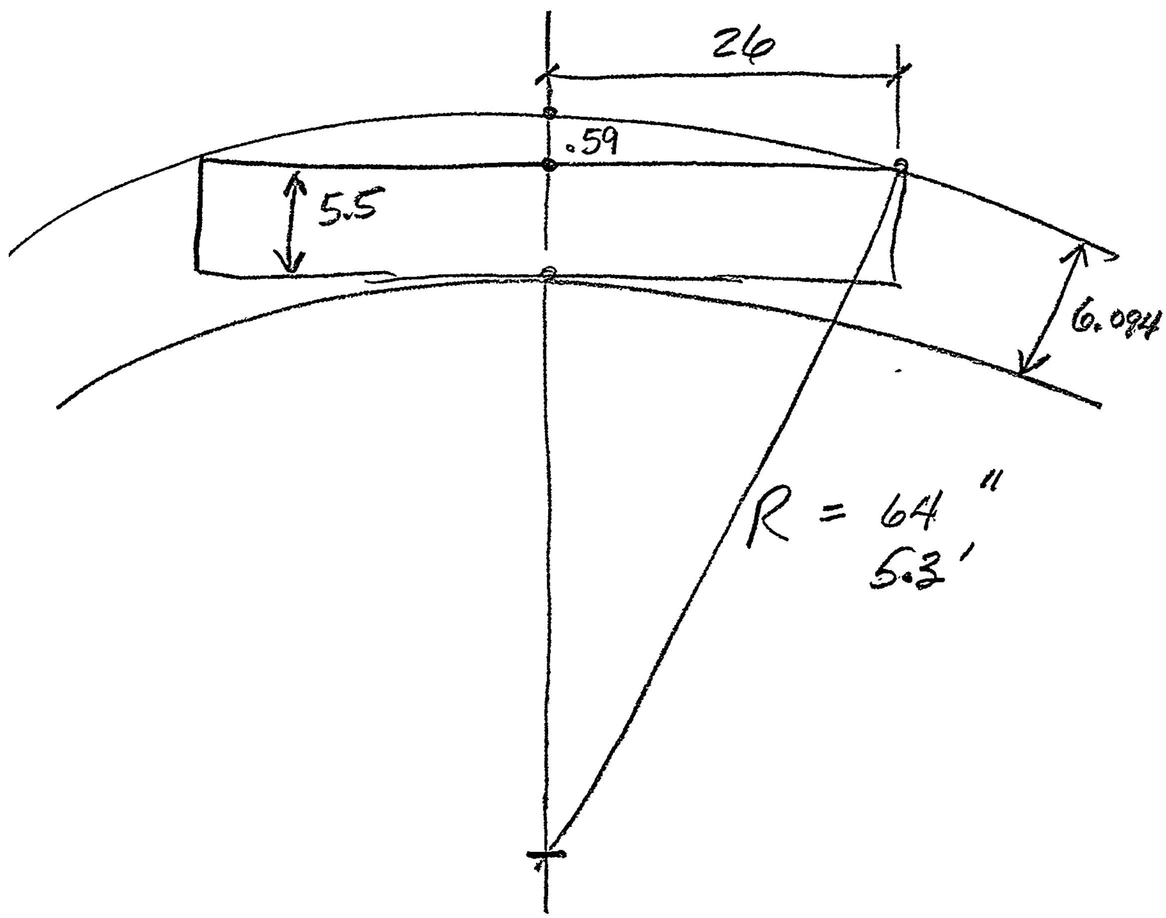
8.5
4
4
16.5
36
52.5
27.5
80

SAMPLE OAL AS MADEUP = 65"

$D + 6\sqrt{Dt} = 7 + 6\sqrt{7 \times .453} = 17.7''$

ID = 6.094

Client	Project No.	Page No. of	By	Date
Subject			Checked By	Date



FOR 5 3/4" BAR, R = 61.6", 5.1'

APPENDIX H

PRELIMINARY COMPRESSION FAILURE TEST DATA

COMPRESSION TEST OF PREL. COUPLED SAMPLE

PIPE MATERIAL YIELD = 122,500 PSI

	MEASURED		AREA	YIELD
SAMPLE	OD	ID	SQ.IN.	KIPS
1	7.048	6.171	9.105	1115
2	7.043	6.145	9.301	1139
3	7.049	6.164	9.184	1125
4	7.042	6.151	9.232	1131
		AVE =	9.206	1128
		NOM. AREA =	9.317	

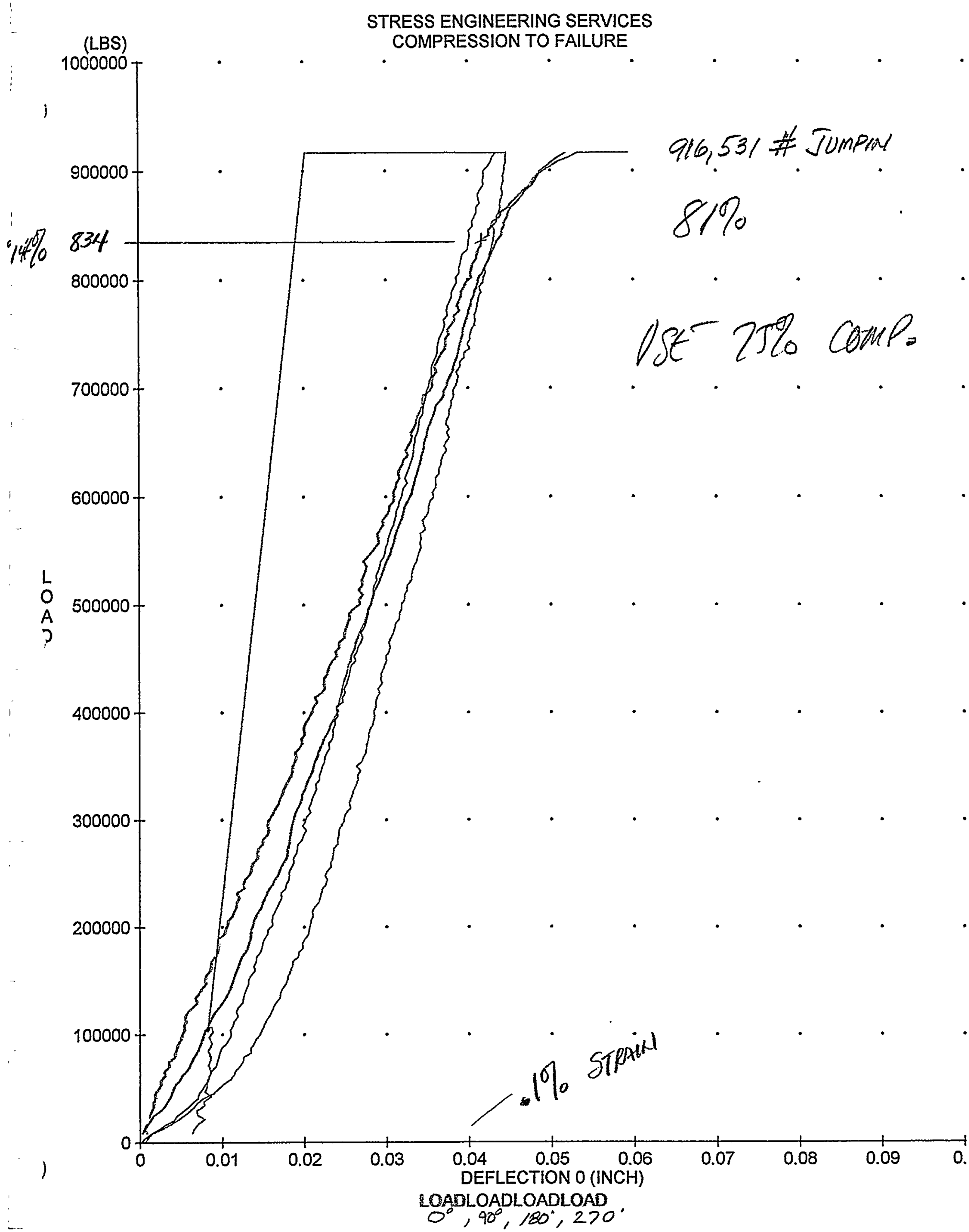
OVERTORQUED END FAILED.

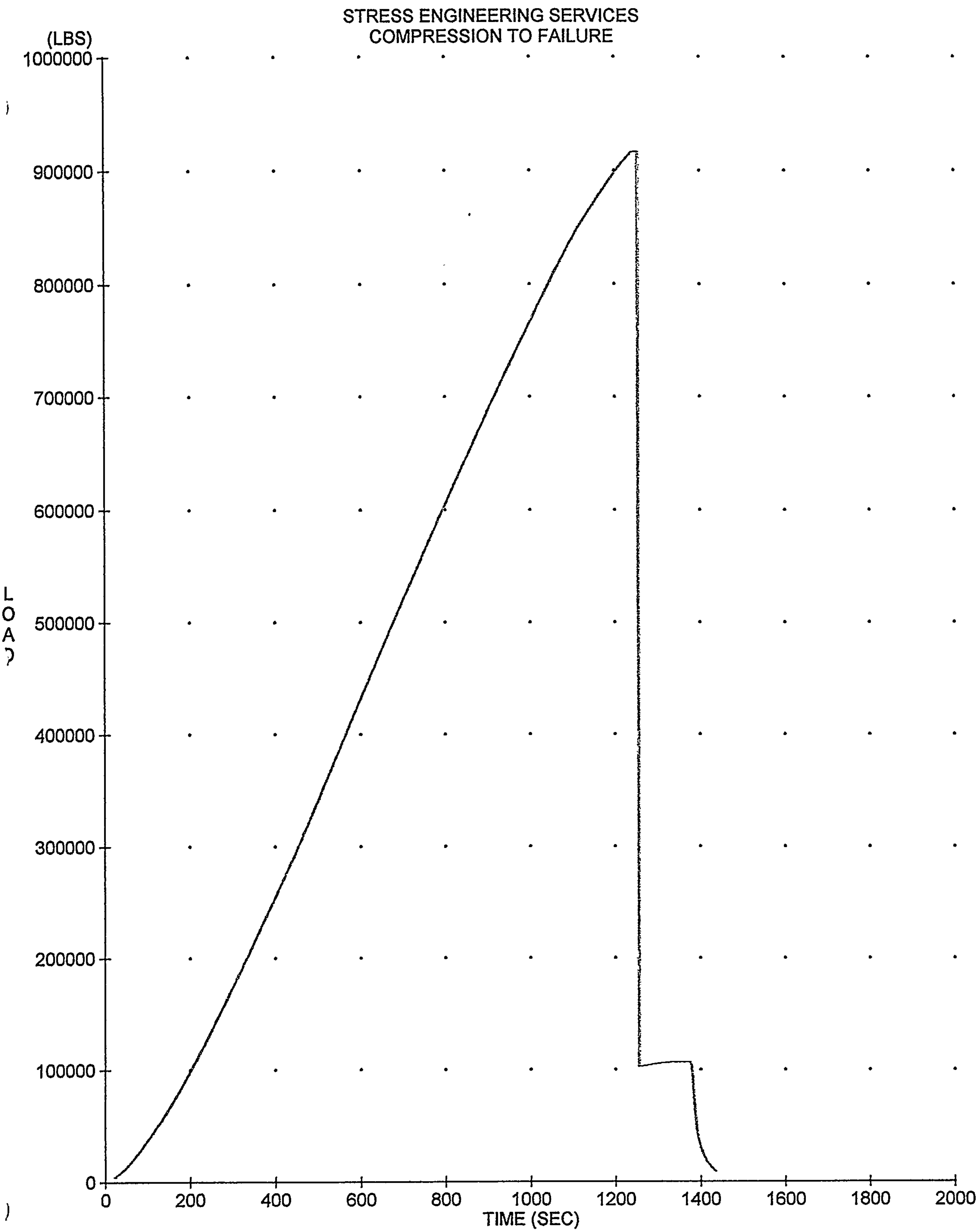
SAMPLE YIELDED AT 834 KIPS
= 834/1128 = 74%

SAMPLE FAILED BY JUMPIN AT 916.5 KIPS
= 916/1128 = 81%

JW WANTS 80% RATING

75%


STRESS ENGINEERING SERVICES
COMPRESSION TO FAILURE
(LBS)
1000000
900000
800000
700000
600000
500000
400000
300000
200000
100000
0
LOAD
916,531 # JUMPIN
81%
USE 75% COMP.
.14% 834
.1% STRAIN
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
DEFLECTION 0 (INCH)
LOADLOADLOADLOAD
0°, 90°, 180°, 270°



STRESS ENGINEERING SERVICES
COMPRESSION TO FAILURE
(LBS)
LOAD
1000000
900000
800000
700000
600000
500000
400000
300000
200000
100000
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000
TIME (SEC)

STRESS ENGINEERING SERVICES
COMPRESSION TO FAILURE

TIME (SEC)	LOAD (LBS)	DEFLECTION 0 deg. (INCH)	DEFLECTION 90 deg. (INCH)	DEFLECTION 180 deg. (INCH)	DEFLECTION 270 deg. (INCH)
1383.2	78560	0.482	0.110	0.009	0.142
1384.3	71887	0.481	0.110	0.008	0.142
1385.5	65877	0.482	0.110	0.009	0.142
1386.6	60597	0.481	0.110	0.008	0.142
1387.7	55912	0.481	0.110	0.008	0.142
1388.8	51779	0.482	0.109	0.008	0.142
1390.4	46684	0.481	0.109	0.008	0.141
1392.0	42585	0.482	0.109	0.009	0.141
1394.1	38298	0.482	0.109	0.008	0.141
1396.6	34180	0.482	0.108	0.008	0.140
1400.1	29699	0.482	0.108	0.007	0.138
1404.1	25615	0.482	0.107	0.007	0.138
1409.0	21425	0.482	0.107	0.008	0.137
1415.3	17239	0.482	0.107	0.007	0.136
1424.0	13154	0.481	0.106	0.007	0.134
1435.0	9089	0.481	0.105	0.006	0.132

STRESS ENGINEERING SERVICES
COMPRESSION TO FAILURE

TIME (SEC)	LOAD (LBS)	DEFLECTION 0 deg. (INCH)	DEFLECTION 90 deg. (INCH)	DEFLECTION 180 deg. (INCH)	DEFLECTION 270 deg. (INCH)
934.1	715190	0.036	0.036	0.039	0.038
939.7	719668	0.036	0.036	0.039	0.038
944.9	723847	0.036	0.036	0.039	0.038
950.2	727967	0.036	0.036	0.039	0.039
956.4	732783	0.037	0.036	0.040	0.039
961.5	736843	0.037	0.036	0.040	0.039
966.7	740942	0.037	0.036	0.040	0.039
972.4	745261	0.037	0.036	0.040	0.039
977.7	749380	0.038	0.037	0.040	0.039
983.3	753958	0.037	0.037	0.040	0.039
989.5	758515	0.038	0.037	0.041	0.040
995.2	763072	0.038	0.037	0.041	0.040
1000.8	767172	0.038	0.038	0.041	0.040
1006.1	771491	0.039	0.037	0.041	0.040
1012.0	776108	0.039	0.038	0.041	0.040
1018.3	780864	0.039	0.038	0.041	0.040
1023.6	784904	0.039	0.038	0.041	0.041
1029.0	788964	0.039	0.038	0.042	0.041
1035.3	793442	0.040	0.038	0.041	0.041
1040.6	797601	0.040	0.039	0.042	0.041
1046.0	801820	0.040	0.039	0.042	0.041
1052.3	806238	0.040	0.039	0.042	0.042
1058.1	810796	0.040	0.039	0.042	0.042
1064.0	814975	0.041	0.039	0.042	0.042
1069.8	819035	0.041	0.039	0.043	0.043
1075.2	823373	0.041	0.039	0.043	0.043
1081.5	827831	0.041	0.040	0.043	0.043
1087.3	832189	0.042	0.040	0.043	0.043
1093.2	836289	0.042	0.040	0.043	0.044
1099.9	840568	0.043	0.040	0.043	0.044
1106.2	845125	0.042	0.040	0.043	0.044
1113.1	849324	0.043	0.041	0.043	0.044
1119.4	853344	0.043	0.041	0.044	0.044
1126.1	857683	0.044	0.041	0.043	0.045
1133.4	861703	0.044	0.041	0.044	0.045
1140.2	866081	0.045	0.041	0.044	0.045
1148.4	870260	0.045	0.041	0.044	0.046
1154.7	874280	0.046	0.041	0.044	0.046
1162.4	878480	0.046	0.041	0.044	0.047
1170.1	882599	0.047	0.041	0.044	0.047
1177.9	886739	0.048	0.042	0.044	0.048
1185.6	890898	0.048	0.042	0.044	0.048
1194.3	895336	0.048	0.042	0.044	0.048
1202.5	899555	0.049	0.042	0.044	0.049
1210.7	903675	0.050	0.042	0.044	0.050
1219.9	907854	0.051	0.043	0.045	0.050
1229.1	911934	0.052	0.043	0.045	0.051
1239.2	916093	0.053	0.043	0.045	0.052
1254.0	916531	0.059	0.242	0.020	0.418
1254.7	102521	0.477	0.109	0.008	0.142
1314.7	106400	0.481	0.110	0.008	0.142
1374.8	107025	0.481	0.110	0.009	0.142
1378.7	102664	0.482	0.110	0.009	0.142
1379.9	97809	0.482	0.110	0.008	0.142
1381.0	91287	0.482	0.110	0.009	0.142
1382.1	84930	0.481	0.110	0.008	0.142

STRESS ENGINEERING SERVICES
COMPRESSION TO FAILURE

TIME (SEC)	LOAD (LBS)	DEFLECTION 0 deg. (INCH)	DEFLECTION 90 deg. (INCH)	DEFLECTION 180 deg. (INCH)	DEFLECTION 270 deg. (INCH)
647.5	474286	0.025	0.027	0.031	0.027
652.3	478644	0.025	0.027	0.031	0.027
658.0	483361	0.025	0.028	0.031	0.027
662.7	487600	0.026	0.028	0.032	0.028
667.9	492277	0.025	0.028	0.032	0.028
673.2	496416	0.026	0.028	0.032	0.028
677.9	500973	0.027	0.028	0.032	0.028
682.7	505033	0.027	0.028	0.032	0.028
687.9	509770	0.027	0.028	0.032	0.028
693.1	514009	0.027	0.028	0.033	0.029
698.3	518566	0.027	0.029	0.033	0.029
703.5	523163	0.027	0.029	0.033	0.029
708.8	527820	0.027	0.029	0.033	0.029
714.0	532338	0.028	0.029	0.033	0.030
719.2	536656	0.028	0.029	0.033	0.030
723.5	540656	0.027	0.029	0.034	0.030
728.7	544955	0.028	0.030	0.034	0.030
733.5	549095	0.028	0.030	0.034	0.031
738.8	553672	0.029	0.030	0.034	0.031
743.5	557752	0.029	0.030	0.034	0.031
748.2	561752	0.029	0.030	0.034	0.031
753.0	566011	0.029	0.030	0.034	0.031
758.2	570389	0.029	0.031	0.035	0.031
763.4	574548	0.030	0.031	0.035	0.032
768.2	578807	0.030	0.031	0.034	0.032
772.9	582907	0.030	0.031	0.035	0.032
778.1	586927	0.030	0.031	0.035	0.032
782.8	591285	0.030	0.031	0.035	0.032
788.6	596161	0.031	0.032	0.035	0.033
793.3	600181	0.031	0.032	0.036	0.033
798.5	604181	0.031	0.032	0.036	0.033
803.3	608400	0.031	0.032	0.036	0.033
808.5	612798	0.031	0.033	0.036	0.033
813.7	617137	0.032	0.032	0.036	0.034
818.9	621435	0.032	0.033	0.036	0.034
824.1	625595	0.032	0.033	0.036	0.034
828.9	629714	0.032	0.033	0.037	0.034
834.1	634073	0.032	0.033	0.037	0.034
839.3	638172	0.033	0.033	0.037	0.034
844.0	642292	0.032	0.033	0.037	0.034
849.3	646412	0.033	0.033	0.037	0.035
854.0	650432	0.033	0.034	0.037	0.035
859.2	654571	0.033	0.034	0.038	0.035
864.4	658909	0.033	0.034	0.037	0.035
869.1	662969	0.033	0.034	0.038	0.035
874.8	667348	0.034	0.034	0.037	0.035
880.0	671527	0.034	0.034	0.037	0.036
885.2	675666	0.034	0.034	0.038	0.036
890.4	679925	0.034	0.035	0.038	0.036
895.7	684005	0.034	0.035	0.038	0.036
900.9	688741	0.034	0.035	0.038	0.037
906.6	693319	0.035	0.035	0.038	0.037
912.2	697697	0.035	0.035	0.038	0.037
917.5	701797	0.036	0.035	0.038	0.037
923.2	706414	0.036	0.035	0.039	0.038
928.4	710633	0.036	0.036	0.039	0.038

STRESS ENGINEERING SERVICES
COMPRESSION TO FAILURE

TIME (SEC)	LOAD (LBS)	DEFLECTION 0 deg. (INCH)	DEFLECTION 90 deg. (INCH)	DEFLECTION 180 deg. (INCH)	DEFLECTION 270 deg. (INCH)
376.5	235917	0.013	0.018	0.022	0.016
381.9	240029	0.013	0.018	0.023	0.016
387.0	244148	0.013	0.018	0.023	0.016
391.6	248248	0.013	0.018	0.023	0.017
396.7	252308	0.014	0.018	0.023	0.017
401.7	256308	0.014	0.018	0.023	0.017
406.3	260427	0.014	0.019	0.023	0.017
411.3	264487	0.014	0.019	0.023	0.018
416.7	269124	0.014	0.019	0.024	0.018
421.7	273244	0.014	0.019	0.024	0.018
426.7	277423	0.015	0.019	0.024	0.018
431.9	281980	0.015	0.020	0.024	0.018
437.2	286359	0.016	0.020	0.024	0.018
442.4	290399	0.016	0.020	0.024	0.018
447.2	294439	0.016	0.020	0.024	0.018
451.9	298478	0.016	0.020	0.025	0.019
456.8	303016	0.016	0.020	0.025	0.019
461.8	307076	0.016	0.021	0.025	0.019
466.2	311315	0.017	0.021	0.026	0.019
471.1	315494	0.017	0.021	0.025	0.020
476.1	319693	0.017	0.021	0.026	0.020
480.8	324191	0.017	0.021	0.026	0.020
486.0	328629	0.017	0.021	0.026	0.020
490.8	333146	0.018	0.021	0.026	0.020
495.5	337465	0.018	0.022	0.027	0.021
500.3	341565	0.018	0.022	0.026	0.021
504.5	345704	0.019	0.022	0.027	0.021
508.8	349784	0.019	0.022	0.026	0.021
513.5	354162	0.019	0.022	0.027	0.021
518.3	358401	0.019	0.022	0.027	0.022
523.1	362660	0.019	0.023	0.027	0.022
527.8	366740	0.019	0.023	0.028	0.022
532.5	370959	0.020	0.023	0.028	0.022
537.2	375337	0.020	0.023	0.028	0.022
542.0	379715	0.020	0.024	0.028	0.023
546.7	384452	0.020	0.024	0.028	0.023
551.9	388691	0.020	0.024	0.028	0.023
556.2	392770	0.020	0.024	0.028	0.024
560.5	396830	0.021	0.024	0.029	0.024
565.7	401308	0.021	0.024	0.029	0.024
570.0	405328	0.021	0.024	0.029	0.024
574.8	409826	0.022	0.025	0.029	0.024
580.0	414124	0.021	0.025	0.029	0.024
584.3	418264	0.022	0.025	0.029	0.025
589.0	422284	0.023	0.025	0.029	0.025
594.2	427060	0.022	0.025	0.030	0.025
599.5	431737	0.022	0.025	0.029	0.025
604.7	436294	0.023	0.026	0.029	0.025
609.4	440314	0.023	0.026	0.030	0.025
613.8	444315	0.023	0.026	0.030	0.025
618.6	448315	0.023	0.026	0.030	0.026
622.8	452454	0.024	0.026	0.030	0.026
627.6	456554	0.024	0.026	0.030	0.026
632.4	460594	0.024	0.027	0.030	0.026
637.6	465251	0.024	0.027	0.030	0.026
642.3	469709	0.025	0.027	0.031	0.027

STRESS ENGINEERING SERVICES
COMPRESSION TO FAILURE

TIME (SEC)	LOAD (LBS)	DEFLECTION 0 deg. (INCH)	DEFLECTION 90 deg. (INCH)	DEFLECTION 180 deg. (INCH)	DEFLECTION 270 deg. (INCH)
0.0	218	0.000	0.000	0.001	0.000
21.4	4280	0.000	0.001	0.001	0.000
34.6	8280	0.001	0.001	0.001	0.000
46.5	12339	0.001	0.002	0.003	0.001
56.8	16404	0.001	0.003	0.004	0.001
66.3	20546	0.001	0.004	0.004	0.001
75.1	24616	0.001	0.004	0.005	0.002
83.3	28747	0.001	0.005	0.006	0.002
91.1	32921	0.002	0.006	0.007	0.003
98.9	37098	0.002	0.006	0.007	0.003
106.3	41196	0.002	0.007	0.008	0.004
114.1	45353	0.002	0.007	0.009	0.004
121.9	49669	0.002	0.008	0.010	0.004
129.7	53849	0.003	0.008	0.010	0.004
136.3	57875	0.002	0.008	0.011	0.005
143.3	61915	0.003	0.008	0.011	0.005
150.3	66315	0.003	0.009	0.012	0.006
157.0	70516	0.004	0.009	0.012	0.006
163.6	74793	0.004	0.009	0.012	0.006
170.2	79060	0.004	0.010	0.013	0.007
176.5	83167	0.004	0.010	0.013	0.007
183.1	87627	0.004	0.010	0.013	0.007
189.3	91677	0.005	0.010	0.014	0.007
195.1	95876	0.005	0.011	0.014	0.008
201.4	99904	0.005	0.011	0.015	0.008
207.2	104109	0.005	0.011	0.015	0.008
212.7	108215	0.005	0.011	0.015	0.008
218.5	112478	0.006	0.011	0.015	0.009
224.8	117089	0.005	0.012	0.016	0.009
231.1	121688	0.006	0.012	0.016	0.009
236.9	125712	0.006	0.012	0.016	0.010
242.3	129927	0.007	0.012	0.017	0.010
247.8	134246	0.007	0.013	0.017	0.010
253.6	138706	0.007	0.013	0.017	0.011
259.1	142885	0.008	0.013	0.017	0.011
264.6	147056	0.008	0.013	0.018	0.011
270.1	151211	0.008	0.013	0.018	0.011
275.5	155379	0.008	0.013	0.018	0.011
280.9	159652	0.009	0.014	0.018	0.012
286.4	164022	0.009	0.014	0.018	0.012
291.9	168169	0.009	0.014	0.019	0.012
297.4	172563	0.009	0.014	0.019	0.012
302.8	176751	0.009	0.015	0.019	0.013
307.9	180856	0.010	0.015	0.020	0.013
313.3	185061	0.010	0.015	0.020	0.013
318.8	189344	0.009	0.015	0.020	0.013
324.3	193822	0.010	0.016	0.021	0.013
329.3	197957	0.010	0.016	0.021	0.014
334.8	202145	0.011	0.016	0.021	0.014
339.9	206280	0.011	0.016	0.021	0.014
344.9	210360	0.011	0.016	0.021	0.014
350.0	214471	0.011	0.016	0.021	0.014
355.5	218804	0.012	0.017	0.021	0.015
360.5	223017	0.012	0.017	0.022	0.015
366.4	227702	0.012	0.017	0.022	0.015
371.4	231772	0.012	0.017	0.022	0.015

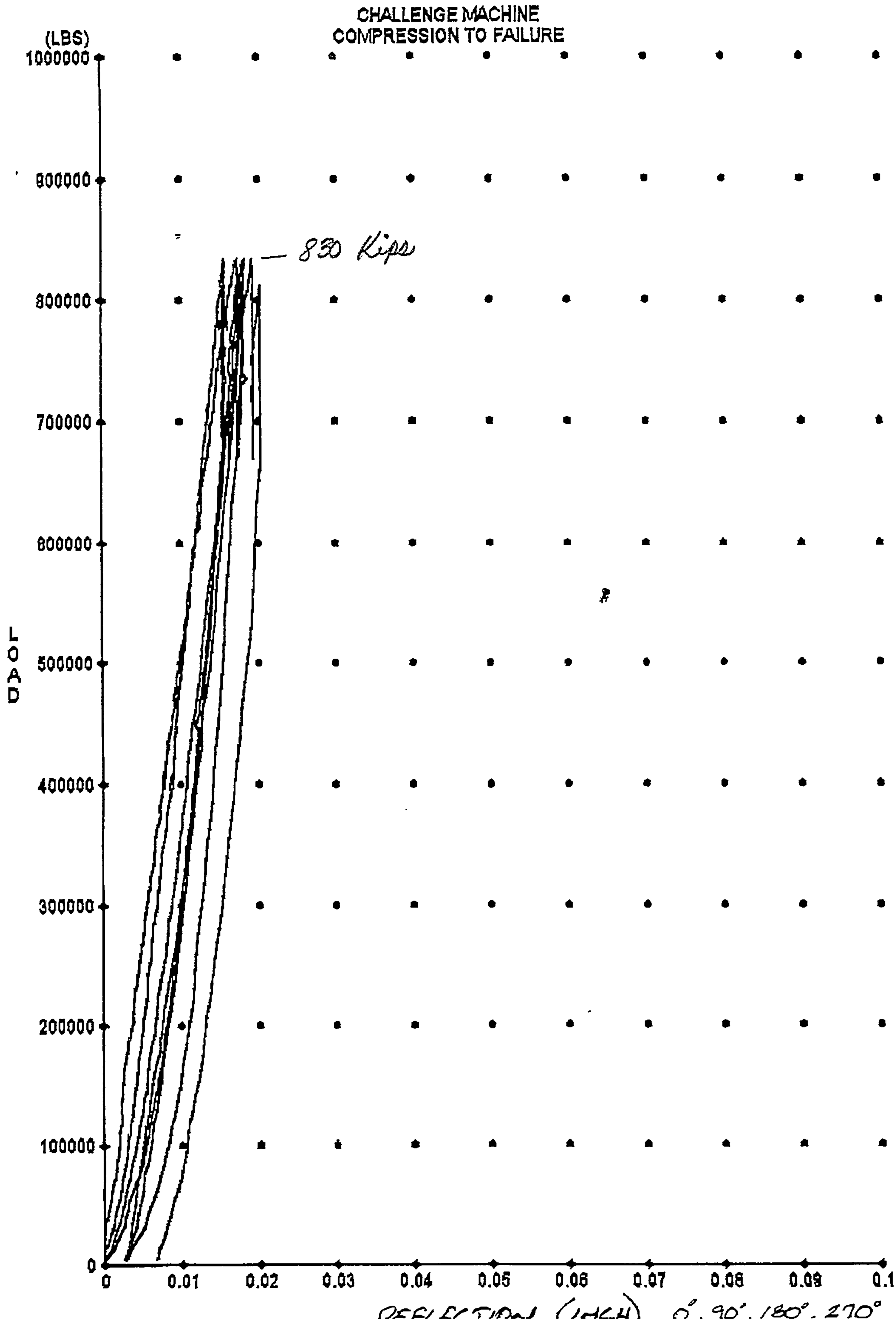
MOHR
Research & Engineering

Northwoods Industrial Park West
12237 FM 529 • Houston, TX 77041-2805
Phone (713) 466-1527 • Fax (713) 896-6807
Email: info@mohreng.com

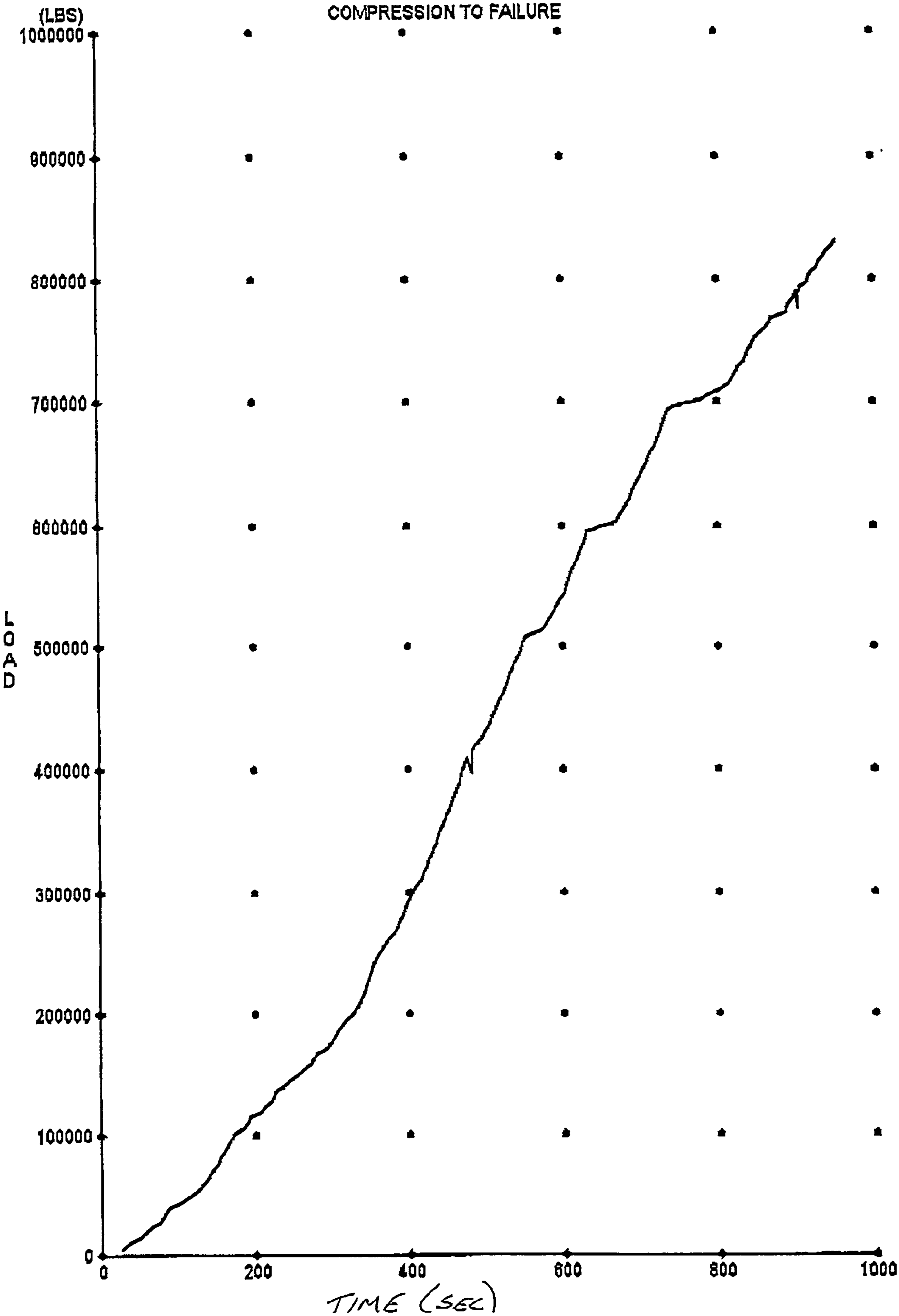
FACSIMILE TRANSMISSION
PAGE 1 OF 3
FROM (713) 896-6807

TO: Tom Asbill
COMPANY: SES
FAX No.: 281-955-2638
FROM: Troy Baker
DATE: 7/12/99
SUBJECT:

MESSAGE:


CHALLENGE MACHINE
COMPRESSION TO FAILURE
(LBS)
1000000
900000
800000
700000
600000
500000
400000
300000
200000
100000
0
LOAD
830 Kips
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
DEFLECTION (INCH) 0°. 90°. 180°. 270°

CHALLENGE MACHINE
COMPRESSION TO FAILURE



H O MOHR Research and Engineering
12237 F M 529
Houston Texas 77041

Test Frame 002-1 -- Four Cylinders -- 1.0 Mlb Tension
Sensotec XDCR: M/ TJE/743-06 S/ 140474
Sensotec Indr: M/ 450-D S/ 84618 Shunt Cal: 2488

Calibration Date: 13 April 1999

Instrumentation:
E M E Load Cell 8512.02
E M E Load Cell 9709.05

FITTED LINEAR EQUATION:

[Gage Rdg] = 7.89881516E+01 + 5.07392222E-03 * [Load]

R M S Error, Linear : 1711.044 lb

Equation Offset: -78.99

Average Effective Area: 188.15 Equation Effective Area: 197.09

Software Full Scale Value: 940750 Equation Full Scale Value: 985431

Point Index	Gage Rdg.	Observed Load	Predicted Load	Error... Absolute	Pct.	Pct.-FS
1	501	83364	83173	-191	-0.23	-0.02
2	1002	181127	181913	786	0.43	0.08
3	1500	278825	280062	1237	0.44	0.12
4	2003	376709	379196	2487	0.66	0.25
5	2500	474005	477148	3143	0.66	0.31
6	3001	573071	575888	2817	0.49	0.28
7	3500	672470	674234	1764	0.26	0.18
8	4001	771726	772974	1248	0.16	0.12
9	4500	870629	871320	692	0.08	0.07
10	4992	968807	968287	-520	-0.05	-0.05
11	500	85458	82976	-2482	-2.90	-0.25
12	1000	183777	181519	-2258	-1.23	-0.23
13	1500	281538	280062	-1477	-0.52	-0.15
14	2002	379378	378999	-379	-0.10	-0.04
15	2500	477612	477148	-464	-0.10	-0.05
16	3000	576436	575691	-745	-0.13	-0.07
17	3502	675513	674628	-884	-0.13	-0.09
18	4001	773812	772974	-837	-0.11	-0.08
19	4501	873019	871517	-1501	-0.17	-0.15
20	5000	972299	969864	-2435	-0.25	-0.24

CERTIFICATE OF VERIFICATION

THIS IS TO CERTIFY THAT THE

Test Frame 002-1 -- Four Cylinders -- 1.0 Mlb Tension
Sensotec XDCR: M/ TJE/743-06 S/ 140474
Sensotec Indr: M/ 450-D S/ 84618 Shunt Cal: 2488
Zero Offset: -79 psi Software Full Scale: 985431

LOCATED AT

H O MOHR Research and Engineering
12237 F M 529
Houston Texas 77041

was calibrated on 13 April 1999 according to the current ASTM Standard E-4 and determined to indicate load within the specified 1.0 percent tolerance on the ranges listed below. Maximum error observed was 0.38 percent.

MACHINE RANGE, LB	LOADING RANGE, LB MINIMUM - MAXIMUM
1,000,000	98,803 - 985,569

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

INSTRUMENTS USED...........	SERIAL NO	CLASS `A' LOADING RANGE...........LB	VERIFIED. .....DATE
E M E Load Cell	8512.02	56,000 - 1,500,000	12 Oct 98
E M E Load Cell	9709.05	50,000 - 1,500,000	13 Oct 98

RCN Enterprises, Inc.
11115 Mills Road, Suite 122
Cypress Texas 77429

13 April 1999

RCN Enterprises, Inc.
11115 Mills Road, Suite 122
Cypress Texas 77429

13 April 1999

CALIBRATION REPORT

OWNER: H O MOHR Research and Engineering
12237 F M 529
Houston Texas 77041

MACHINE: Test Frame 002-1 -- Four Cylinders -- 1.0 Mlb Tension
Sensotec XDCR: M/ TJE/743-06 S/ 140474
Sensotec Indr: M/ 450-D S/ 84618 Shunt Cal: 2488
Zero Offset: -79 psi Software Full Scale: 985431

CALIBRATION DATA:	RANGE. LB	LOAD............LB INDICATED	TRUE	MACHINE LB	ERROR PERCENT
	1000000	98803.	99158.	-355.	0.36
		198401.	197644.	757.	0.38
		294723.	294927.	-204.	0.07
		392123.	392641.	-518.	0.13
		490035.	490706.	-671.	0.14
		588026.	588911.	-885.	0.15
		688402.	688231.	171.	0.02
		788246.	787877.	369.	0.05
		887775.	887174.	601.	0.07
		985569.	985639.	-70.	0.01

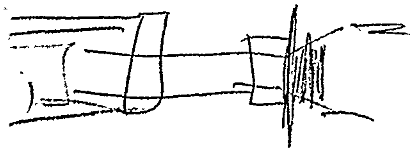
True loads were recorded at the values of indicated load listed above according to the current ASTM Standard E-4.

DEVICE DATA:	INSTRUMENTS USED...........	SERIAL NO	CLASS 'A' LOADING RANGE...........LB	VERIFIED. .....DATE
	E M E Load Cell	8512.02	56,000 - 1,500,000	12 Oct 98
	E M E Load Cell	9709.05	50,000 - 1,500,000	13 Oct 98

Instruments were verified as noted above by National Standards Testing Laboratory according to current ASTM Standard E-74. Instruments were compensated for effect of temperature on zero and span by the manufacturer(s).

APPENDIX I

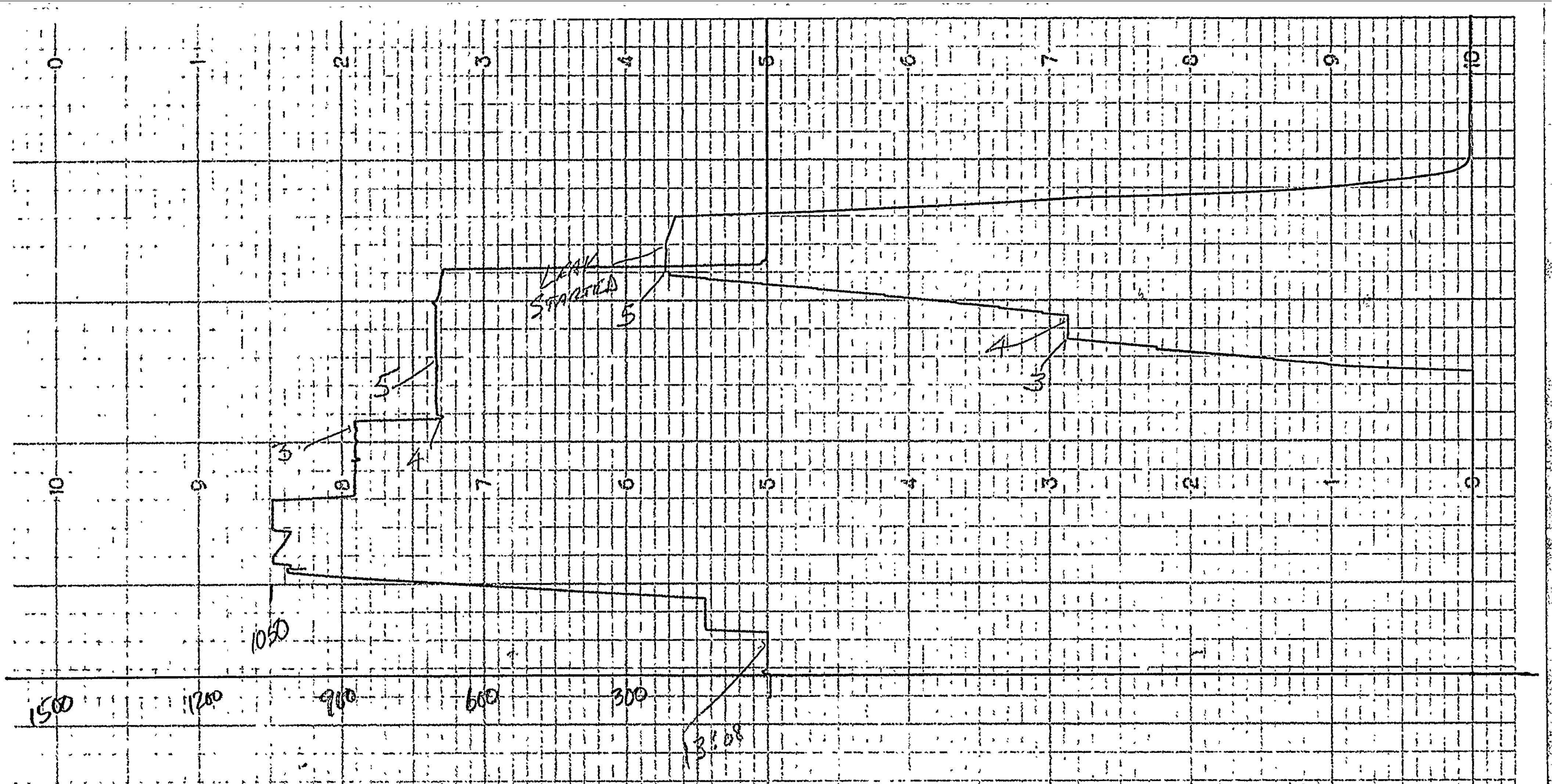
SAMPLE 1 TEST DATA



ISO TEST SERIES A - TEST LOG
JOHN WATTS 7" COUPLED CONNECTION
SAMPLE # 1

DATE: 7/20/99 BY: GS PAGE 1 OF

LOAD STEP	TIME 24 HR.	FRAME KIPS	PRESSURE PSI	BUBBLES CC	COMMENTS
—	13:08	0	0	0	—
1	13:37	1032/10,190	0	0	5MIN.
2	13:44	862/8520	0	1cc	—
3	13:58	862/8570	5700	9cc	— DISPLACED ADJUSTING LOAD
4	14:02	691/6860	5710	9cc	—
5	14:14	691/6900	11,400	15cc	60MIN
	14:19	690/6890	11,390		SAMPLE STARTED LEAKING.
		KIPS / PSI			



TENSION 0 COMPRESSION

Stress Engineering Services, Inc.
P.N. 5806 Date 7/20/99
Operator GS Chart Sp 2 cm HR.
Sample #1
Full Scale Ch. No. 1 20,000 PSI
Full Scale Ch. No. 2 1500 KIPS
Transducer S/N Ch. No. 1 059860075
Transducer S/N Ch. No. 2 BRIDGE #1 N1000

LOAD
SHUNT T. 988.5
C. 1002.3
1500 KIP F/S

PRESSURE
24219 SHUNT
20,000 PSI F/S

NO. ECX-100

ISO TEST SERIES A LOAD POINTS
JOHN WATTS 7" COUPLED CONNECTION
SAMPLE #1
7/20/99

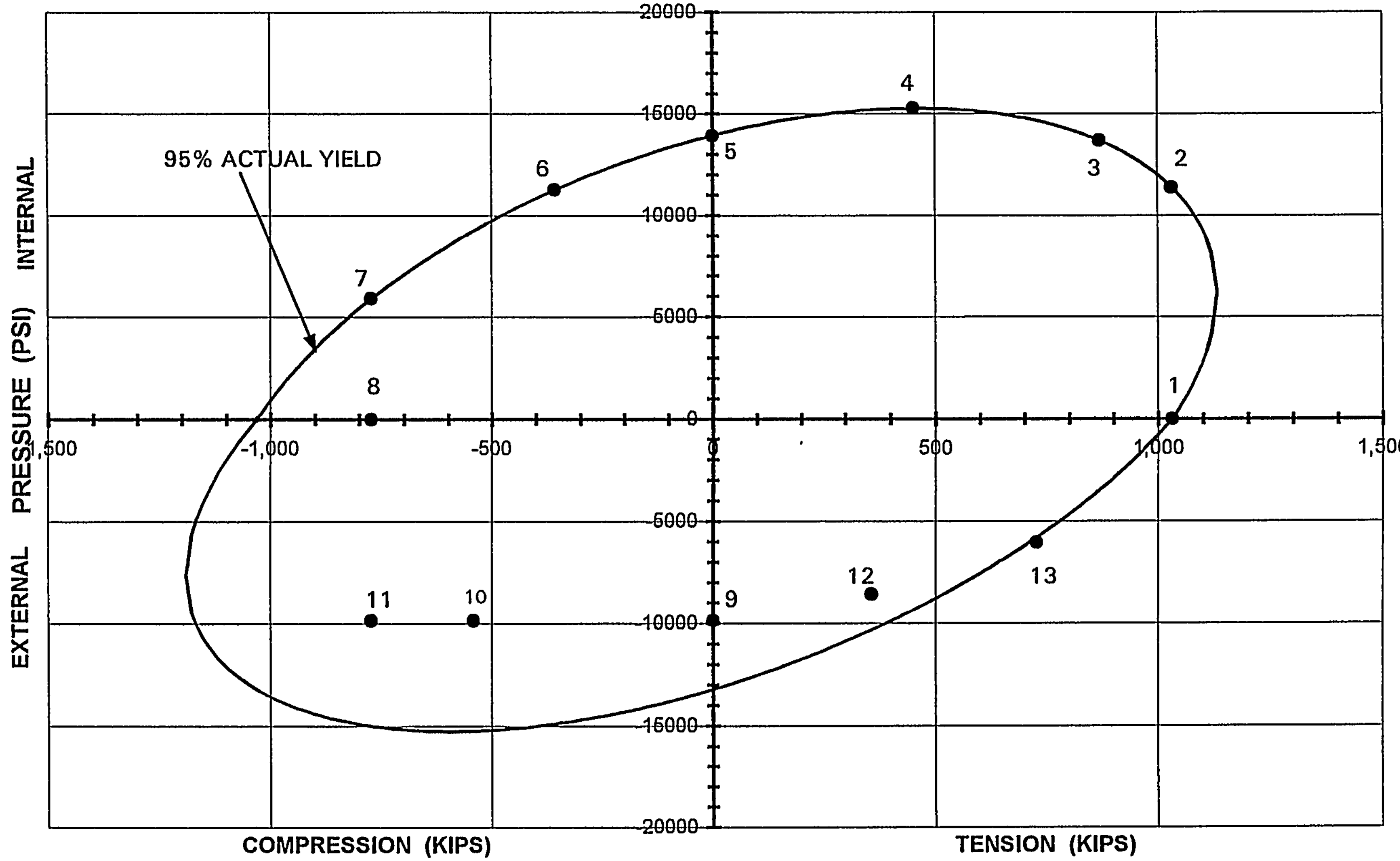
PIPE PROPERTIES:

ACTUAL AVERAGE OD =	7.048	INCH
ACTUAL MINIMUM WALL =	0.426	INCH
CROSS SECTION AREA =	8.862	SQ. IN.
ACTUAL AVERAGE ID =	6.171	INCH
INT. PRESS. END LOAD =	29.909	x Pi, KIPS
PIPE ACTUAL MINIMUM YIELD STRENGTH =	122,500	PSI
PIPE BODY YIELD =	1,086	KIPS

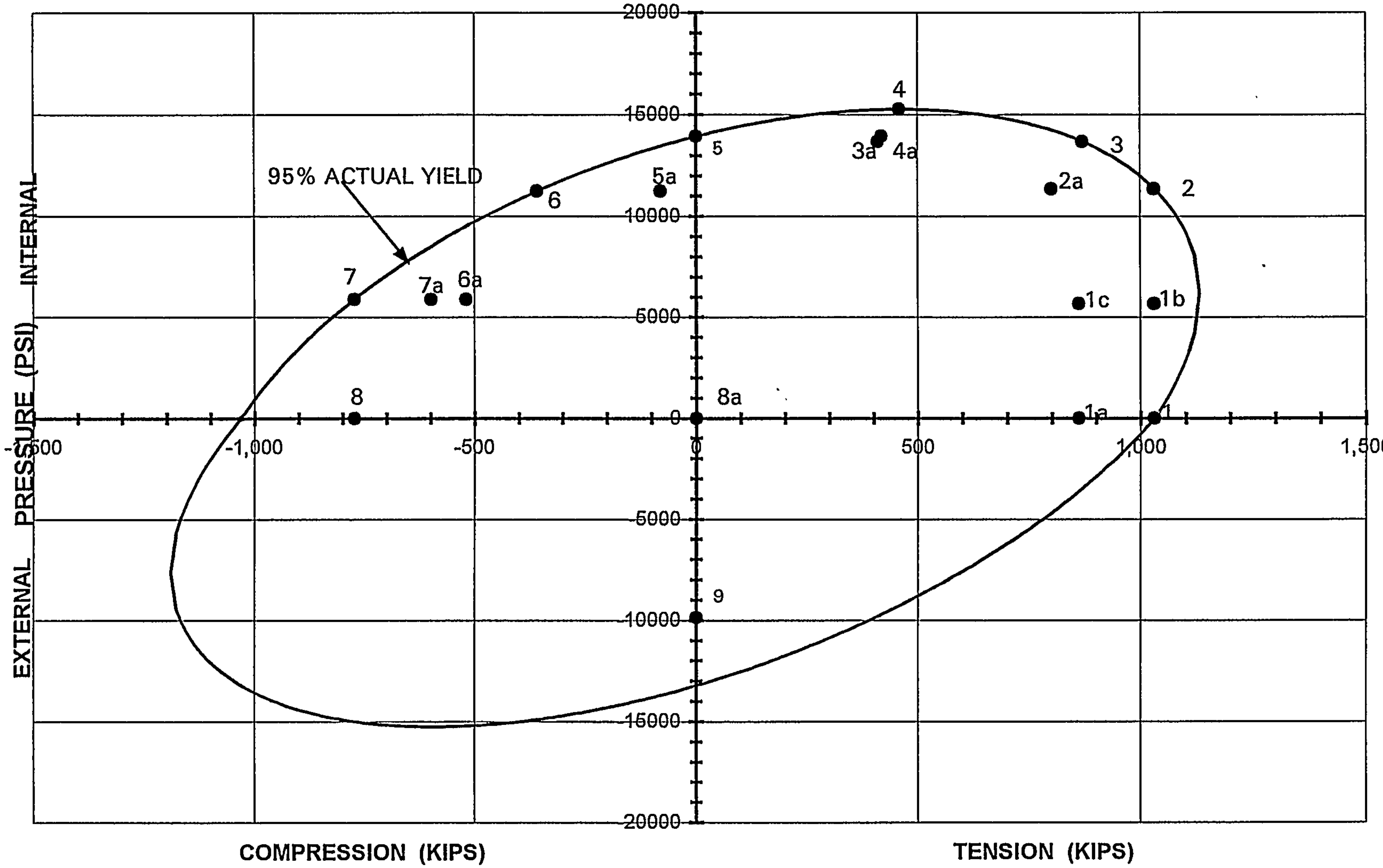
CONNECTION LIMITED IN COMPRESSION TO 75% PIPE BODY YIELD

LOAD POINT	AXIAL LOAD *% YIELD*	AXIAL LOAD *KIPS*	PRESSURE *PSI*
1	95	1,031	0
2	95	1,031	11,367
3	80	869	13,688
4	CEYP		15,263
5	0	0	13,938
6	-33	-358	11,248
7	-71.3	-774	5,888
8	-71.3	-774	0
9	0	0	-9,874
10	-50	-543	-9,874
11	-71.3	-774	-9,874
12	33	358	-8,603
13	67	727	-6,054

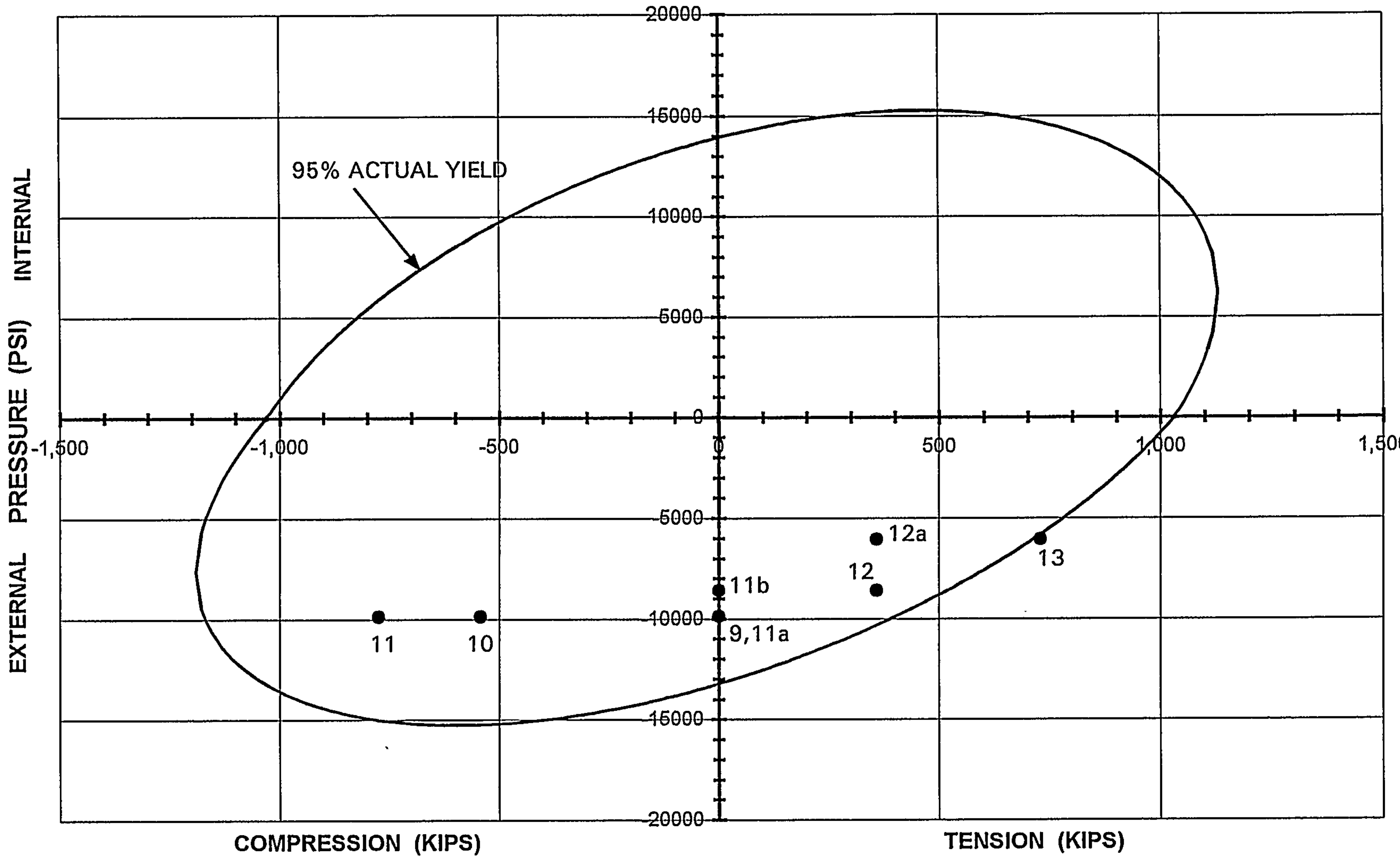
JOHN WATTS 7" PIPE COUPLED CONNECTION
ISO SERIES A TEST LOADS
SAMPLE #1 - FIRST TEST



JOHN WATTS 7" PIPE COUPLED CONNECTION
ISO SERIES A TEST LOADS - SAMPLE 1
LOAD POINTS 1 THRU 9



JOHN WATTS 7" PIPE COUPLED CONNECTION
ISO SERIES A TEST LOADS - SAMPLE 1
LOAD POINTS 9 THRU 13



ISO TEST SERIES A LOAD POINTS
JOHN WATTS 7" PIPE COUPLED CONNECTION
SAMPLE #1
07/19/1999

TESTING IN GUADRANTS I, II, III & IV, NO BENDING

DIRECTION AROUND VME CURVE	LOAD STEP	VME LOAD POINT	AXIAL FORCE *KIPS*	FRAME FORCE *KIPS*	PRESSURE *PSI*	HOLD TIME MIN.
	1	1	1,031	1,031	0	5
	2	1a	861	861	0	-
	3	1b	1,031	861	5,684	-
	4	1c	861	691	5,684	-
	5	2	1,031	691	11,367	60
	6	2a	799	459	11,367	-
	7	3	869	459	13,688	15
	8	3a	409	0	13,688	-
	9	4	457	0	15,263	15
	10	4a	417	0	13,938	-
	11	5	0	-417	13,938	15
	12	5a	-80	-417	11,248	-
	13	6	-358	-695	11,248	15
	14	6a	-519	-695	5,888	-
CCW	15	7	-774	-950	5,888	15
	16	7a	-598	-774	5,888	-
	17	8	-774	-774	0	5
	18	8a	0	0	0	-
	SWITCH FROM INT. TO EXT. PRESSURE & FILL INSIDE WITH WATER					
	19	9	0	0	-9,874	15
	20	10	-543	-543	-9,874	15
	21	11	-774	-774	-9,874	15
	22	11a	0	0	-9,874	-
	23	11b	0	0	-8,603	-
	24	12	358	358	-8,603	15
	25	12a	358	358	-6,054	-
	26	13	727	727	-6,054	15
	27	12a	358	358	-6,054	-
	28	12	358	358	-8,603	15
	29	11b	0	0	-8,603	-
CW	30	11a	0	0	-9,874	-
	31	11	-774	-774	-9,874	15
	32	10	-543	-543	-9,874	15
	33	9	0	0	-9,874	15
	34	9b	0	0	0	-

	A	B	C	D	E	F	G
81	DIRECTION	LOAD	VME	AXIAL	FRAME	PRESSURE	HOLD
82	AROUND	STEP	LOAD	FORCE	FORCE		TIME
83	VME CURVE		POINT	*KIPS*	*KIPS*	*PSI*	MIN.
84		SWITCH FROM EXT. TO INT. PRESSURE & REMOVE INSIDE WATER					
85		35	9c	691	691	0	-
86	CCW	36	2	1,031	691	11,367	15
87		37	2a	799	459	11,367	-
88		38	3	869	459	13,688	15
89		39	3b	459	459	0	-
90		40	8	-774	-774	0	5
91		41	7a	-598	-774	5,888	-
92		42	7	-774	-950	5,888	15
93		43	6a	-519	-695	5,888	-
94		44	6	-358	-695	11,248	15
95		45	5a	-80	-417	11,248	-
96		46	5	0	-417	13,938	15
97		47	4a	417	0	13,938	-
98	CW	48	4	457	0	15,263	15
99		49	3a	409	0	13,688	-
100		50	3	869	459	13,688	15
101		51	2a	799	459	11,367	-
102		52	2	1,031	691	11,367	60
103		53	1c	861	691	5,684	-
104		54	1b	1,031	861	5,684	-
105		55	1a	861	861	0	-
106		56	1	1,031	1,031	0	5
107		57	0	0	0	0	-
108		58	1	1,031	1,031	0	5
109		59	1a	861	861	0	-
110		60	1b	1,031	861	5,684	-
111		61	1c	861	691	5,684	-
112		62	2	1,031	691	11,367	15
113		63	2a	799	459	11,367	-
114		64	3	869	459	13,688	15
115		65	3a	409	0	13,688	-
116		66	4	457	0	15,263	15
117		67	4a	417	0	13,938	-
118	CCW	68	5	0	-417	13,938	15
119		69	5a	-80	-417	11,248	-
120		70	6	-358	-695	11,248	15
121		71	6a	-519	-695	5,888	-
122		72	7	-774	-950	5,888	15
123		73	7a	-598	-774	5,888	-
124		74	8	-774	-774	0	5
125		75	8a	0	0	0	-
126		SWITCH FROM INT. TO EXT. PRESSURE & FILL INSIDE WITH WATER					
127		76	9	0	0	-9,874	15
128		77	10	-543	-543	-9,874	15
129		78	11	-774	-774	-9,874	15
130		79	11a	0	0	-9,874	-
131		80	11b	0	0	-8,603	-
132		81	12	358	358	-8,603	15
133		82	12a	358	358	-6,054	-
134		83	13	727	727	-6,054	15

	A	B	C	D	E	F	G
135	DIRECTION	LOAD	VME	AXIAL	FRAME	PRESSURE	HOLD
136	AROUND	STEP	LOAD	FORCE	FORCE		TIME
137	VME CURVE		POINT	*KIPS*	*KIPS*	*PSI*	MIN.
138	↑	84	13a	727	727	0	-
139		85	13b	0	0	0	-
140		SWITCH FROM EXT. TO INT. PRESSURE & REMOVE INSIDE WATER					
141		86	13c	691	691	0	
142	CCW	87	2	1,031	691	11,367	60
143		88	2a	799	459	11,367	-
144		89	3	869	459	13,688	15
145		90	3d	869	459	0	-
146	↓	91	0	0	0	0	-

Stress Engineering Services, Inc.

VON MISES TRI-AXIAL EQUIVALENT YIELD ELLIPSE
VALUES AT THE INSIDE SURFACE OF A CYLINDER

Date:	07/17/1999
Project Number: PN	5806

116375

Input Information:

Outer Diameter =	7.048	inches		
Inner Diameter =	6.196	inches		
Yield Strength =	122,500	psi		
Ellipse 1 Strength =	116,375	psi,	based on	95% ACTUAL AVG. YIELD
Ellipse 2 Strength =		psi,	based on	
Joint Efficiency =	100.00	%,	based on input diameters	

Ellipse 1 Maximum Loads for Internal Pressure

Tension =	1,129.4	kips
Tension / Compression (Pi = 0) =	1,031.4	kips
Capped-End Yield Pressure =	15,263	psi
Pressure (T/C = 0) =	13,938	psi

Ellipse 1 Maximum Loads for External Pressure

Compression =	-1,190.9	kips
Tension / Compression (Pe = 0) =	-1,031.4	kips
Capped-End Yield Pressure =	-15,263	psi
Pressure (T/C = 0) =	-13,218	psi

Ellipse 1 User Selection of Point on the VME Ellipse

Select : Axial Force =	358.00	kips
Internal Pressure (+ root) =	15,191	psi
Internal Pressure (- root) =	----------	psi
External Pressure (+ root) =	----------	psi
External Pressure (- root) =	-10,312	psi

*API Internal Yield Pressure**

Yield Pressure (87.5%) =	12,957	psi
Yield Pressure (100%) =	14,808	psi

*Burst Pressure**

Burst Pressure =	18,225	psi

*Based on Input Yield Strength

API Collapse Resistance Pressure

For Ellipse 1 Strength of	116,375	psi,	Collapse Pressure =	9,596	psi
For Ellipse 1 Strength and Axial Tension of	358.0	kips,	Collapse Pressure =	8,230	psi
For Input Yield Strength =	116,375	psi,	Collapse Pressure =	9,596	psi

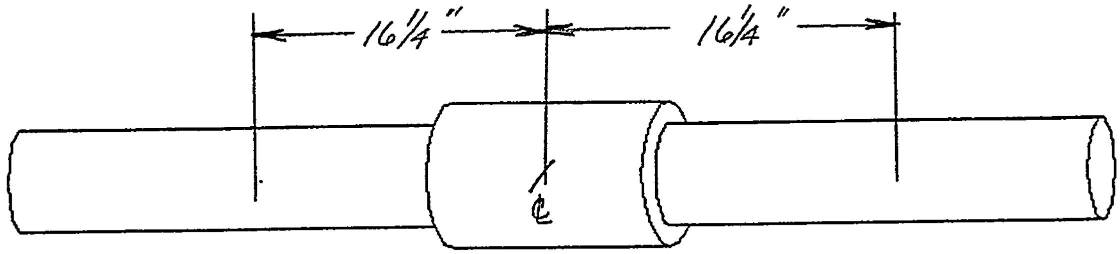
Bending Information, for 10 degrees/100 feet

Radius of Curvature =	573	ft
Bending Moment =	17,735	ft-lbs
Bending Stress =	15,375	psi

Stress Engineering Services

PN 5806
Date 7/91
Inspector GS / NH

Customer JOHN WATTS
Sample # 1
T & C or Flush T+C



Side 1A		Side 1B	
	AREA IS APPROX. 1/8 SQUARE		AREA IS APPROX. 1/8 SQUARE
Wall 0°	.157 .444 EITHER SIDE	**Wall** 0°	.290 .465 EITHER SIDE
90°	.438	90°	.431
180°	.445	180°	.427
MIN. 270°	.426	270°	.431
Avg. Wall	.438 NOT USING .157 .367 USING .157	Avg. Wall	.439 NOT USING .290 .395 USING .290
OD 0°-180°	7.052	**OD** 0°-180°	7.046
90°-270°	7.046	90°-270°	7.046
Avg. OD	7.049 7.048	Avg. OD	7.046
Avg. ID	6.173 NOT USING .157 6.315 USING .157	Avg. ID	6.168 NOT USING .290 6.256 USING .290

(OD - 2x Avg. Wall)

ID = 6.171 MEAS

OD = 6.171 + 2X .426 = 7.023

BAKEOUT
DATA LOG SHEET

Sample 1,3→6

Page ____ of ____

PN 5806	TRANS #	SN	CHAN #	LABEL	
CLIENT JW	TRANS #	SN	CHAN #	LABEL	
BY JF	TRANS #	SN	CHAN #	LABEL	
DATE 7-14-99	TRANS #	SN	CHAN #	LABEL	

STEP	TIME	UNITS SCAN #	Temp °F						
	9:30		99	START	HEATUP				
	10:08		228						
	10:40		294						
	11:24		335						
	11:53		350	BEGIN	24 HR BAKE				
	1:01		368						
	3:03		368						
	3:52		365						
	7:09		362						
	7:42		363						
	9:00		362°F						
	11:51		362°F						
	02:05		361°F						
	10:52		364						
	12:00		362	END 24 HR HOLD					

APPENDIX J

SAMPLE 2 TEST DATA

Client JW	Project No. 5806	Page No. 1 of 1	By WDA	Date 8/12/99
Subject			Checked By	Date

JW SAMPLE #2 - REMACHINED

THREAD CRESTS HAVE BEEN SANDED BY MACHINE SHOP PER JOHN WATTS.

CAPPED END PRESSURE TEST -

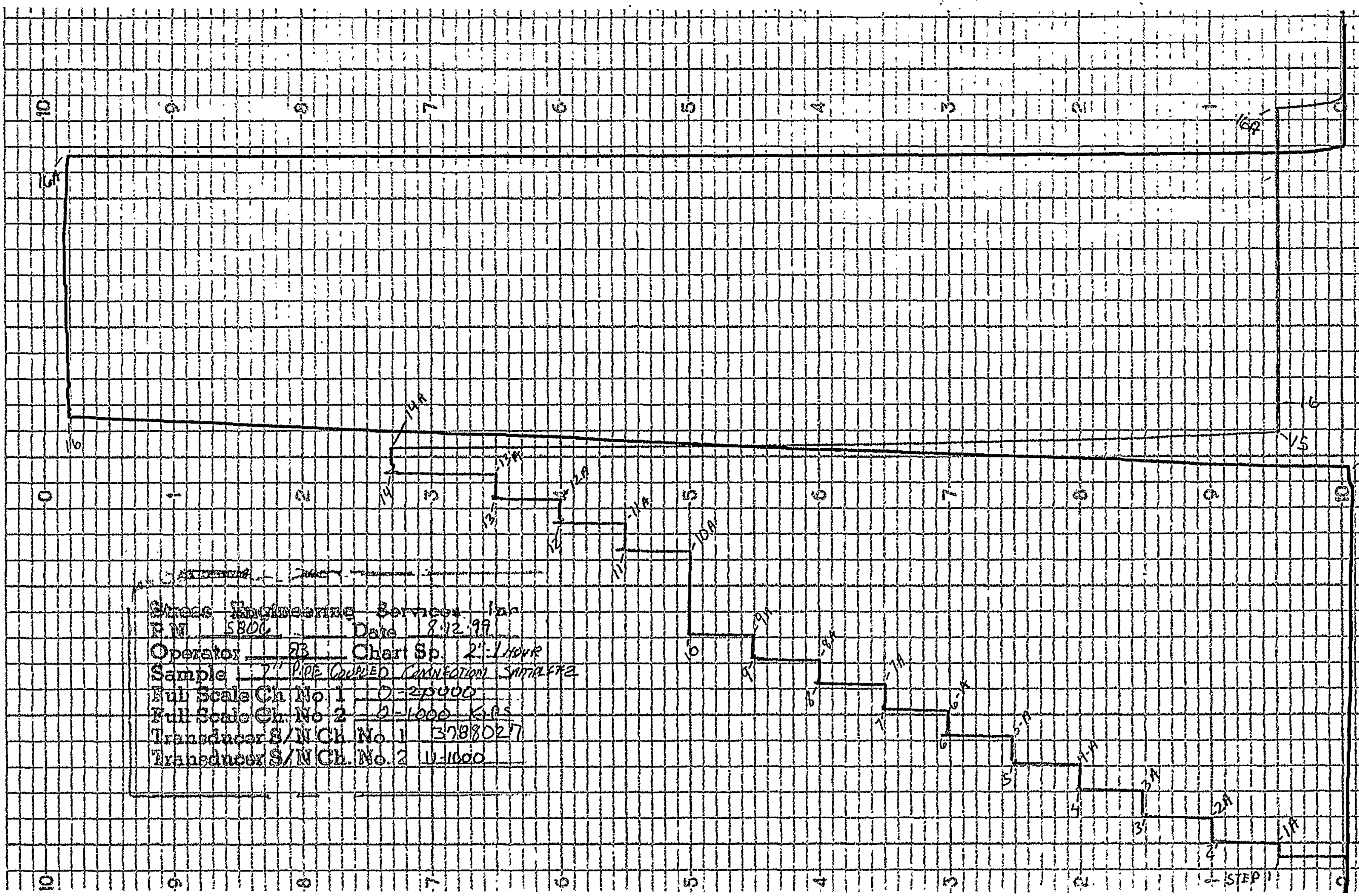
SLOWLY APPLY INTERNAL GAS PRESSURE AS FOLLOWS

	PRESSURE	HOLD
	0	—
	1000	5 MIN. HOLD
	2000	
	3000	
	4000	
	5000	
	6000	
	7000	
	8000	
	9000	
	10,000	
	11,000	
	12,000	
	13,000	
90% CEYP →	14,628	
90% YIELD →	1,000 PLUS 985 KIPS FRAME	60

ISO TEST SERIES B - TEST LOG
JOHN WATTS 7" PIPE COUPLED CONNECTION
SAMPLE # 2
CAPPED END PRESSURE TEST

DATE: 8/12/99 BY: PAGE OF

LOAD STEP	TIME 24 HR.	FRAME KIPS	PRESSURE PSI	BENDING DEG/100'	BUBBLES, CC END A	BUBBLES, CC END B	COMMENTS
1.	13:00		1,000 PSI		—	—	S/H 5 MIN START TEST
1a	13:03		1,010 PSI		—	—	E/H
2	13:07		2,030 PSI		—	—	S/H
2A	13:12		2,020 PSI		—	—	E/H
3	13:13		3,080 PSI		—	—	S/H
3A	13:18		3,070 PSI		—	—	E/H
4	13:19		4,040 PSI		—	—	S/H
4A	13:24		4,030 PSI		—	—	E/H
5	13:26		5,090 PSI		—	—	S/H
5A	13:31		5,070 PSI		—	—	E/H
6	13:32		6,070 PSI		—	—	S/H
6A	13:37		6,050 PSI		—	—	E/H
7	13:38		7,040 PSI		—	—	S/H
7A	13:43		7,010 PSI		—	—	E/H
8	13:44		8,050 PSI		—	—	S/H
8A	13:49		8,020 PSI		—	—	E/H
9	13:50		9,080 PSI		—	—	S/H
9A	13:55		9,050 PSI		—	—	E/H
10	13:56		10,050 PSI		—	—	S/H
10A	14:01		10,040 PSI		—	—	E/H
11	14:16		11,070 PSI		—	—	S/H
11A	14:22		11'040 PSI		—	—	E/H
12	14:23		12,060 PSI		—	—	S/H
12A	14:28		12,050 PSI		—	—	E/H
13	14:29		13,070 PSI		—	—	S/H
13A	14:34		13,040 PSI		—	—	E/H
14	14:36		14,650 PSI		—	—	S/H
14A	14:41		14,650 PSI		—	—	E/H
15	14:44		1,000 PSI		—	—	.
16	15:00	986.5	1,000 PSI		—	—	S/H 60 MIN
16A	16:00	985.5	1,000 PSI		—	—	E/H END TEST


Stress Engineering Services Inc
P.N. 5806 Date 8.12.99
Operator BB Chart Sp. 2" : 1 HOUR
Sample 7" PIPE COUPLED CONNECTION SAMPLE #2
Full Scale Ch. No. 1 0-25000
Full Scale Ch. No. 2 0-1000 KIPS
Transducer S/N Ch. No. 1 3788027
Transducer S/N Ch. No. 2 U-1000
STEP 1
1A
2A
3A
4A
5A
6A
7A
8A
9A
10A
11A
12A
13A
14A
15
16
16A

Stress Engineering Services, Inc.

VON MISES TRI-AXIAL EQUIVALENT YIELD ELLIPSE

VALUES AT THE INSIDE SURFACE OF A CYLINDER

Date: 08/12/1999

Project Number: PN 5806

SAMPLE #2

Input Information:

Outer Diameter =	7.043	inches		
Inner Diameter =	6.181	inches		
Yield Strength =	122,500	psi		
Ellipse 1 Strength =	116,375	psi,	based on	95% ACTUAL AVE YIELD
Ellipse 2 Strength =		psi,	based on	
Joint Efficiency =	100.00	%,	based on input diameters	

Ellipse 1 Maximum Loads for Internal Pressure

Tension =	1,140.2	kips
Tension / Compression (Pi = 0) =	1,041.9	kips
Capped-End Yield Pressure =	15,440	psi
Pressure (T/C = 0) =	14,108	psi

90% = 14,630

Ellipse 1 Maximum Loads for External Pressure

Compression =	-1,203.1	kips
Tension / Compression (Pe = 0) =	-1,041.9	kips
Capped-End Yield Pressure =	-15,440	psi
Pressure (T/C = 0) =	-13,372	psi

Ellipse 1 User Selection of Point on the VME Ellipse

Select : Axial Force =	0.00	kips
Internal Pressure (+ root) =	----------	psi
Internal Pressure (- root) =	----------	psi
External Pressure (+ root) =	----------	psi
External Pressure (- root) =	----------	psi

API Internal Yield Pressure*

Yield Pressure (87.5%) =	13,119	psi
Yield Pressure (100%) =	14,993	psi

Burst Pressure*

Burst Pressure = 18,467 psi

*Based on Input Yield Strength

API Collapse Resistance Pressure

For Ellipse 1 Strength of	116,375	psi,	Collapse Pressure =	9,877	psi
For Ellipse 1 Strength and Axial Tension of	0.0	kips,	Collapse Pressure =	9,877	psi
For Input Yield Strength =	122,500	psi,	Collapse Pressure =	10,172	psi

Bending Information, for 10 degrees/100 feet

Radius of Curvature =	573	ft
Bending Moment =	17,864	ft-lbs
Bending Stress =	15,364	psi

ISO TEST SERIES B - TEST LOG
JOHN WATTS 7" PIPE COUPLED CONNECTION
SAMPLE # 2

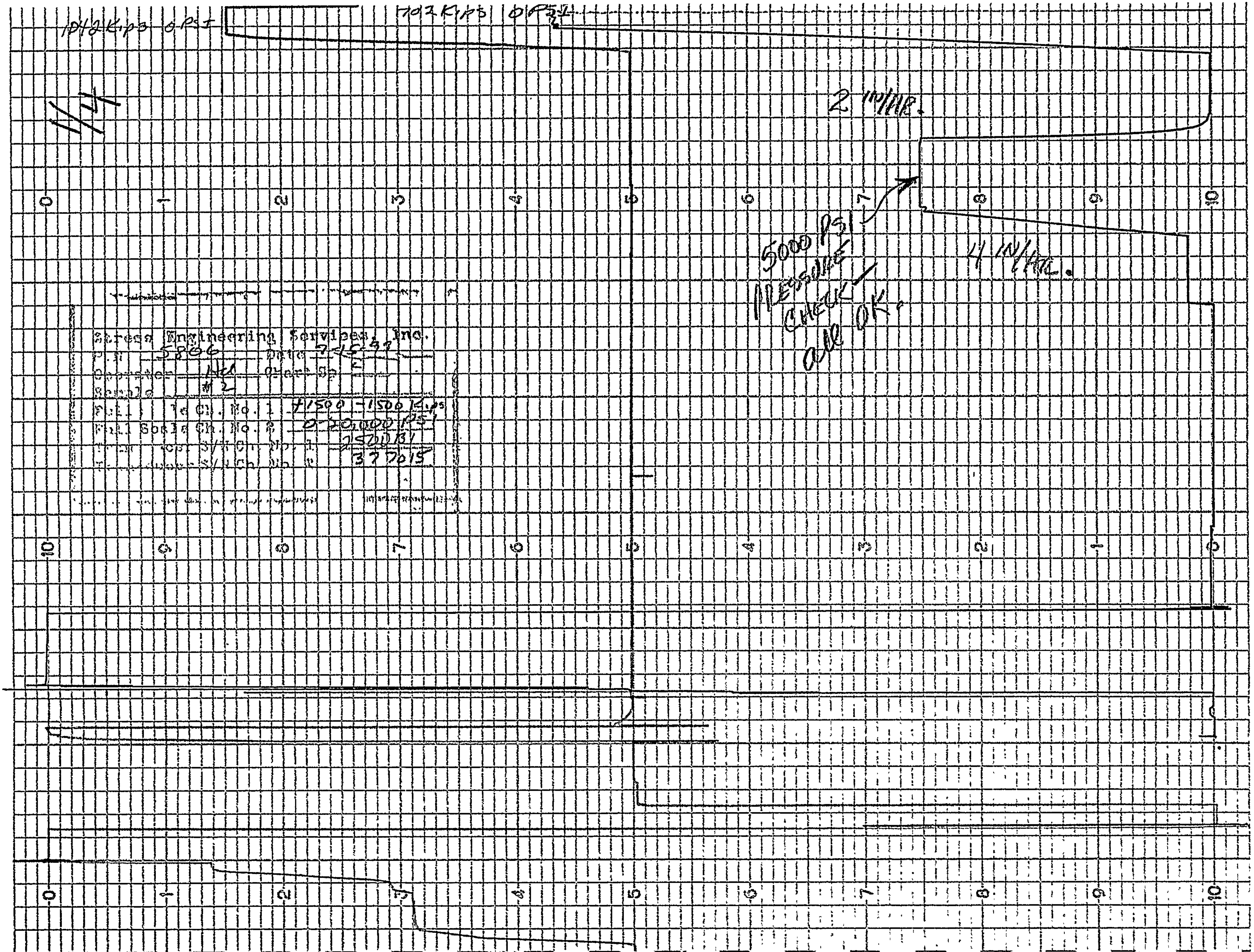
DATE: 7/15/99 BY: HD

LOAD STEP	TIME 24 HR.	FRAME KIPS	PRESSURE PSI	BENDING DEG/100'	BUBBLES, CC END A	BUBBLES, CC END B	COMMENTS
	15:30	0	0	0	0	0	
	15:45	4	5050	.8	0	0	Pressure check
	16:10	4	5050	.8	*	0	1 small Bubble side A during check
	16:12	3	30	.2	0	0	
1	16:20	1042	30	2.5	0	0	5 min Hold
	16:25	1041	30	2.3	0	0	END Hold
1A	16:27	702	30	1.9	0	0	
	16:36	702	11470	4.3	0	0	15 min Hold
	END	Cap Weld	Blew Apart				
							580652A.csv
7-16-99	13:00	0	1050	.2	0	0	2C-0006.PRN
	13:15	0	0	0	0	0	
1	13:29	1042	0	5.0	0	0	5 min
	13:34	1036	0	9.3	0	0	Hold
	13:48	2	0	0.1	0	0	Add Shim @90°
1	13:57	1042	0	1.9	0	0	
	14:02	1033	0	4.4	0	0	
	14:13	3	0	0	0	0	Add 2nd shim @90°
1	14:19	1042	0	2.6	0	0	
	14:24	1033	0	3.3	0	0	
	14:56	0	0	0	0	0	Take 2nd shim out
		647	0	3.3	0	0	
		0	0	.2	0	0	Remove all Shims
2	15:35	702	0	2.4	0	0	
3	15:45	702	11420	8.9	0	0	15 min
	15:50	697	11440	10.4	0	0	Kips To 702
	15:55	699	11420	11.5	0	0	
	16:00	698	11410	11.8	0	0	END Hold
4	16:01	459	11470	12.0	0	0	

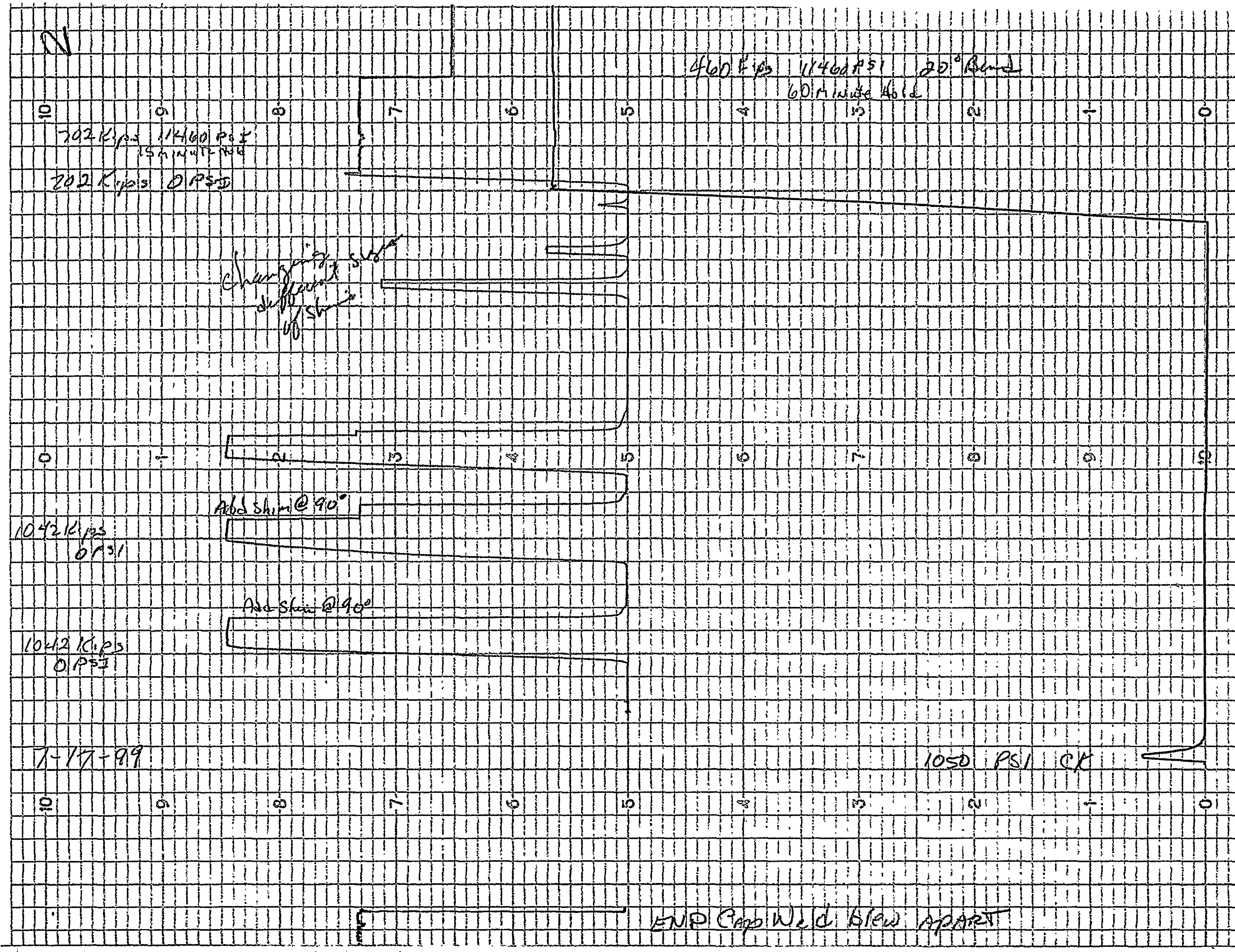
ISO TEST SERIES B - TEST LOG
JOHN WATTS 7" PIPE COUPLED CONNECTION
SAMPLE # 2

DATE: 7-16-99 BY: Hd

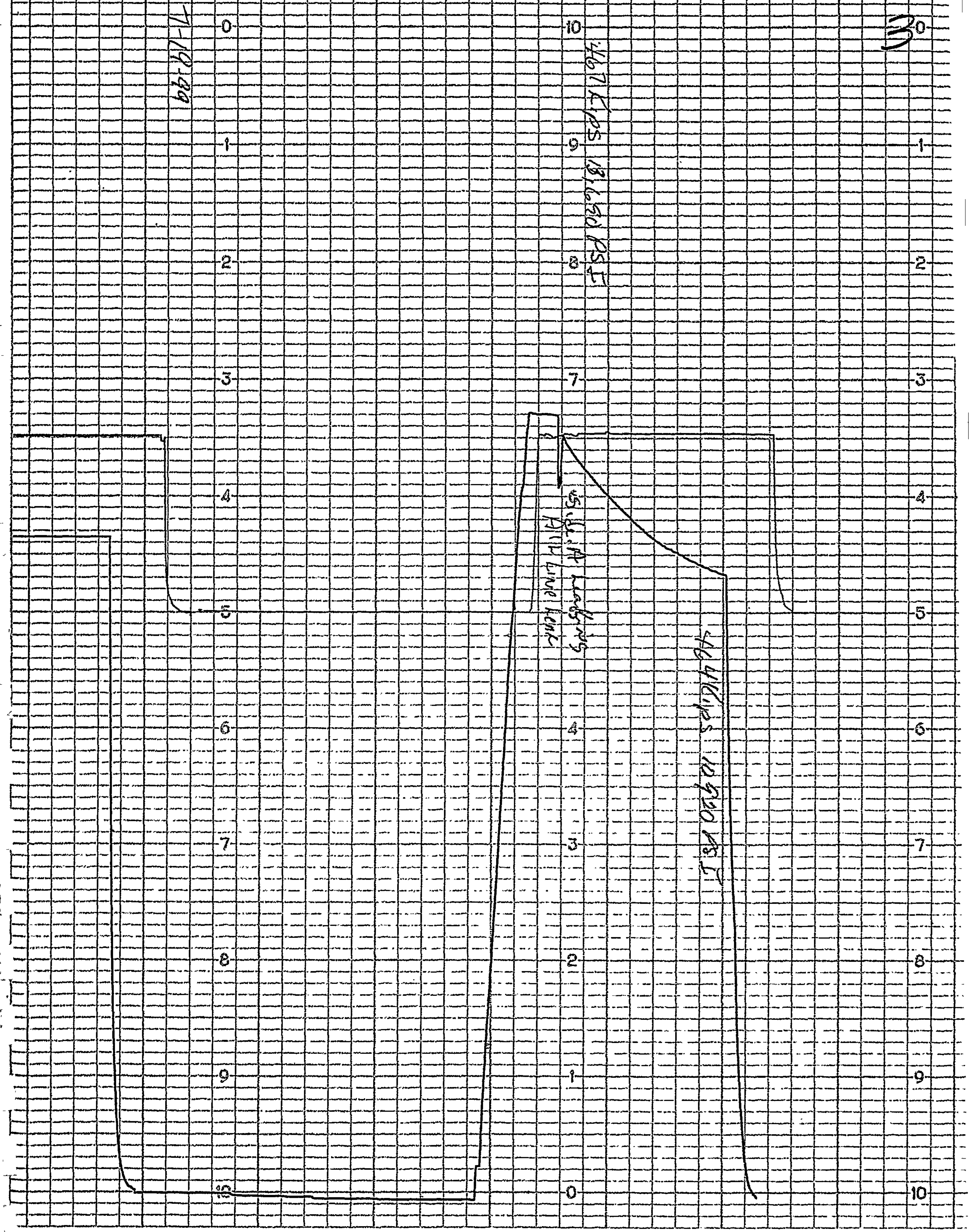
LOAD STEP	TIME 24 HR.	FRAME KIPS	PRESSURE PSI	BENDING DEG/100'	BUBBLES, CC END A	BUBBLES, CC END B	COMMENTS
5	16:05	460	11450	201	0	0	60 MIN
	16:20	459	11480	19.6	0	0	
	16:35	458	11460	20.0	0	0	
	16.50	460	11440	20.1	0	0	
	17:05	459	11430	20.1	0	0	END Hold
6	17:06	444	11430	11.4	0	0	
	17:20	0	0	5.8	0	0	STOP for day
7-19-99	09:04	0	0	0.1	0	0	
7	09:18	468	11480	4.0	0	0	
8	09:22	468	13690	6.7	0	0	15 MIN.
	09:30	465	13260	7.7	Leaking	0	Lock in Pressure
	10:12	464	10920	7.8	✓	0	Reduce PSI +
	10:23	0	0	2.6	—	—	Kips TO Zero
	Made up 4 Shell 72732			+ Baked	12 hr @ 350°F		
7-20-99	15:31	0	0	0	0	0	
1	15:44	1042	0	.7	29	7	During Pumpup 5 min Hold
2	15:53	708	0	.3	29	7	
3	15:55	702	3110	.4	29	leaking	←
2	17:43	707	0	.9	0	0	Bleed off til later
3	17:53	704	11470	.3	0	Start leak	@ 3000 PSI
	17:58	702	11410	.3	0	Yes	
	18:03	701	11500	.4	0	Yes	
	18:08	700	11460	.5	0	Yes	
	18:09	473	11440	.7	0	Yes	
8	18:11	463	13850	.7	0	Yes	
	18:12	467	13800	.7	Yes	Yes	
	18:25	0	0	1.1	—	—	END TEST



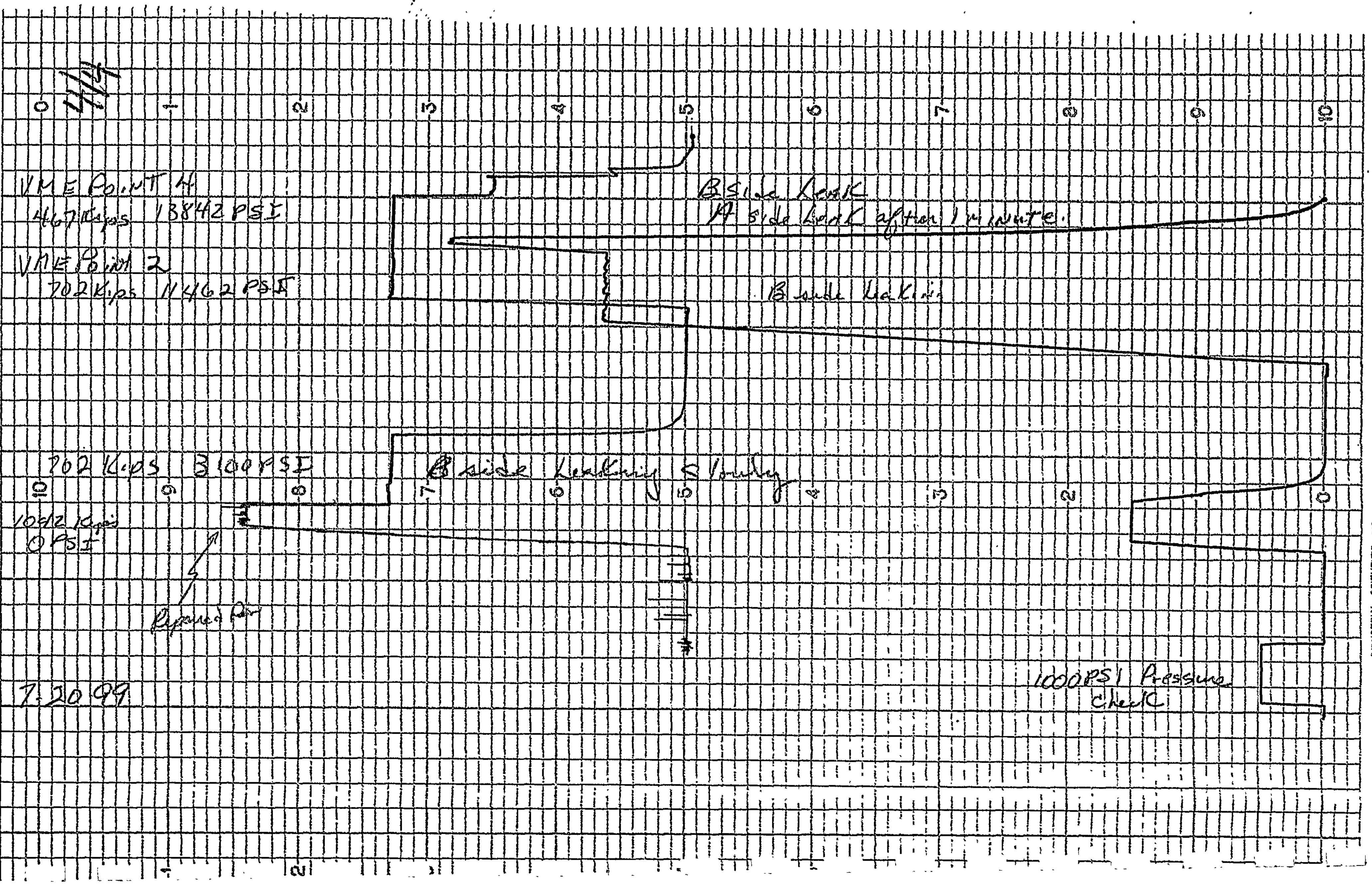
INDUSTRIAL SCIENTIFIC, INC.



2
460 Kips 11460 PSI 20° Bend
60 minute Hold
702 Kips 11460 PSI
15 minute Hold
202 Kips 0 PSI
Changing to different size of Shims
Add Shim @ 90°
1042 Kips
0 PSI
Add Shim @ 90°
1042 Kips
0 PSI
7-17-99
1050 PSI CK
END Cap Weld blew apart
10 9 8 7 6 5 4 3 2 1 0
0 1 2 3 4 5 6 7 8 9 10
PRINTED IN U.S.A.



NO. ECX-100


4/4
VME Point 4
467 Kips 13842 PSI
VME Point 2
702 Kips 11462 PSI
B Side Leak
A side Leak after 1 minute.
B side leaking
702 Kips 3100 PSI
B side Leaking Slowly
1092 Kips
0 PSI
Repaired Pin
7-20-99
1000PSI Pressure
Check
0
1
2
3
4
5
6
7
8
9
10
INDUSTRIAL SCIENTIFIC, INC.

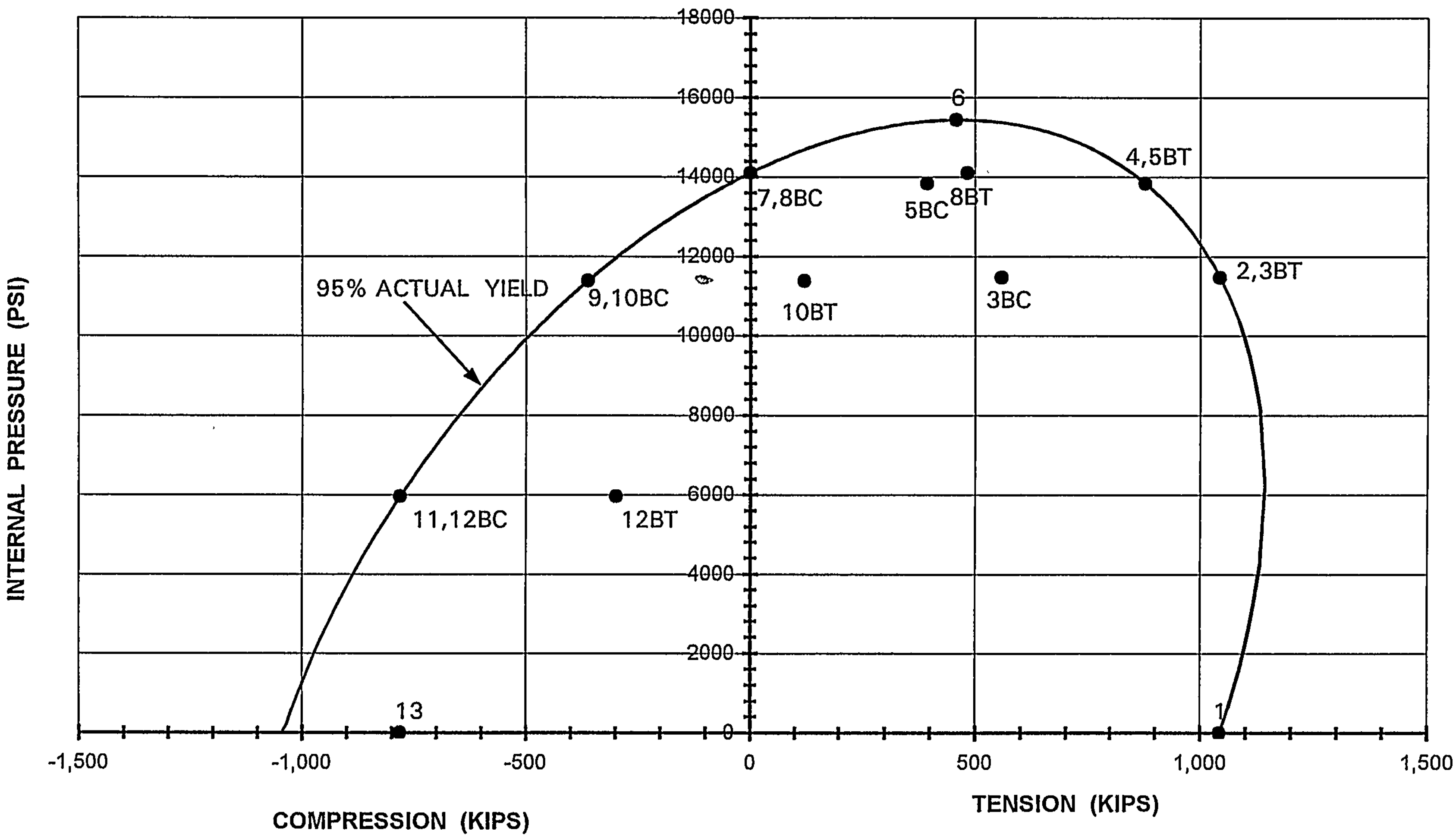
ISO TEST SERIES B LOAD POINTS
JOHN WATTS 7" PIPE COUPLED CONNECTION
SAMPLE #2
7/15/99

PIPE PROPERTIES:	ACTUAL AVERAGE OD =	7.043	INCH
	ACTUAL MINIMUM WALL =	0.431	INCH
	CROSS SECTION AREA =	8.953	SQ. IN.
	ACTUAL AVERAGE ID =	6.145	INCH
	INT. PRESS. END LOAD =	29.658	x Pi, KIPS
	PIPE ACTUAL AVERAGE YIELD STRENGTH =	122,500	PSI
	PIPE BODY YIELD =	1,097	KIPS
	OD STRESS AT 20 DEG/100 FT. =	30,736	PSI
	EQUIVALENT FORCE AT 20 DEG/100 FT. =	275	KIPS
	ID STRESS AT 20 DEG/100 FT. =	26,974	PSI
	EQUIVALENT FORCE AT 20 DEG/100 FT. =	241	KIPS

CONNECTION LIMITED IN COMPRESSION TO 75% PIPE BODY YIELD

LOAD	TOTAL AXIAL LOAD		BENDING	PRESSURE
POINT	*% YIELD*	*KIPS*	*DEG/100 FT.*	*PSI*
1	95	1,042	0	0
2	95	1,042	0	11,462
3-BT	95	1,042	20	11,462
3-BC	-	559	20	11,462
4	80	877	0	13,842
5-BT	80	877	20	13,842
5-BC	-	394	20	13,842
6	CEYP	458	0	15,440
7	0	0	0	14,108
8-BC	0	0	20.0	14,108
8-BT	-	483	20.0	14,108
9	-33	-362	0	11,387
10-BC	-33	-362	20	11,387
10-BT	-	121	20	11,387
11	-71.3	-782	0	5,965
12-BC	-71.3	-782	20	5,965
12-BT	-	-299	20	5,965
13	-71.3	-782	0	0

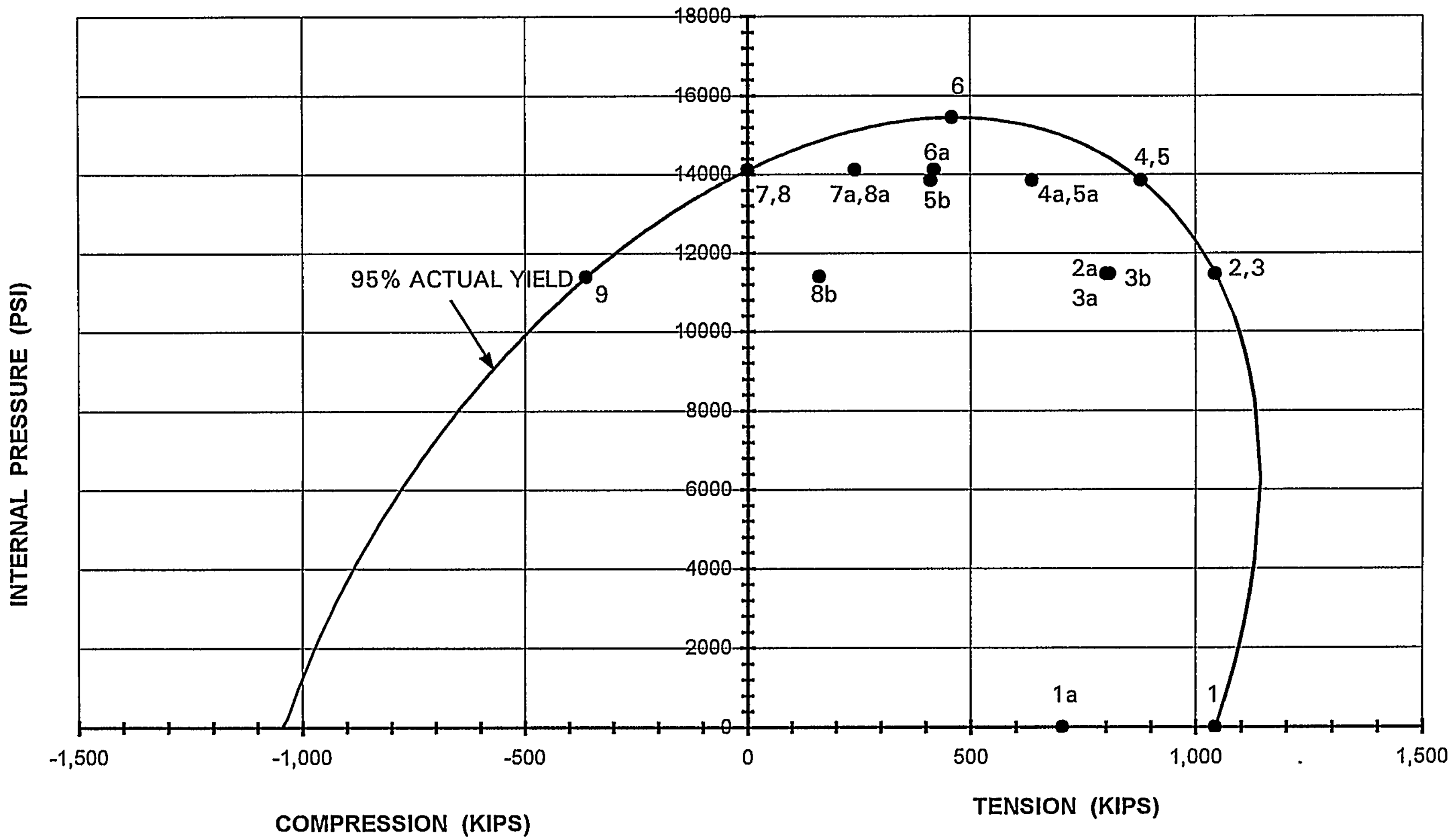
JOHN WATTS 7" PIPE COUPLED CONNECTION
ISO SERIES B TEST LOADS
SAMPLE #2



07/15/1999

SAMPLE 2 VME POINTS 1-13.xls

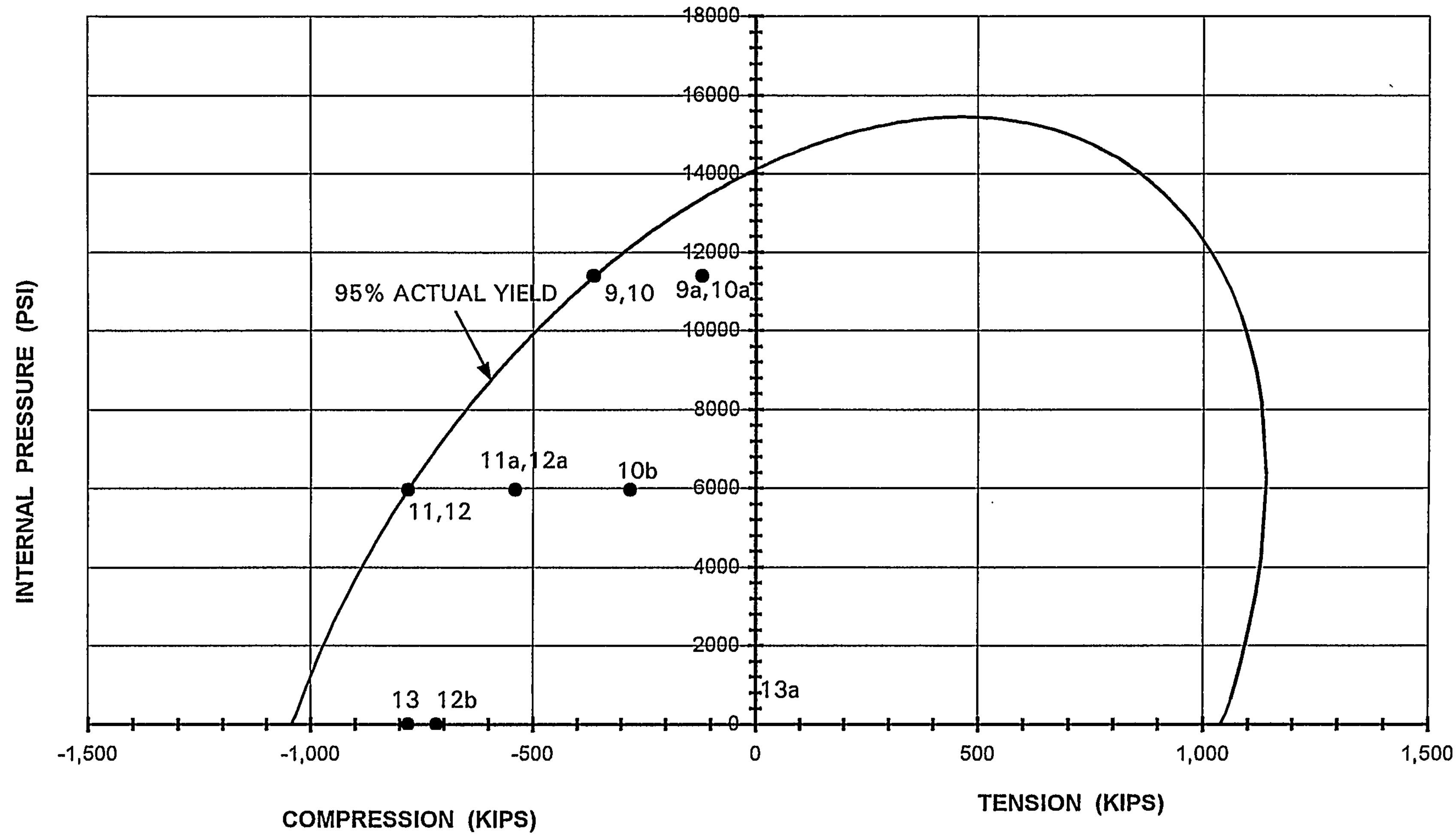
JOHN WATTS 7" PIPE COUPLED CONNECTION
ISO SERIES B TEST LOADS - SAMPLE #2
LOAD POINTS 1 THRU 9



07/15/1999

SERIES B VME POINTS 1-9.xls

JOHN WATTS 7" PIPE COUPLED CONNECTION
ISO SERIES B TEST LOADS - SAMPLE #2
LOAD POINTS 9 THRU 13a



	A	B	C	D	E	F	G	H
42								
43	**ISO TEST SERIES B LOAD POINTS**							
44	**JOHN WATTS 7" PIPE COUPLED CONNECTION**							
45	**SAMPLE #2**							
46	**7/15/99**							
47								
48								
49	TESTING IN GUADRANTS I & II, WITH BENDING							
50								
51-53	DIRECTION AROUND VME CURVE	LOAD STEP	VME LOAD POINT	TOTAL FORCE *KIPS*	FRAME FORCE *KIPS*	BENDING DEG/100 FT.	PRESSURE *PSI*	HOLD TIME MIN.
54		1	1	1,042	1,042	0	0	5
55		2	1a	702	702	0	0	-
56		3	2	1,042	702	0	11,462	15
57		4	2a	800	460	0	11,462	-
58		5	3-BT	1,042	460	20	11,462	60
59		6	3a	800	460	0	11,462	-
60		7	3b	807	467	0	11,462	-
61		8	4	877	467	0	13,842	15
62		9	4a	636	225	0	13,842	-
63		10	5-BT	877	225	20	13,842	15
64		11	5a	636	225	0	13,842	-
65		12	5b	411	0	0	13,842	-
66		13	6	458	0	0	15,440	15
67		14	6a	418	0	0	14,108	-
68	CCW	15	7	0	-418	0	14,108	15
69		16	7a	241	-177	0	14,108	-
70		17	8-BC	0	-177	20.0	14,108	15
71		18	8a	241	-177	0	14,108	-
72		19	8b	161	-177	0	11,387	
73		20	9	-362	-700	0	11,387	15
74		21	9a	-120	-458	0	11,387	-
75		22	10-C	-362	-458	20	11,387	15
76		23	10a	-120	-458	0	11,387	-
77		24	10b	-281	-458	0	5,965	-
78		25	11	-782	-959	0	5,965	15
79		26	11a	-541	-717	0	5,965	-
80		27	12-C	-782	-717	20	5,965	15
81		28	12a	-541	-717	0	5,965	-
82		29	12b	-717	-717	0	0	-
83		30	13	-782	-782	0	0	5
84		31	13a	0	0	0	0	-
85		32	1a	702	702	0	0	-
86		33	2	1,042	702	0	11,462	15
87		34	2a	800	460	0	11,462	-
88		35	3-BT	1,042	460	20	11,462	60
89		36	3a	800	460	0	11,462	-
90		37	3aa	460	0	0	11,462	-
91		38	13a	0	0	0	0	-

	A	B	C	D	E	F	G	H
92 93 94	DIRECTION AROUND VME CURVE	LOAD STEP	VME LOAD POINT	TOTAL FORCE *KIPS*	FRAME FORCE *KIPS*	BENDING DEG/100 FT.	PRESSURE *PSI*	HOLD TIME MIN.
95		39	13	-782	-782	0	0	0
96		40	12b	-717	-717	0	0	-
97		41	12a	-541	-717	0	5,965	-
98		42	12-C	-782	-717	20	5,965	15
99		43	11a	-541	-717	0	5,965	-
100		44	11	-782	-959	0	5,965	15
101		45	10b	-281	-458	0	5,965	-
102		46	10a	-120	-458	0	11,387	-
103		47	10-C	-362	-458	20	11,387	15
104		48	9a	-120	-458	0	11,387	-
105		49	9	-362	-700	0	11,387	15
106		50	8b	161	-177	0	11,387	
107		51	8a	241	-177	0	14,108	-
108		52	8-BC	0	-177	20.0	14,108	15
109		53	7a	241	-177	0	14,108	-
110	CW	54	7	0	-418	0	14,108	15
111		55	6a	418	0	0	14,108	-
112		56	6	458	0	0	15,440	15
113		57	5b	411	0	0	13,842	-
114		58	5a	636	225	0	13,842	-
115		59	5-BT	877	225	20	13,842	15
116		60	4a	636	225	0	13,842	-
117		61	4	877	467	0	13,842	15
118		62	3b	807	467	0	11,462	-
119		63	3a	800	460	0	11,462	-
120		64	3-BT	1,042	460	20	11,462	15
121		65	2a	800	460	0	11,462	-
122		66	2	1,042	702	0	11,462	15
123		67	1a	702	702	0	0	-
124		68	1	1,042	1,042	0	0	5
125		69	13a	1,042	1,042	0	0	-

	A	B	C	D	E	F	G	H
126	DIRECTION	LOAD	VME	TOTAL	FRAME	BENDING	PRESSURE	HOLD
127	AROUND	STEP	LOAD	FORCE	FORCE			TIME
128	VME CURVE		POINT	*KIPS*	*KIPS*	DEG/100 FT.	*PSI*	MIN.
129		70	1	1,042	1,042	0	0	5
130		71	1a	702	702	0	0	-
131		72	2	1,042	702	0	11,462	15
132		73	2a	800	460	0	11,462	-
133		74	3-BT	1,042	460	20	11,462	15
134		75	3a	800	460	0	11,462	-
135		76	3b	807	467	0	11,462	-
136		77	4	877	467	0	13,842	15
137		78	4a	636	225	0	13,842	-
138		79	5-BT	877	225	20	13,842	15
139		80	5a	636	225	0	13,842	-
140		81	5b	411	0	0	13,842	-
141		82	6	458	0	0	15,440	15
142		83	6a	418	0	0	14,108	-
143	CCW	84	7	0	-418	0	14,108	15
144		85	7a	241	-177	0	14,108	-
145		86	8-BC	0	-177	20.0	14,108	15
146		87	8a	241	-177	0	14,108	-
147		88	8b	161	-177	0	11,387	-
148		89	9	-362	-700	0	11,387	15
149		90	9a	-120	-458	0	11,387	-
150		91	10-C	-362	-458	20	11,387	15
151		92	10a	-120	-458	0	11,387	-
152		93	10b	-281	-458	0	5,965	-
153		94	11	-782	-959	0	5,965	15
154		95	11a	-541	-717	0	5,965	-
155		96	12-C	-782	-717	20	5,965	15
156		97	12a	-541	-717	0	5,965	-
157		98	12b	-717	-717	0	0	-
158		99	13	-782	-782	0	0	5
159		100	13a	0	0	0	0	-
160		101	1a	702	702	0	0	-
161		102	2	1,042	702	0	11,462	15
162		103	2a	800	460	0	11,462	-
163		104	3-BT	1,042	460	20	11,462	60
164		105	3a	800	460	0	11,462	-
165		106	3aa	460	0	0	11,462	-
166		107	13a	0	0	0	0	-

Stress Engineering Services, Inc.

VON MISES TRI-AXIAL EQUIVALENT YIELD ELLIPSE
VALUES AT THE INSIDE SURFACE OF A CYLINDER

Date: 07/14/1999

Project Number: PN 5806

SAMPLE #2

Input Information:

Outer Diameter =	7.043	inches	
Inner Diameter =	6.181	inches	
Yield Strength =	122,500	psi	
Ellipse 1 Strength =	116,375	psi, based on	95% ACTUAL AVE YIELD
Ellipse 2 Strength =		psi, based on	
Joint Efficiency =	100.00	% , based on input diameters	

Ellipse 1 Maximum Loads for Internal Pressure

Tension =	1,140.2	kips
Tension / Compression (Pi = 0) =	1,041.9	kips
Capped-End Yield Pressure =	15,440	psi
Pressure (T/C = 0) =	14,108	psi

Ellipse 1 Maximum Loads for External Pressure

Compression =	-1,203.1	kips
Tension / Compression (Pe = 0) =	-1,041.9	kips
Capped-End Yield Pressure =	-15,440	psi
Pressure (T/C = 0) =	-13,372	psi

Ellipse 1 User Selection of Point on the VME Ellipse

Select : Axial Force =	-782.00	kips
Internal Pressure (+ root) =	5,965	psi
Internal Pressure (- root) =	----------	psi
External Pressure (+ root) =	----------	psi
External Pressure (- root) =	-15,180	psi

*API Internal Yield Pressure**

Yield Pressure (87.5%) =	13,119	psi
Yield Pressure (100%) =	14,993	psi

*Burst Pressure**

Burst Pressure =	18,467	psi

*Based on Input Yield Strength

API Collapse Resistance Pressure

For Ellipse 1 Strength of	116,375	psi,	Collapse Pressure =	9,877 psi
For Ellipse 1 Strength and Axial Tension of	0.0	kips,	Collapse Pressure =	9,877 psi
For Input Yield Strength =	122,500	psi,	Collapse Pressure =	10,172 psi

Bending Information, for 10 degrees/100 feet

Radius of Curvature =	573	ft
Bending Moment =	17,864	ft-lbs
Bending Stress =	15,364	psi

BAKEOUT

DATA LOG SHEET

Bake 12 Hr. @ 350°

Sample Assy #2 Page ____ of ____

PN 5802	TRANS #	SN	CHAN #	LABEL
CLIENT John Watts	TRANS #	SN	CHAN #	LABEL
BY NH / LEW	TRANS #	SN	CHAN #	LABEL
DATE 7-13-99	TRANS #	SN	CHAN #	LABEL

STEP	TIME	UNITS SCAN #	90° B	270° B	90° A	270° A			
	18:30		81°	81°	76°	79°			
	18:47		180°	186°	169°	173°			
	19:45		300	336	308	372	start 12	Hr. Bake	7:45pm
	24:30		344	346	346	366			
7-14-99	04:47		348	348	349	365			
	06:40		349	351	351	367			
	09:00		343	345	344	361	End Bake	OFF	

Chart speed on alarm   off

DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

Channel No.:   21 22 23 24
Color: __ __ __ __

DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

21: 90x B	0 ... 500 xF	23: 90x A	0 ... 500 xF
22: 270x B	0 ... 500 xF	24: 270x A	0 ... 500 xF

10:18:18 09/30/90 CHART _ ON _ OFF

Linseis LS836 V4.B2 10/1/92 Parameter Print   10:19:09 09/30/90

DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

Data recording with
scanner box
LS836 V4.B2 10/1/92

DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

Channel No.:   1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
Color: __

DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

Channel No. Name	Input Type	Input Margins Left	Input	User Margins	Alarm Margins High	User/Alarm Unit
90x B	Type J	0.0			500.0	xF
270x B	Type J	0.0			500.0	xF
90x A	Type J	0.0			500.0	xF
270x A	Type J	0.0			500.0	xF

JW 9578"
SAMPLE #2
BAKE
360°F FOR
12 HOURS
7/13-14/99

Channel No.	Alarm State	Alarm Relay Low	High	Cold State	...cording ...me	Print	Disc	Interval	Scale
21	off			interi		on	on	0 00:00:01	on
22	off			interi		on	on	0 00:00:01	on
23	off			interi		on	on	0 00:00:01	on
24	off			inter		on	on	0 00:00:01	on

Chart Parameters:

Chart speed   2 inch/hour
Chart speed on alarm   off

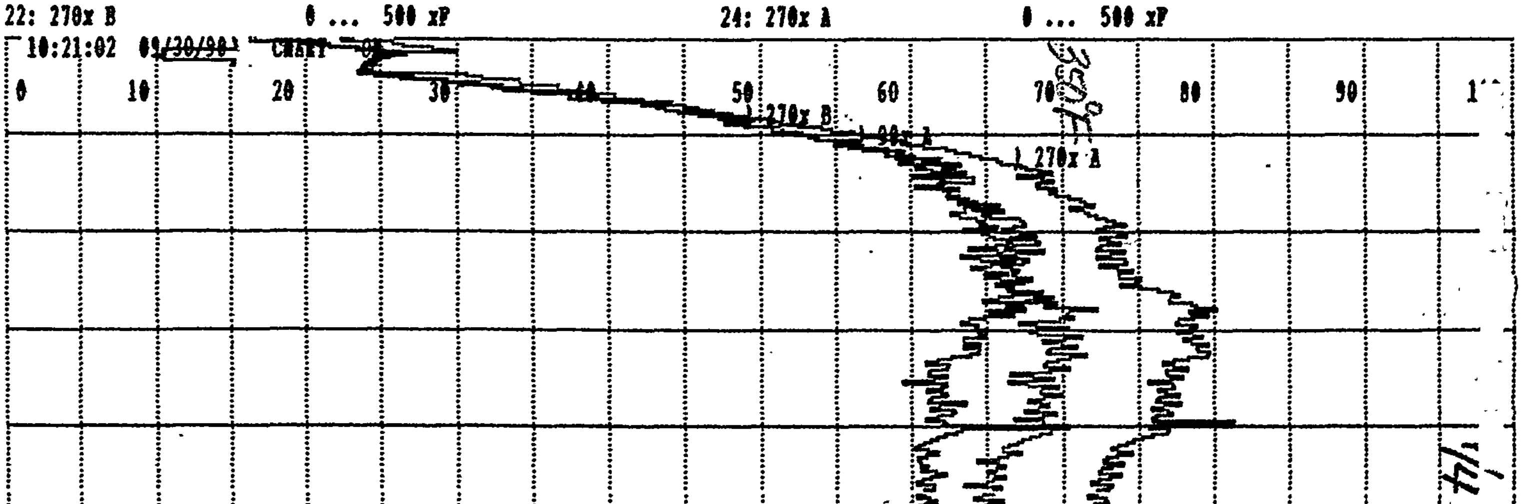
DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

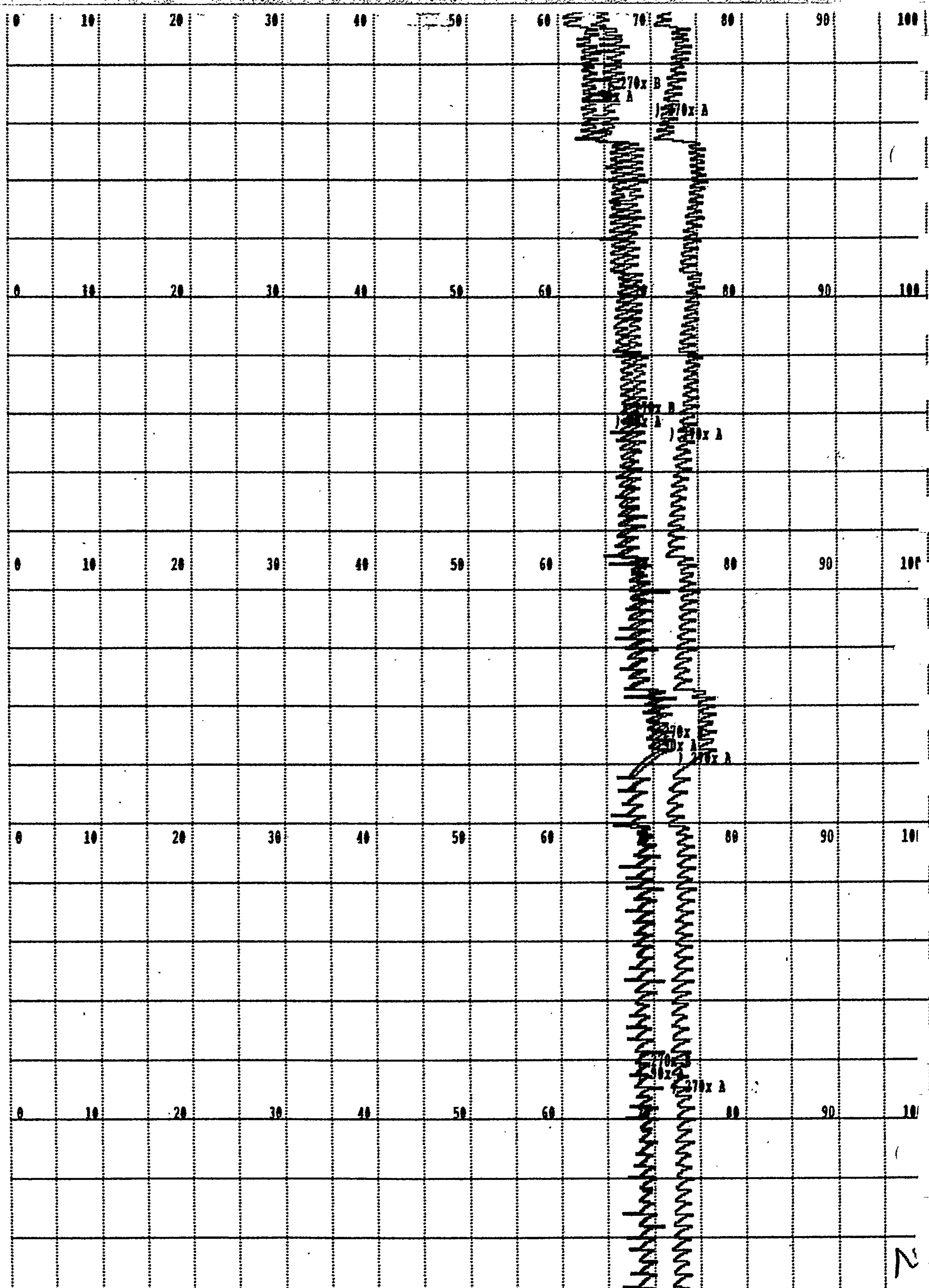
DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

Channel No.:   21 22 23 24
Color: __ __ __ __

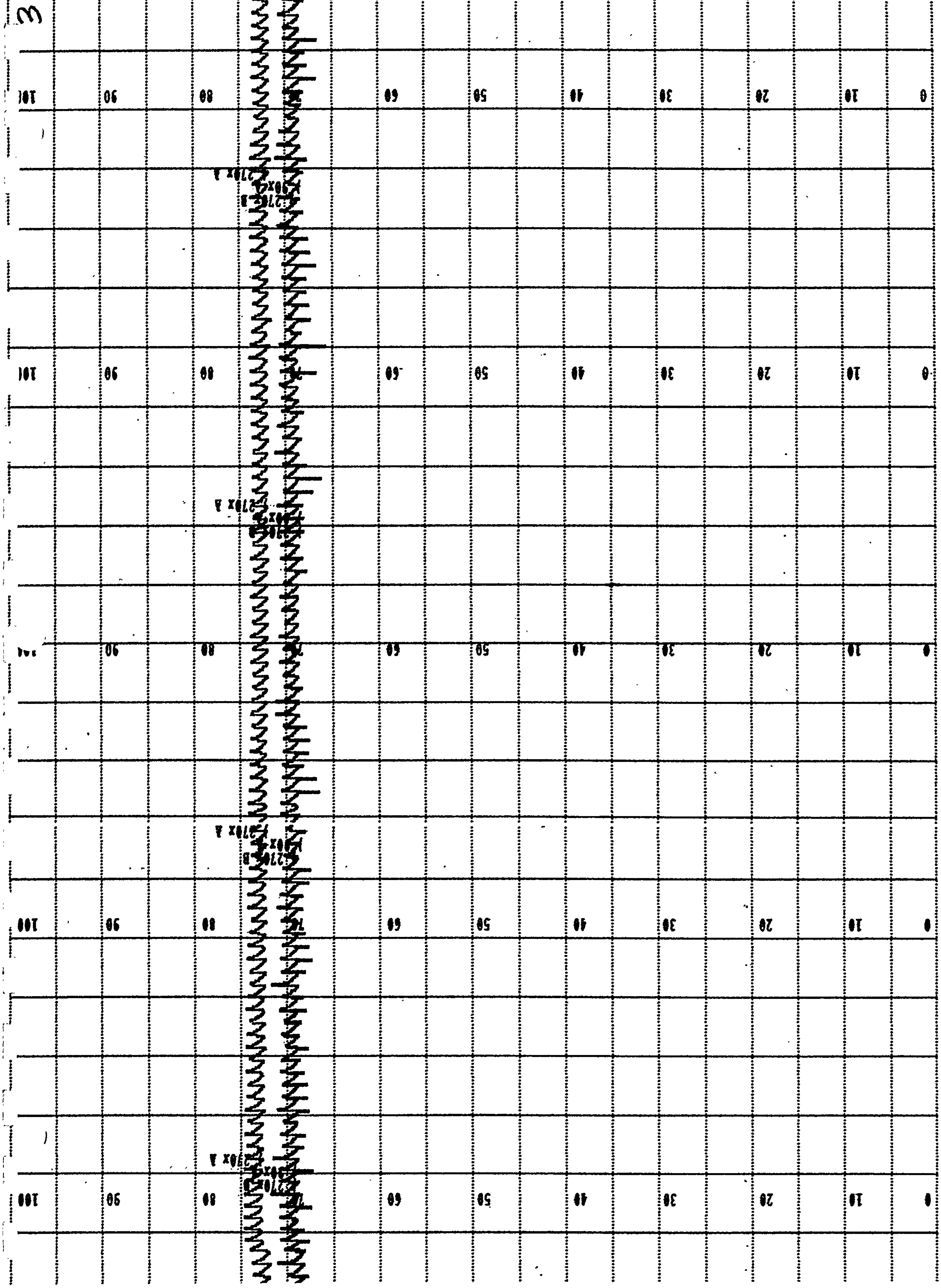
DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

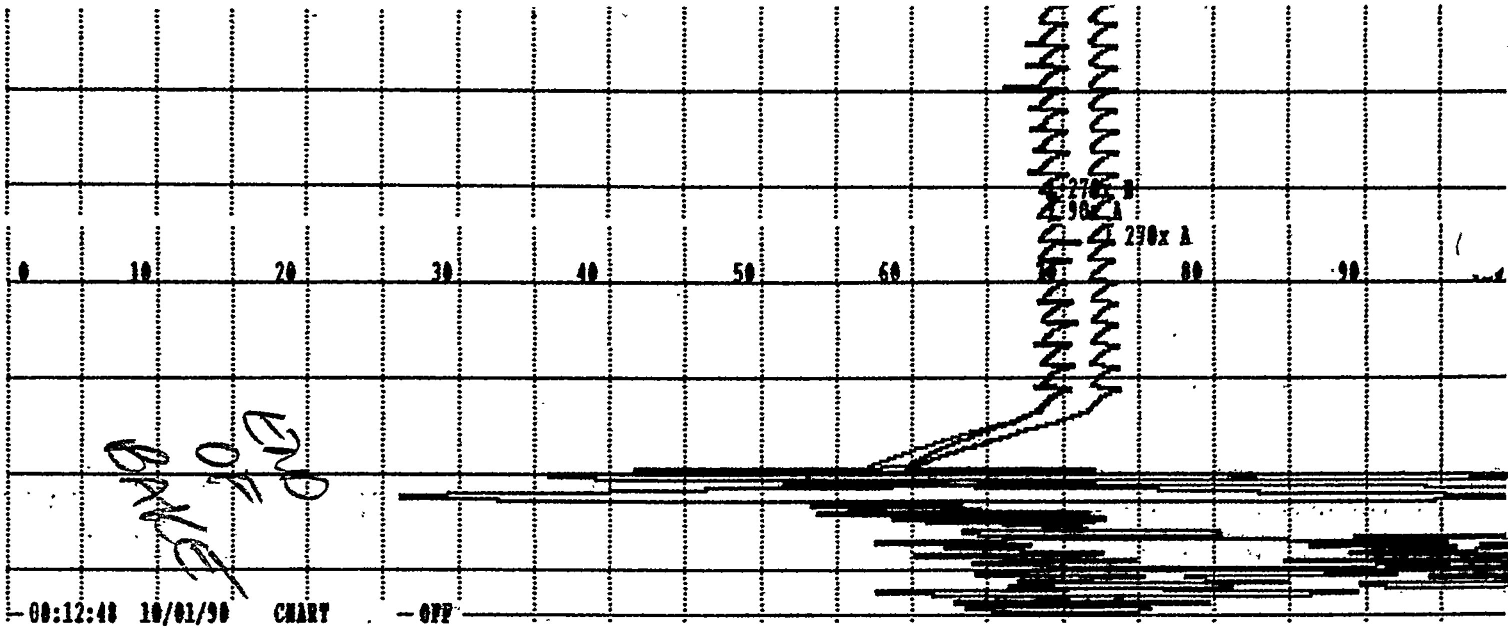
21: 90x B	0 ... 500 xF	23: 90x A	0 ... 500 xF
22: 270x B	0 ... 500 xF	24: 270x A	0 ... 500 xF





3





0
10
20
30
40
50
60
80
90
230x A
-00:12:48 10/01/90 CHART -OFF
END OF BAKE

4/4

60/400

DATA LOG SHEET

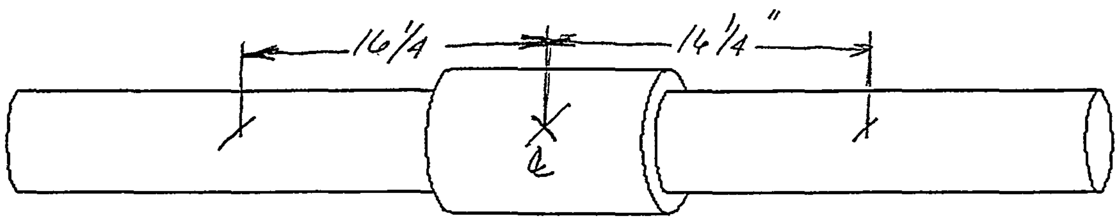
Sample #2 4/Shell 72732 | Page 1 of 1

N 5806 TRANS # ___ SN ___ CHAN # ___ LABEL ___
CLIENT John Watts TRANS # ___ SN ___ CHAN # ___ LABEL ___
BY Hd TRANS # ___ SN ___ CHAN # ___ LABEL ___
DATE 7-19-99 TRANS # ___ SN ___ CHAN # ___ LABEL ___

STEP	TIME	UNITS SCAN #	°F A	°F B					
	19:10		85	85			Start Heat		
	19:22		271	313					
	19:30		372	338			Start Bake		
	19:45		308	356					
	06:55		355	357					
	07:30		350	351					
	07:47		350	351					

Stress Engineering Services

PN 5806 | Customer JOHN WATTS
Date 7/9/99 | Sample # 2
Inspector GS & NH | T & C or Flush T&C



Side 2A | Side 2B

		AREA IS APPROX. 1/8 SQUARE .446 ON EITHER SIDE			AREA IS APPROX. 1/8 SQUARE .446 ON EITHER SIDE
Wall	0°	.150	**Wall**	0°	.257
	90°	.465		90°	.444
	180°	.454		MIN. 180°	.431
	270°	.448		270°	.460
	Avg. Wall	.453 NOT USING .150 DIM. .379 USING .150		Avg. Wall	.445 NOT USING .257 .398 USING .257
OD	0°-180°	7.0430	**OD**	0°-180°	7.0425
	90°-270°	7.0455		90°-270°	7.0400
	Avg. OD	7.044	7.043 AVG.	Avg. OD	7.041
	Avg. ID	6.138 NOT USING .150 6.286 USING .150		Avg. ID	6.151 NOT USING .257 6.245 USING .257

(OD - 2x Avg. Wall)

6.145 AVG. ID

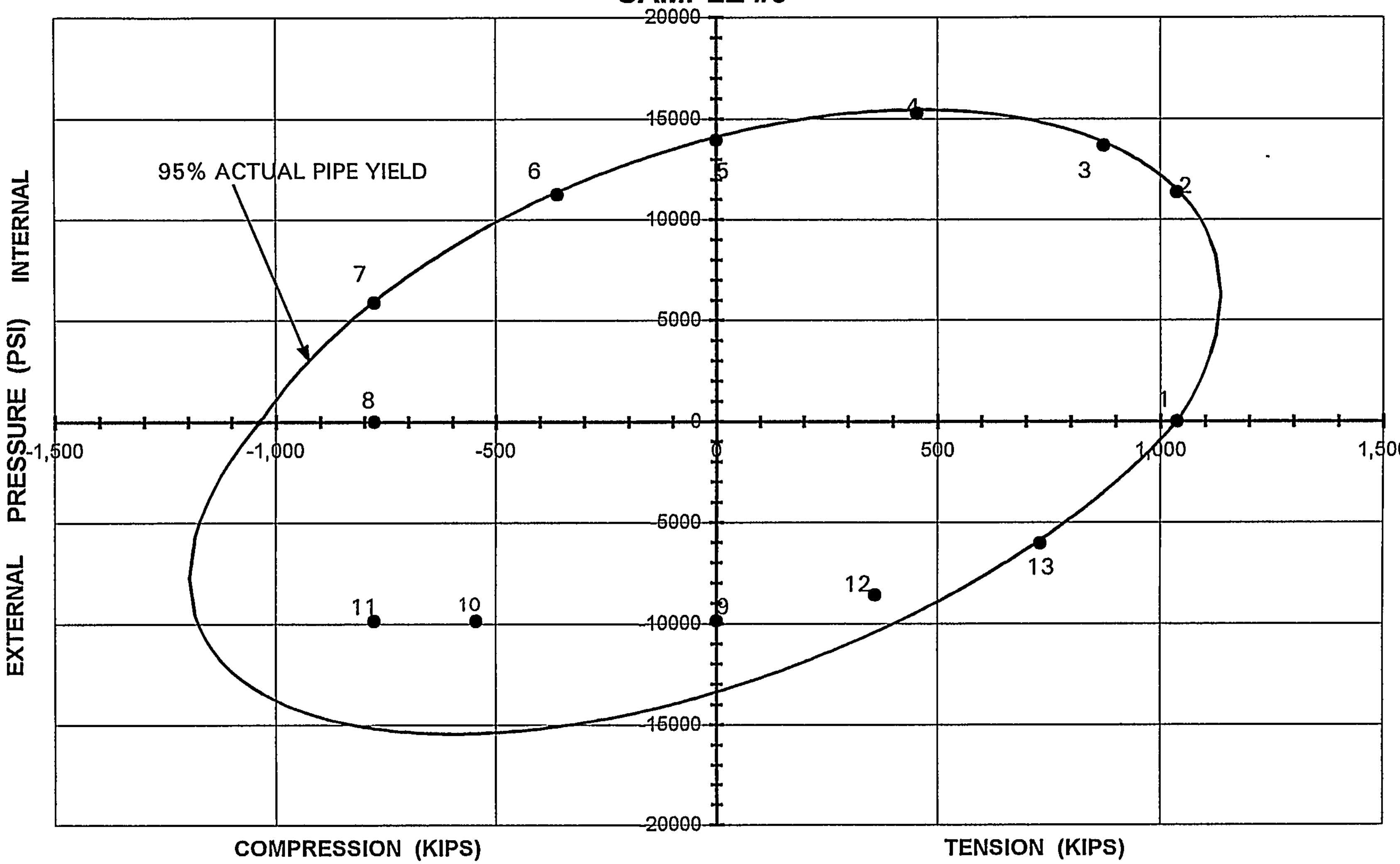
OD = 6.145 + 2X .431 = 7.007

APPENDIX K

SAMPLE 3 TEST DATA

	A	B	C	D	E	F	G
1	**ISO TEST SERIES A LOAD POINTS**						
2	**JOHN WATTS 7" COUPLED CONNECTION**						
3	**SAMPLE #3**						
4	**7/27/99**						
5							
6							
7	PIPE PROPERTIES:			ACTUAL AVERAGE OD =	7.024	INCH	
8				ACTUAL MINIMUM WALL =	0.430	INCH	
9				CROSS SECTION AREA =	8.908	SQ. IN.	
10				ACTUAL AVERAGE ID =	6.164	INCH	
11				INT. PRESS. END LOAD =	29.841	x Pi, KIPS	
12		PIPE ACTUAL MINIMUM YIELD STRENGTH =			122,500	PSI	
13				PIPE BODY YIELD =	1,091	KIPS	
14							
15	CONNECTION LIMITED IN COMPRESSION TO 75% PIPE BODY YIELD						
16							
17							
18		**LOAD**	**AXIAL LOAD**		**PRESSURE**		
19		**POINT**	***% YIELD***	***KIPS***	***PSI***		
20		1	95	1,037	0		
21		2	95	1,037	11,367		
22		3	80	873	13,688		
23		4	CEYP		15,263		
24		5	0	0	13,938		
25		6	-33	-360	11,248		
26		7	-71.3	-778	5,888		
27		8	-71.3	-778	0		
28		9	0	0	-9,874		
29		10	-50	-546	-9,874		
30		11	-71.3	-778	-9,874		
31		12	33	360	-8,603		
32		13	67	731	-6,054		
33							

JOHN WATTS 7" PIPE COUPLED CONNECTION
ISO SERIES A TEST LOADS
SAMPLE #3



ISO TEST SERIES A LOAD POINTS
JOHN WATTS 7" PIPE COUPLED CONNECTION
SAMPLE #3
07/27/1999

TESTING IN GUADRANTS I, II, III & IV, NO BENDING

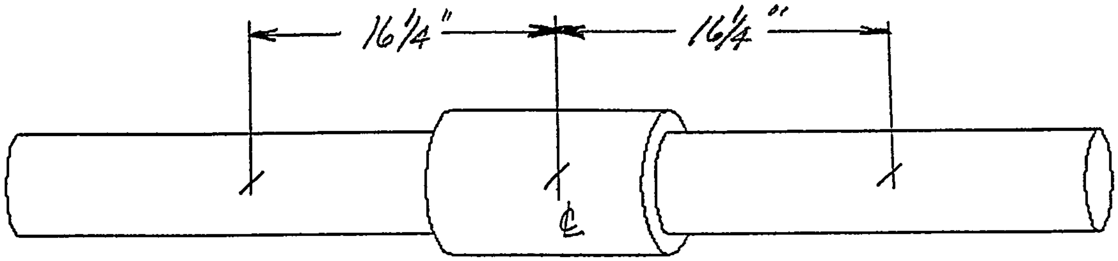
DIRECTION AROUND VME CURVE	LOAD STEP	VME LOAD POINT	AXIAL FORCE *KIPS*	FRAME FORCE *KIPS*	PRESSURE *PSI*	HOLD TIME MIN.
	1	1	1,037	1,037	0	5
	2	1a	867	867	0	-
	3	1b	1,037	867	5,684	-
	4	1c	867	697	5,684	-
	5	2	1,037	697	11,367	60
	6	2a	804	464	11,367	-
	7	3	873	464	13,688	15
	8	3a	408	0	13,688	-
	9	4	455	0	15,263	15
	10	4a	416	0	13,938	-
	11	5	0	-416	13,938	15
	12	5a	-80	-416	11,248	-
	13	6	-360	-696	11,248	15
	14	6a	-520	-696	5,888	-
CCW	15	7	-778	-954	5,888	15
	16	7a	-602	-778	5,888	-
	17	8	-778	-778	0	5
	18	8a	0	0	0	-
	SWITCH FROM INT. TO EXT. PRESSURE & FILL INSIDE WITH WATER					
	19	9	0	0	-9,874	15
	20	10	-546	-546	-9,874	15
	21	11	-778	-778	-9,874	15
	22	11a	0	0	-9,874	-
	23	11b	0	0	-8,603	-
	24	12	360	360	-8,603	15
	25	12a	360	360	-6,054	-
	26	13	731	731	-6,054	15
	27	12a	360	360	-6,054	-
	28	12	360	360	-8,603	15
	29	11b	0	0	-8,603	-
CW	30	11a	0	0	-9,874	-
	31	11	-778	-778	-9,874	15
	32	10	-546	-546	-9,874	15
	33	9	0	0	-9,874	15
	34	9b	0	0	0	-

	A	B	C	D	E	F	G
81	DIRECTION	LOAD	VME	AXIAL	FRAME	PRESSURE	HOLD
82	AROUND	STEP	LOAD	FORCE	FORCE		TIME
83	VME CURVE		POINT	*KIPS*	*KIPS*	*PSI*	MIN.
84		SWITCH FROM EXT. TO INT. PRESSURE & REMOVE INSIDE WATER					
85		35	9c	697	697	0	-
86	CCW	36	2	1,037	697	11,367	15
87		37	2a	804	464	11,367	-
88		38	3	873	464	13,688	15
89		39	3b	464	464	0	-
90		40	8	-778	-778	0	5
91		41	7a	-602	-778	5,888	-
92		42	7	-778	-954	5,888	15
93		43	6a	-520	-696	5,888	-
94		44	6	-360	-696	11,248	15
95		45	5a	-80	-416	11,248	-
96		46	5	0	-416	13,938	15
97		47	4a	416	0	13,938	-
98	CW	48	4	455	0	15,263	15
99		49	3a	408	0	13,688	-
100		50	3	873	464	13,688	15
101		51	2a	804	464	11,367	-
102		52	2	1,037	697	11,367	60
103		53	1c	867	697	5,684	-
104		54	1b	1,037	867	5,684	-
105		55	1a	867	867	0	-
106		56	1	1,037	1,037	0	5
107		57	0	0	0	0	-
108		58	1	1,037	1,037	0	5
109		59	1a	867	867	0	-
110		60	1b	1,037	867	5,684	-
111		61	1c	867	697	5,684	-
112		62	2	1,037	697	11,367	15
113		63	2a	804	464	11,367	-
114		64	3	873	464	13,688	15
115		65	3a	408	0	13,688	-
116		66	4	455	0	15,263	15
117		67	4a	416	0	13,938	-
118	CCW	68	5	0	-416	13,938	15
119		69	5a	-80	-416	11,248	-
120		70	6	-360	-696	11,248	15
121		71	6a	-520	-696	5,888	-
122		72	7	-778	-954	5,888	15
123		73	7a	-602	-778	5,888	-
124		74	8	-778	-778	0	5
125		75	8a	0	0	0	-
126		SWITCH FROM INT. TO EXT. PRESSURE & FILL INSIDE WITH WATER					
127		76	9	0	0	-9,874	15
128		77	10	-546	-546	-9,874	15
129		78	11	-778	-778	-9,874	15
130		79	11a	0	0	-9,874	-
131		80	11b	0	0	-8,603	-
132		81	12	360	360	-8,603	15
133		82	12a	360	360	-6,054	-
134		83	13	731	731	-6,054	15

	A	B	C	D	E	F	G
135	DIRECTION	LOAD	VME	AXIAL	FRAME	PRESSURE	HOLD
136	AROUND	STEP	LOAD	FORCE	FORCE		TIME
137	VME CURVE		POINT	*KIPS*	*KIPS*	*PSI*	MIN.
138	↑	84	13a	731	731	0	-
139		85	13b	0	0	0	-
140		SWITCH FROM EXT. TO INT. PRESSURE & REMOVE INSIDE WATER					
141		86	13c	697	697	0	
142	CCW	87	2	1,037	697	11,367	60
143		88	2a	804	464	11,367	-
144		89	3	873	464	13,688	15
145		90	3d	873	464	0	-
146	↓	91	0	0	0	0	-

Stress Engineering Services

PN 5806 | Customer JOHN WATTS
Date 7/9/99 | Sample # 3
Inspector GS / NH | T & C or Flush T & C



Side 3A | Side 3B

Wall (Side 3A)

AREA IS APPROX. 1/8 SQUARE

0° .224 .443 EITHER SIDE

90° .432

180° .449

270° .436

Avg. Wall .440 NOT USING .224
.385 USING .224

Wall (Side 3B)

AREA IS APPROX. 1/8 SQUARE

0° .240 .451 EITHER SIDE

90° .464

MIN. 180° .430

270° .435

Avg. Wall .445 NOT USING .224
.392 USING .224

OD (Side 3A)

0°-180° 7.052

90°-270° 7.041

Avg. OD 7.047 7.049

OD (Side 3B)

0°-180° 7.0475

90°-270° 7.0515

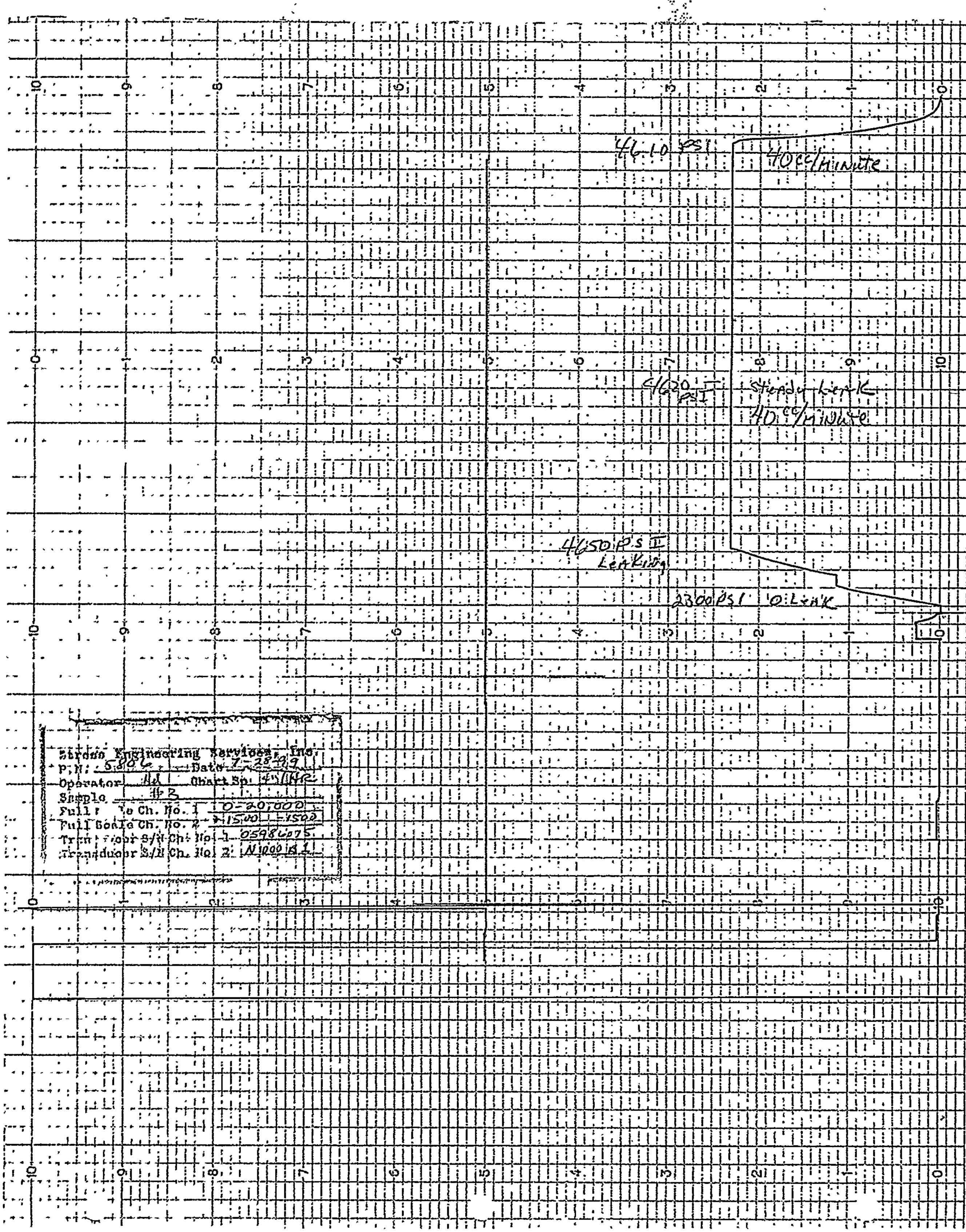
Avg. OD 7.050

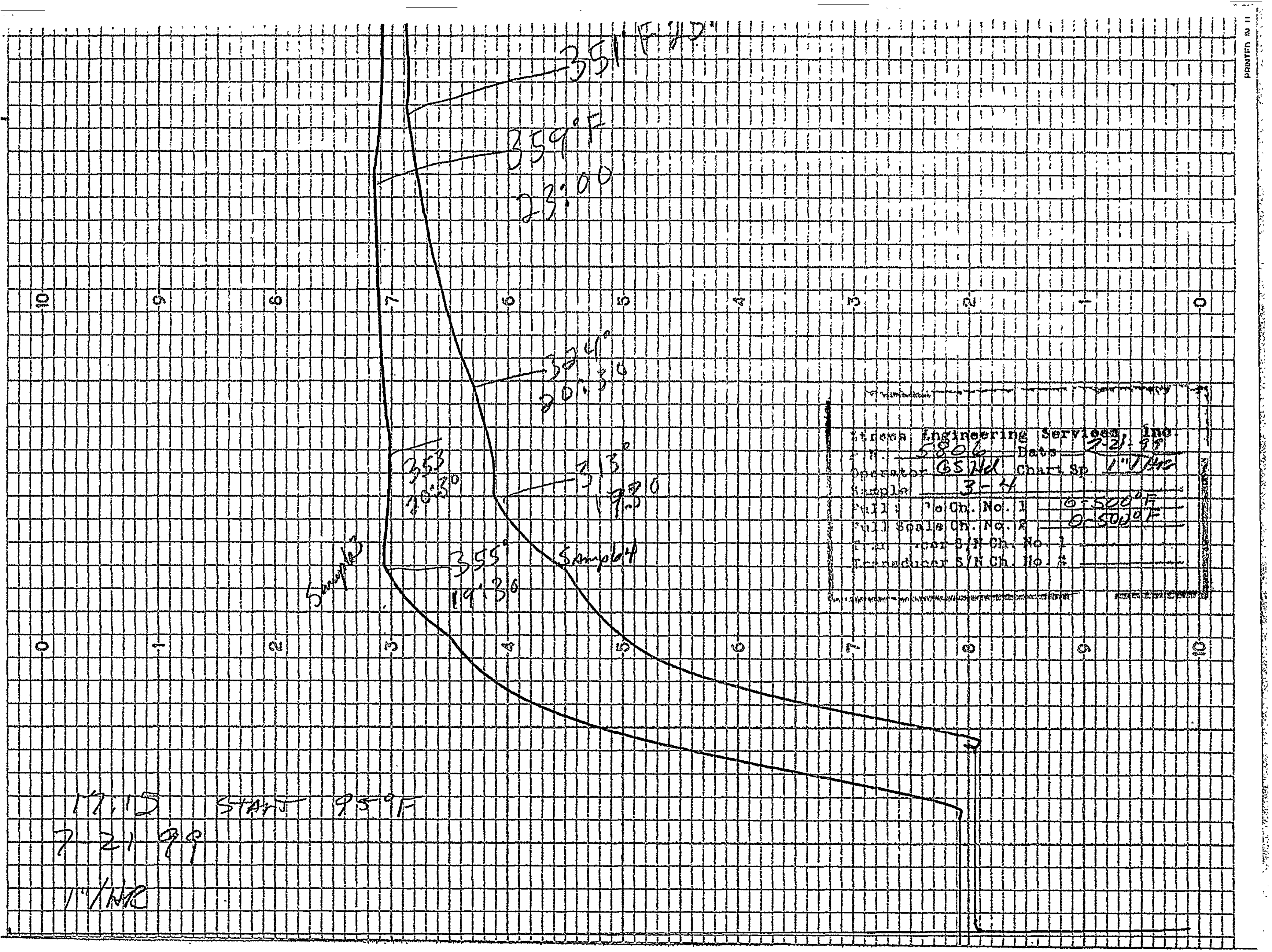
Avg. ID 6.167 NOT USING .224
6.277 USING .224
(OD - 2x Avg. Wall)

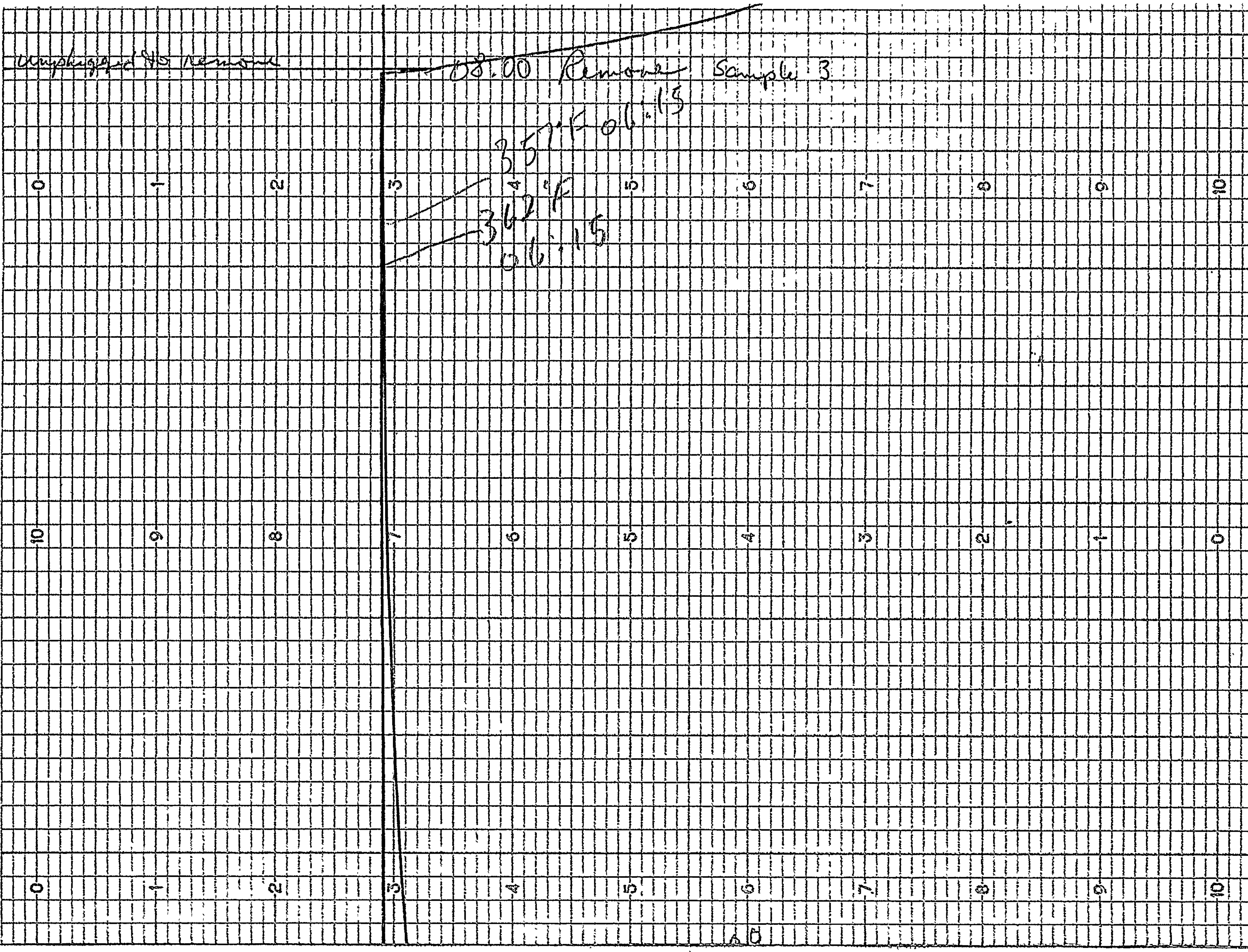
Avg. ID 6.160 NOT USING .22
6.266 USING .224

6.164 AVG. ID

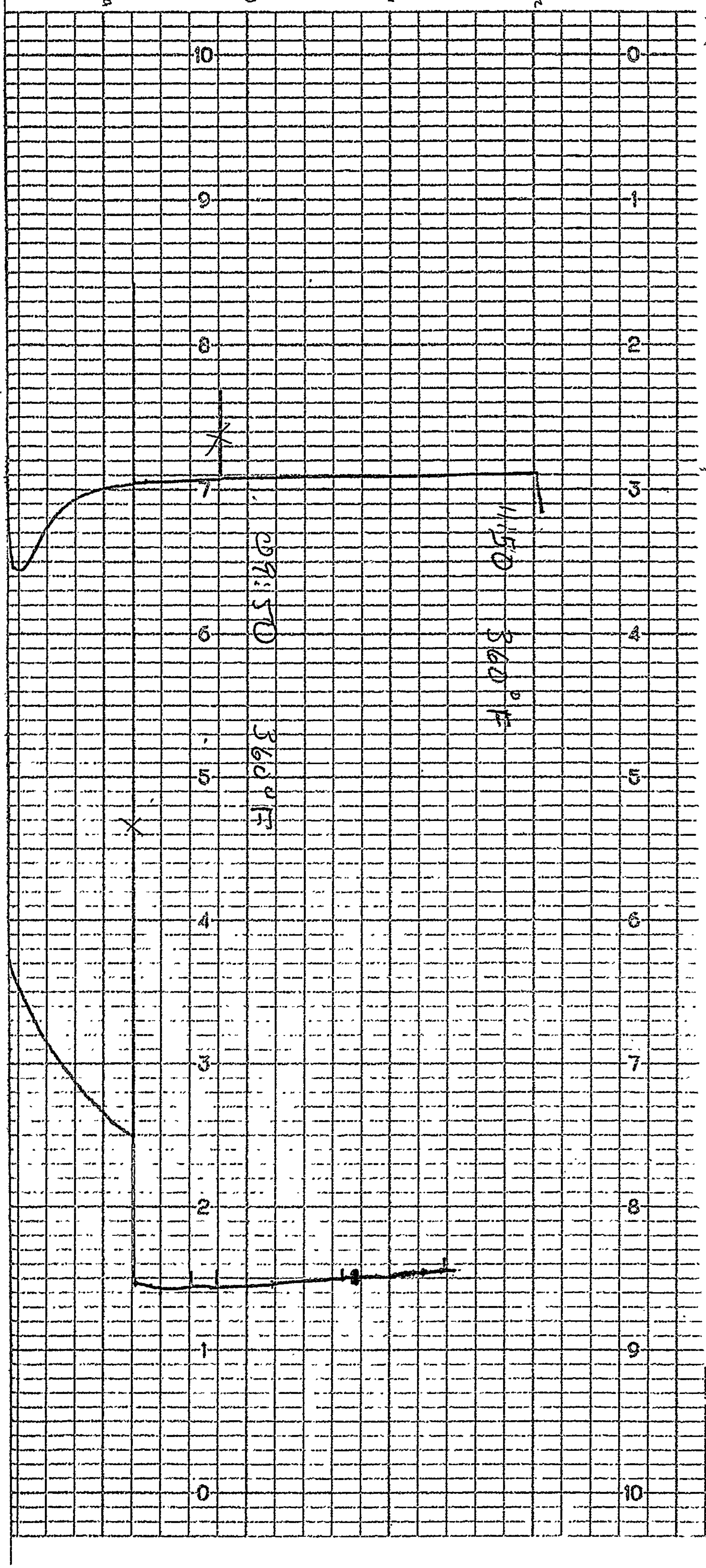
OD = 6.164 + 2x .430 = 7.024


Sirdco Engineering Services, Inc.
P.N: 5806 Date 7-28-99
Operator Hd Chart Sp: 4"/HR
Sample #3
Full Scale Ch. No. 1 0-20,000
Full Scale Ch. No. 2 +1500 -1500
Transducer S/N Ch. No. 1 0598605
Transducer S/N Ch. No. 2 N100081
2300 PSI 0 Leak
4650 PSI Leaking
4620 PSI Steady Leak 40 cc/minute
4610 PSI 40cc/minute


17:15 START 95°F
7 21 99
1"/HR
Sample 3
355° 19:30
353 20:30
Sample 4
313° 19:30
384° 20:30
359°F 23:00
351°F
Stress Engineering Services, Inc.
5806 Date 7-21-99
Operator GS/Hd Chart Sp 1"/HR
Sample 3-4
Ch. No. 1 0-500°F
Full Scale Ch. No. 2 0-500°F
S/N Ch. No. 1
Transducer S/N Ch. No. 2
PRINTED IN U



NO. ECX-100


9:50 360°F
11:50 360°F
10 9 8 7 6 5 4 3 2 1 0
0 1 2 3 4 5 6 7 8 9 10

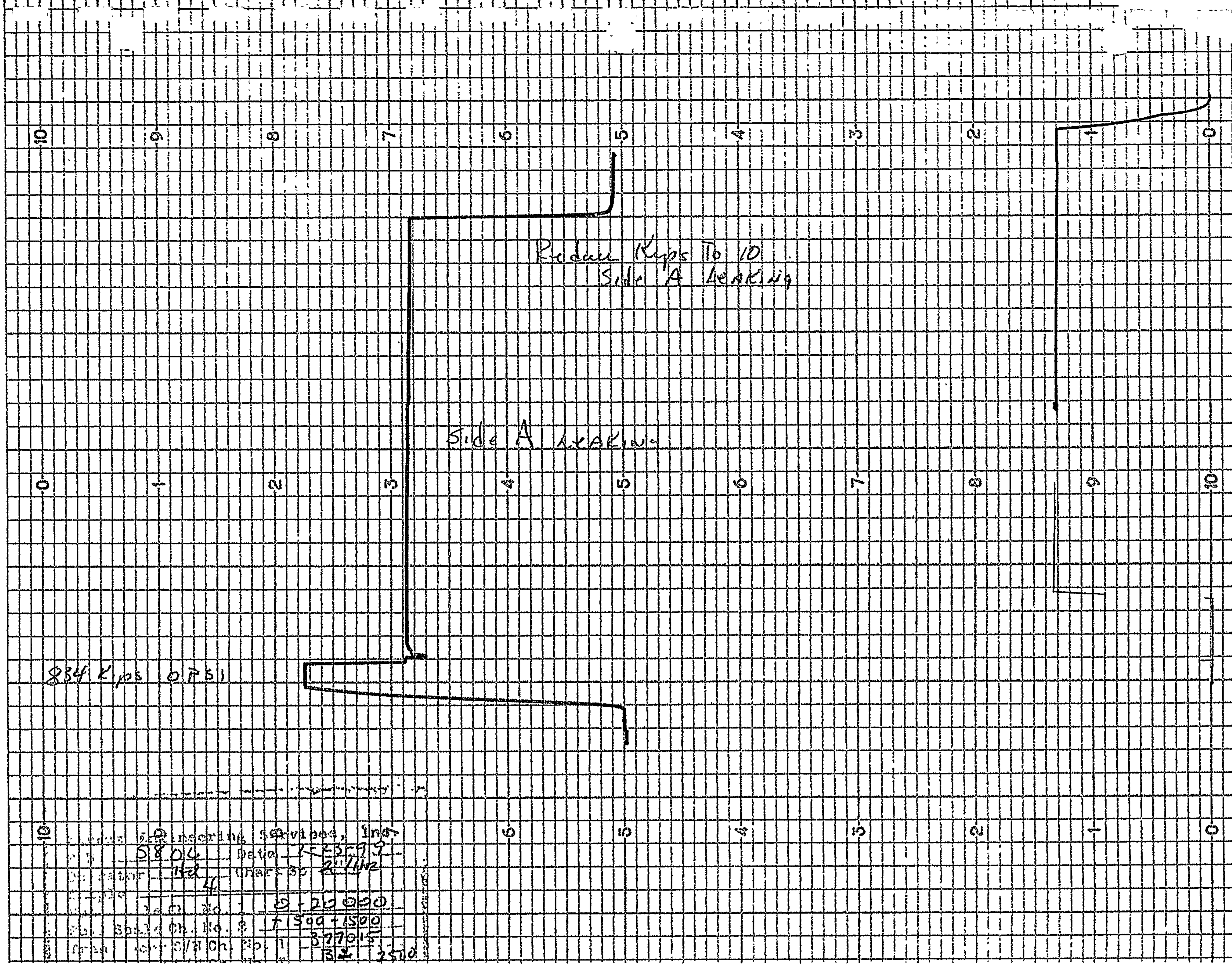
APPENDIX L

SAMPLE 4 TEST DATA

ISO TEST SERIES B - TEST LOG
JOHN WATTS 7" PIPE COUPLED CONNECTION
SAMPLE # 4

DATE: 7-23-99 BY: [illegible] PAGE 1 OF

LOAD STEP	TIME 24 HR.	FRAME KIPS	PRESSURE PSI	BENDING DEG/100'	BUBBLES, CC END A	BUBBLES, CC END B	COMMENTS
	11:30	0	0	0	0	0	
1	11:40	835	0	1.1	5	27	5 min
	11:45	833	0	1.0	5	27	END
2	11:47	559	0	1.0	5	27	
	11:50	561	2750	0.7	Yes	27	
	14:00	553	2700	0.8	Yes	27	
	14:02	10	2690	0.4	Yes	27	
	14:05	0	0	0.2	—	—	
		END	OF TEST —		LEAKING		


Reduce Kips To 10
Side A Leaking
Side A Leaking
834 Kips 0 PSI
Engineering Services, Inc.
5804
Date
Chart Sp
0 - 20 000
7500 + 1500
377015

ISO TEST SERIES B LOAD POINTS
JOHN WATTS 7" PIPE COUPLED CONNECTION
SAMPLE #4
7/23/99

PIPE PROPERTIES:	ACTUAL AVERAGE ID =	6.151	INCH
	ACTUAL MINIMUM WALL =	0.433	INCH
	CROSS SECTION AREA =	8.956	SQ. IN.
	EQUIVALENT OD =	7.017	INCH
	INT. PRESS. END LOAD =	29.715	x Pi, KIPS
	PIPE ACTUAL AVERAGE YIELD STRENGTH =	122,500	PSI
	PIPE BODY YIELD =	1,097	KIPS
	OD STRESS AT 20 DEG/100 FT. =	30,622	PSI
	EQUIVALENT FORCE AT 20 DEG/100 FT. =	274	KIPS
	ID STRESS AT 20 DEG/100 FT. =	26,843	PSI
	EQUIVALENT FORCE AT 20 DEG/100 FT. =	240	KIPS

CONNECTION RATING: TENSION = 80% PIPE BODY
COMPRESSION = 75% PIPE BODY
INTERNAL PRESSURE = 80% PIPE BODY

LOAD POINT	TOTAL AXIAL LOAD		BENDING	PRESSURE
	% YIELD	*KIPS*	*DEG/100 FT.*	*PSI*
1	76	834	0	0
2	76	834	0	9,225
3-BT	76	834	20	9,225
3-BC	-	353	20	9,225
4	60	658	0	11,523
5-BT	60	658	20	11,523
5-BC	-	177	20	11,523
6	CEYP	370	0	12,449
7	0	0	0	11,379
8-BC	0	0	20.0	11,379
8-BT	-	481	20.0	11,379
9	-33	-362	0	8,441
10-BC	-33	-362	20	8,441
10-BT	-	119	20	8,441
11	-55	-603	0	5,201
12-BC	-55	-603	20	5,201
12-BT	-	-123	20	5,201
13	-71.3	-782	0	0

ISO TEST SERIES B LOAD POINTS
JOHN WATTS 7" PIPE COUPLED CONNECTION
SAMPLE #4
7/15/99

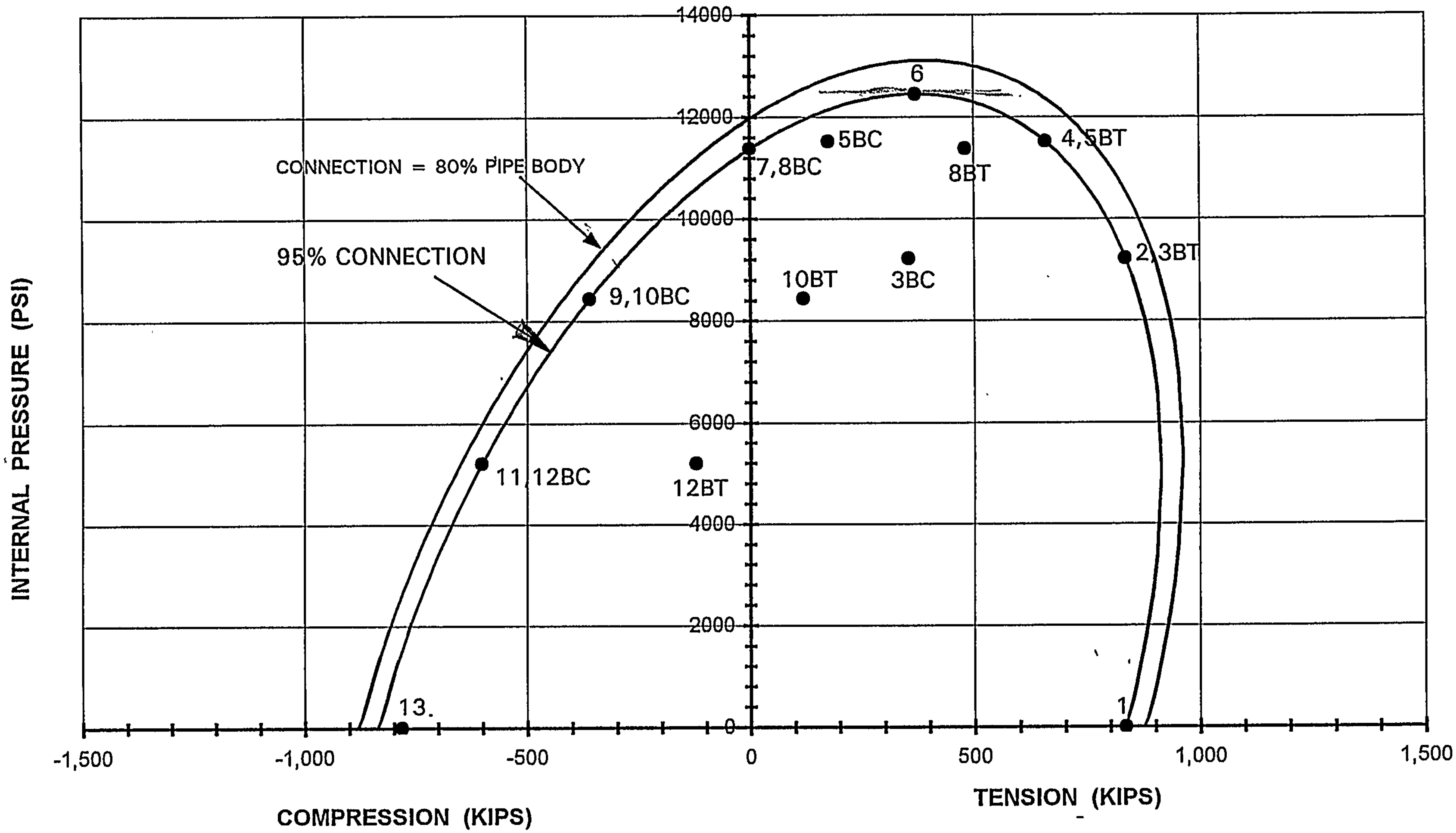
TESTING IN GUADRANTS I & II, WITH BENDING

DIRECTION AROUND VME CURVE	LOAD STEP	VME LOAD POINT	TOTAL FORCE *KIPS*	FRAME FORCE *KIPS*	BENDING DEG/100 FT.	PRESSURE *PSI*	HOLD TIME MIN.
	1	1	834	834	0	0	5
	2	1a	560	560	0	0	-
	3	2	834	560	0	9,225	15
	4	2a	593	319	0	9,225	-
	5	3-BT	834	319	20	9,225	60
	6	3a	593	319	0	9,225	-
	7	3b	590	316	0	9,225	-
	8	4	658	316	0	11,523	15
	9	4a	418	75	0	11,523	-
	10	5-BT	658	75	20	11,523	15
	11	5a	418	75	0	11,523	-
	12	5b	342	0	0	11,523	-
	13	6	370	0	0	12,449	15
	14	6a	338	0	0	11,379	-
CCW	15	7	0	-338	0	11,379	15
	16	7a	240	-98	0	11,379	-
	17	8-BC	0	-98	20	11,379	15
	18	8a	240	-98	0	11,379	-
	19	8b	153	-98	0	8,441	
	20	9	-362	-613	0	8,441	15
	21	9a	-122	-372	0	8,441	-
	22	10-C	-362	-372	20	8,441	15
	23	10a	-122	-372	0	8,441	-
	24	10b	-218	-372	0	5,201	-
	25	11	-603	-758	0	5,201	15
	26	11a	-363	-518	0	5,201	-
	27	12-C	-603	-518	20	5,201	15
	28	12a	-363	-518	0	5,201	-
	29	12b	-518	-518	0	0	-
	30	13	-782	-782	0	0	5
	31	13a	0	0	0	0	-
	32	1a	560	560	0	0	-
	33	2	834	560	0	9,225	15
	34	2a	593	319	0	9,225	-
	35	3-BT	834	319	20	9,225	60
	36	3a	593	319	0	9,225	-
	37	3aa	319	0	0	9,225	-
	38	13a	0	0	0	0	-

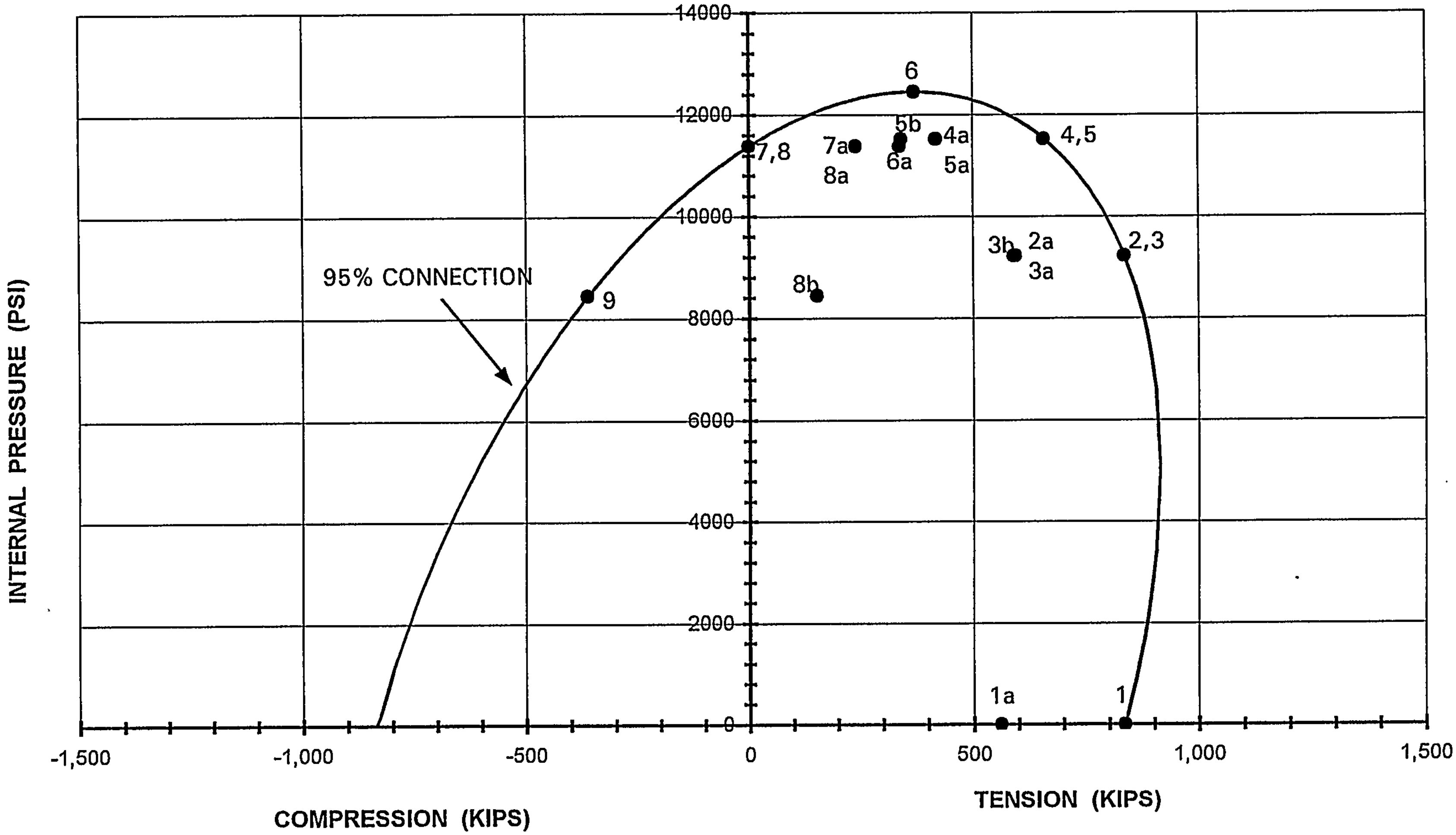
	A	B	C	D	E	F	G	H
93	DIRECTION	LOAD	VME	TOTAL	FRAME	BENDING	PRESSURE	HOLD
94	AROUND	STEP	LOAD	FORCE	FORCE			TIME
95	VME CURVE		POINT	*KIPS*	*KIPS*	DEG/100 FT.	*PSI*	MIN.
96		39	13	-782	-782	0	0	0
97		40	12b	-518	-518	0	0	-
98		41	12a	-363	-518	0	5,201	-
99		42	12-C	-603	-518	20	5,201	15
100		43	11a	-363	-518	0	5,201	-
101		44	11	-603	-758	0	5,201	15
102		45	10b	-218	-372	0	5,201	-
103		46	10a	-122	-372	0	8,441	-
104		47	10-C	-362	-372	20	8,441	15
105		48	9a	-122	-372	0	8,441	-
106		49	9	-362	-613	0	8,441	15
107		50	8b	153	-98	0	8,441	
108		51	8a	240	-98	0	11,379	-
109		52	8-BC	0	-98	20	11,379	15
110		53	7a	240	-98	0	11,379	-
111	CW	54	7	0	-338	0	11,379	15
112		55	6a	338	0	0	11,379	-
113		56	6	370	0	0	12,449	15
114		57	5b	342	0	0	11,523	-
115		58	5a	418	75	0	11,523	-
116		59	5-BT	658	75	20	11,523	15
117		60	4a	418	75	0	11,523	-
118		61	4	658	316	0	11,523	15
119		62	3b	590	316	0	9,225	-
120		63	3a	593	319	0	9,225	-
121		64	3-BT	834	319	20	9,225	15
122		65	2a	593	319	0	9,225	-
123		66	2	834	560	0	9,225	15
124		67	1a	560	560	0	0	-
125		68	1	834	834	0	0	5
126		69	13a	834	834	0	0	-

	A	B	C	D	E	F	G	H
127 128 129	DIRECTION AROUND VME CURVE	LOAD STEP	VME LOAD POINT	TOTAL FORCE *KIPS*	FRAME FORCE *KIPS*	BENDING DEG/100 FT.	PRESSURE *PSI*	HOLD TIME MIN.
130		70	1	834	834	0	0	5
131		71	1a	560	560	0	0	-
132		72	2	834	560	0	9,225	15
133		73	2a	593	319	0	9,225	-
134		74	3-BT	834	319	20	9,225	15
135		75	3a	593	319	0	9,225	-
136		76	3b	590	316	0	9,225	-
137		77	4	658	316	0	11,523	15
138		78	4a	418	75	0	11,523	-
139		79	5-BT	658	75	20	11,523	15
140		80	5a	418	75	0	11,523	-
141		81	5b	342	0	0	11,523	-
142		82	6	370	0	0	12,449	15
143		83	6a	338	0	0	11,379	-
144	CCW	84	7	0	-338	0	11,379	15
145		85	7a	240	-98	0	11,379	-
146		86	8-BC	0	-98	20	11,379	15
147		87	8a	240	-98	0	11,379	-
148		88	8b	153	-98	0	8,441	-
149		89	9	-362	-613	0	8,441	15
150		90	9a	-122	-372	0	8,441	-
151		91	10-C	-362	-372	20	8,441	15
152		92	10a	-122	-372	0	8,441	-
153		93	10b	-218	-372	0	5,201	-
154		94	11	-603	-758	0	5,201	15
155		95	11a	-363	-518	0	5,201	-
156		96	12-C	-603	-518	20	5,201	15
157		97	12a	-363	-518	0	5,201	-
158		98	12b	-518	-518	0	0	-
159		99	13	-782	-782	0	0	5
160		100	13a	0	0	0	0	-
161		101	1a	560	560	0	0	-
162		102	2	834	560	0	9,225	15
163		103	2a	593	319	0	9,225	-
164		104	3-BT	834	319	20	9,225	60
165		105	3a	593	319	0	9,225	-
166		106	3aa	319	0	0	9,225	-
167		107	13a	0	0	0	0	-

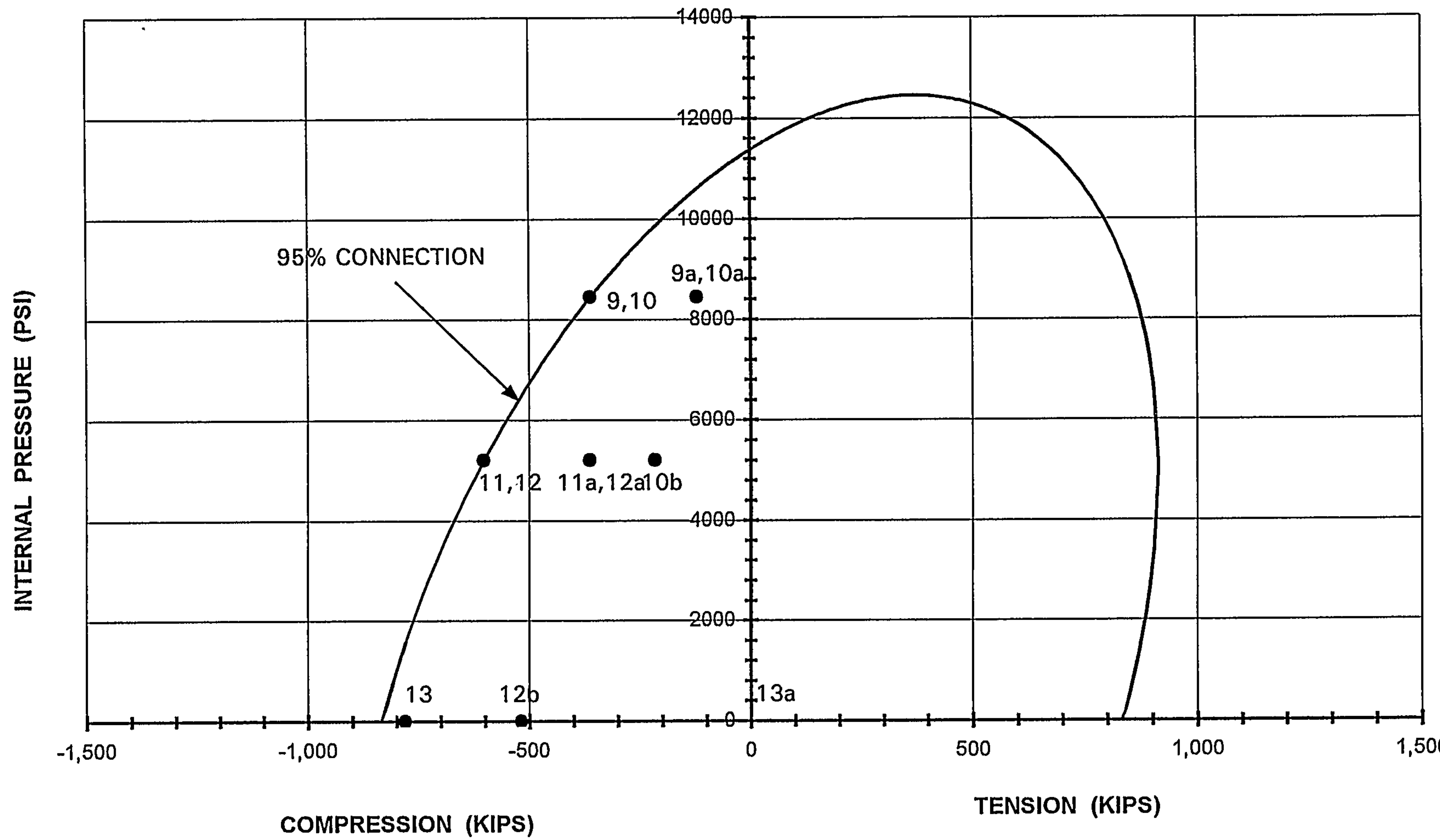
JOHN WATTS 7" PIPE COUPLED CONNECTION
ISO SERIES B TEST LOADS
SAMPLE #4



JOHN WATTS 7" PIPE COUPLED CONNECTION
ISO SERIES B TEST LOADS - SAMPLE #4
LOAD POINTS 1 THRU 9



JOHN WATTS 7" PIPE COUPLED CONNECTION
ISO SERIES B TEST LOADS - SAMPLE #4
LOAD POINTS 9 THRU 13a



Stress Engineering Services, Inc.

VON MISES TRI-AXIAL EQUIVALENT YIELD ELLIPSE
VALUES AT THE INSIDE SURFACE OF A CYLINDER

Date: 7/22/99

Project Number: PN 5806

SAMPLE #4

Input Information:

Outer Diameter =	7.017	inches		
Inner Diameter =	6.151	inches		
Yield Strength =	122,500	psi		
Ellipse 1 Strength =	93,100	psi,	based on	80% ACTUAL AVE YIELD
Ellipse 2 Strength =	98,000	psi,	based on	
Joint Efficiency =	100.00	% ,	based on input diameters	

Ellipse 1 Maximum Loads for Internal Pressure

Tension =	912.2	kips
Tension / Compression (Pi = 0) =	833.8	kips
Capped-End Yield Pressure =	12,449	psi
Pressure (T/C = 0) =	11,379	psi

Ellipse 1 Maximum Loads for External Pressure

Compression =	-962.8	kips
Tension / Compression (Pe = 0) =	-833.8	kips
Capped-End Yield Pressure =	-12,449	psi
Pressure (T/C = 0) =	-10,781	psi

Ellipse 1 User Selection of Point on the VME Ellipse

Select : Axial Force =	-603.00	kips
Internal Pressure (+ root) =	5,201	psi
Internal Pressure (- root) =	----------	psi
External Pressure (+ root) =	----------	psi
External Pressure (- root) =	-12,303	psi

*API Internal Yield Pressure**

Yield Pressure (87.5%) =	13,228	psi
Yield Pressure (100%) =	15,118	psi

*Burst Pressure**

Burst Pressure =	18,632	psi

*Based on Input Yield Strength

API Collapse Resistance Pressure

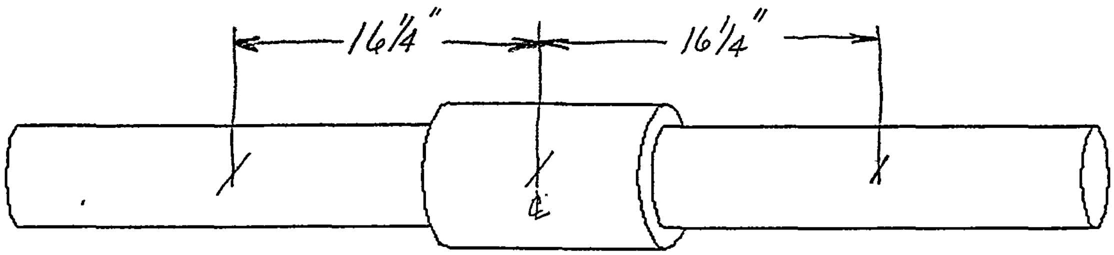
For Ellipse 1 Strength of	93,100	psi,	Collapse Pressure =	8,734	psi
For Ellipse 1 Strength and Axial Tension of	0.0	kips,	Collapse Pressure =	8,734	psi
For Input Yield Strength =	122,500	psi,	Collapse Pressure =	10,374	psi

Bending Information, for 10 degrees/100 feet

Radius of Curvature =	573	ft
Bending Moment =	17,721	ft-lbs
Bending Stress =	15,308	psi

Stress Engineering Services

PN 5806 | Customer JOHN WATTS
Date 7/9/99 | Sample # 4
Inspector GS + NH | T & C or Flush T+C



Side 4A

AREA IS APPROX. 1/8 SQUARE

Wall 0° .207 .435 EITHER SIDE

90° .448

MIN. 180° .433

270° .439

Avg. Wall .439 NOT USING .207
.382 USING .207

OD 0°-180° 7.0430

90°-270° 7.0415

Avg. OD 7.042

7.042

Avg. ID 6.164 NOT USING .207
6.278 USING .207

(OD - 2x Avg. Wall)

Side 4B

AREA IS APPROX. 1/8 SQUARE

Wall 0° .210 .450 EITHER SIDE

90° .454

180° .457

270° .447

Avg. Wall .452 NOT USING .210
.392 USING .210

OD 0°-180° 7.0355

90°-270° 7.0470

Avg. OD 7.041

Avg. ID 6.137 NOT USING .210
6.257 USING .210

6.151

OD = 6.151 + 2x .433 = 7.017

APPENDIX M

SAMPLE 5 TEST DATA

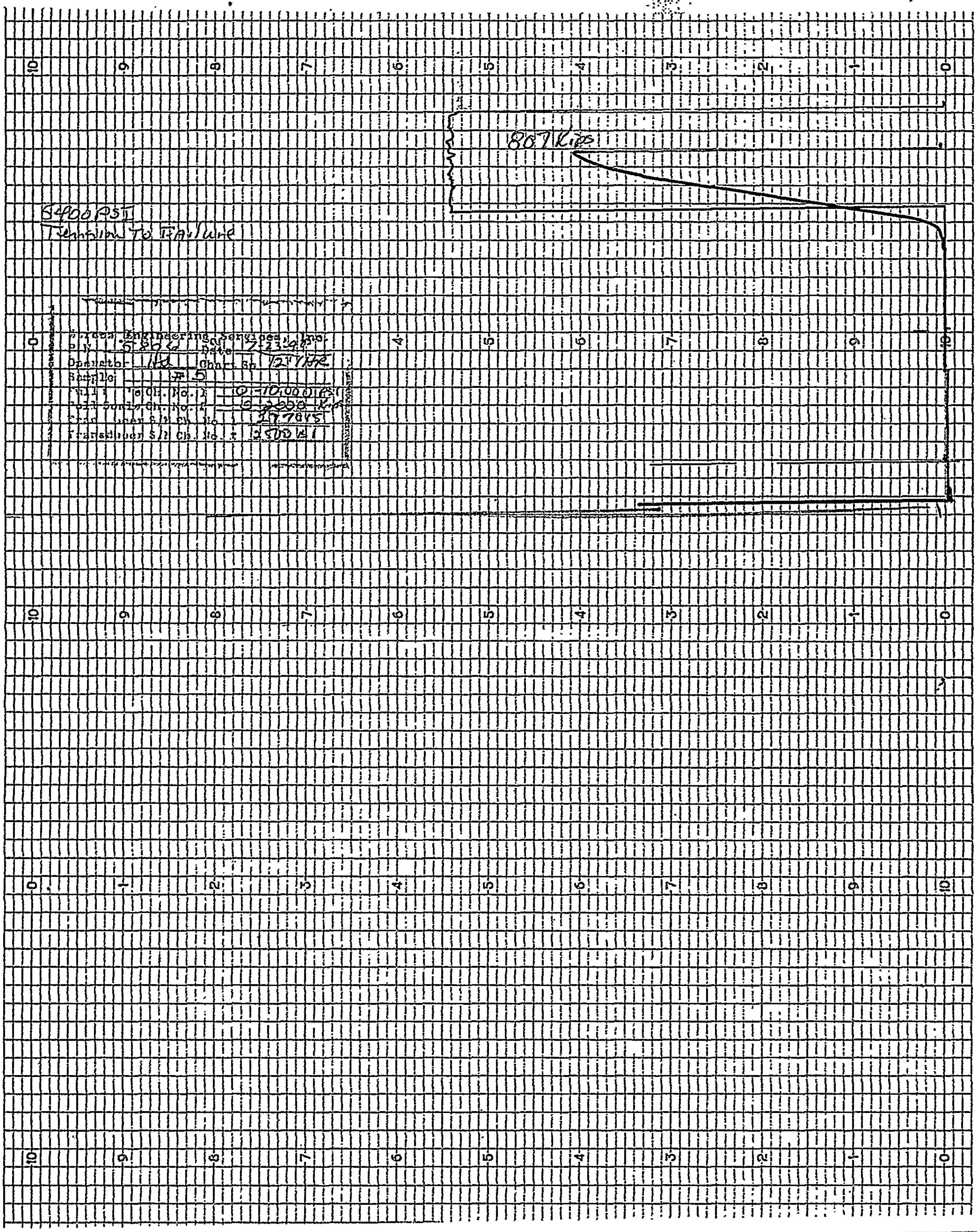
DATA LOG SHEET

Tension Failure w/ Internal PSI

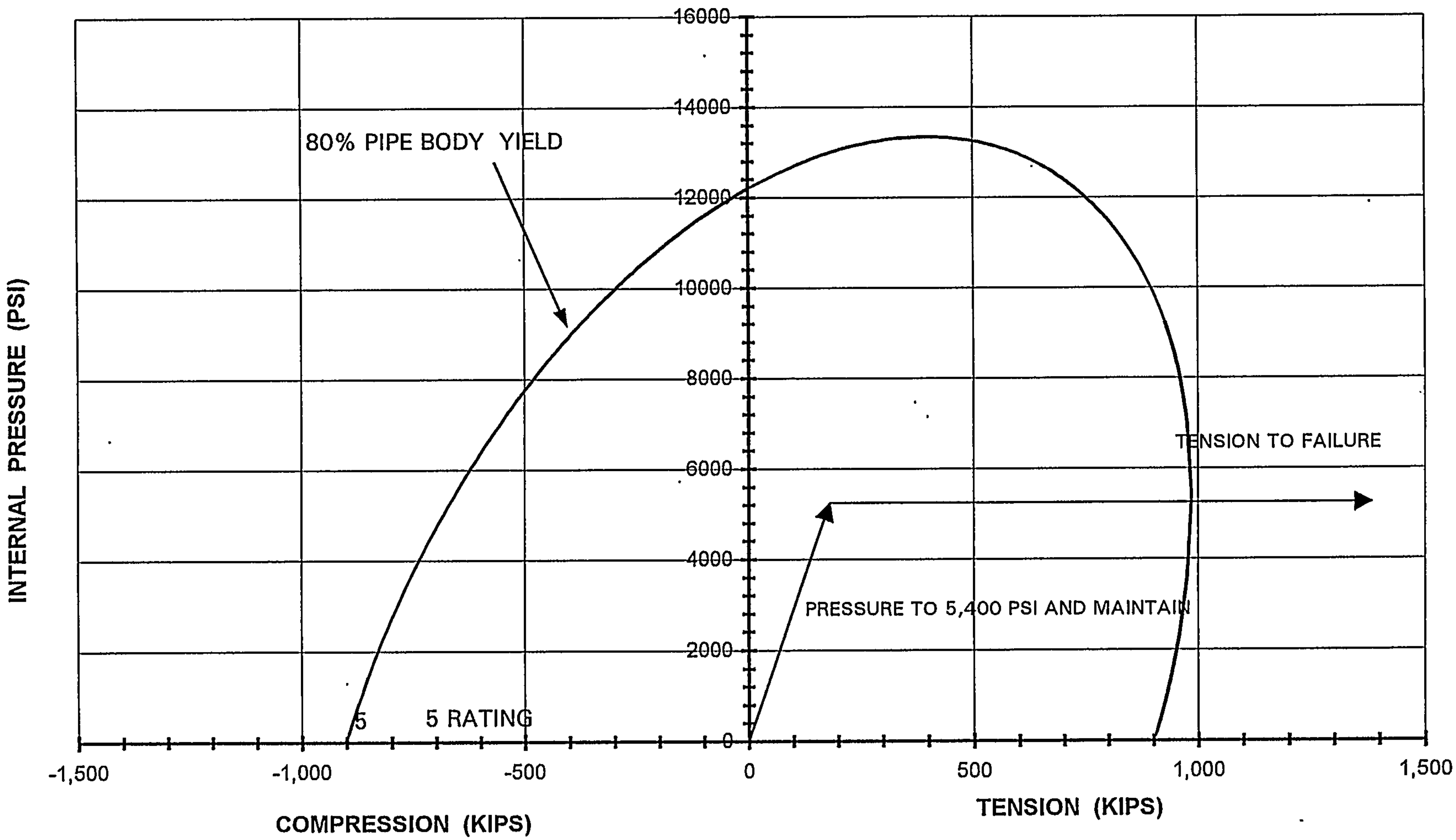
Sample 5 | Page 1 of 1

PN 5806	TRANS # 30K	SN 377015	CHAN # 1	LABEL PSI
CLIENT John Watts	TRANS # Frame	SN 2500B1	CHAN # 2	LABEL Kip's
BY Hd	TRANS #	SN	CHAN #	LABEL
DATE 7-23-99	TRANS #	SN	CHAN #	LABEL

STEP	TIME	UNITS SCAN #	Internal PSI	Tension Kip's					
			5400	0					
			5400	807	Failure @ Connection				
					No Leakage				
		ID =	6.158						
		PEC =	$\pi/4(6.158)^2 (5400) =$		160.8	KIPS			
		TOTAL	TENSION = 807 + 161		= 968	KIPS.			


5400 PSI
Tension To Failure
807 Kips
Stress Engineering Services, Inc.
P.N. 5806 Date 7-23-94
Operator
Chart Sp 12"/HR
Sample #5
0-10,000 PSI
0-2000 Kips
177845
2500
PRINTED IN U.S.A.

JOHN WATTS 7" PIPE INTEGRAL CONNECTION
SAMPLE 5 FAILURE LOADS



Stress Engineering Services, Inc.

VON MISES TRI-AXIAL EQUIVALENT YIELD ELLIPSE
VALUES AT THE INSIDE SURFACE OF A CYLINDER

Date: 07/22/1999 SAMPLE 5

Project Number: PN 5806

Input Information:

Outer Diameter =	7.044	inches	
Inner Diameter =	6.158	inches	
Yield Strength =	122,500	psi	
Ellipse 1 Strength =	98,000	psi,	based on
Ellipse 2 Strength =		psi,	based on
Joint Efficiency =	100.00	% ,	based on input diameters

Ellipse 1 Maximum Loads for Internal Pressure

Tension =	984.1	kips
Tension / Compression (Pi = 0) =	900.3	kips
Capped-End Yield Pressure =	13,338	psi
Pressure (T/C = 0) =	12,203	psi

Ellipse 1 Maximum Loads for External Pressure

Compression =	-1,039.6	kips
Tension / Compression (Pe = 0) =	-900.3	kips
Capped-End Yield Pressure =	-13,338	psi
Pressure (T/C = 0) =	-11,551	psi

Ellipse 1 User Selection of Point on the VME Ellipse

Select : Axial Force =		kips
Internal Pressure (+ root) =	----------	psi
Internal Pressure (- root) =	----------	psi
External Pressure (+ root) =	----------	psi
External Pressure (- root) =	----------	psi

API Internal Yield Pressure*

Yield Pressure (87.5%) =	13,482	psi
Yield Pressure (100%) =	15,408	psi

Burst Pressure*

Burst Pressure = 19,014 psi

*Based on Input Yield Strength

API Collapse Resistance Pressure

For Ellipse 1 Strength of	98,000	psi,	Collapse Pressure =	9,400	psi
For Ellipse 1 Strength and Axial Tension of	0.0	kips,	Collapse Pressure =	9,400	psi
For Input Yield Strength =	122,500	psi,	Collapse Pressure =	10,842	psi

Bending Information, for 10 degrees/100 feet

Radius of Curvature =	573	ft
Bending Moment =	18,275	ft-lbs
Bending Stress =	15,366	psi

Stress Engineering Services

PN 5806
Date 7/22/99
Inspector GS

Customer JOHN WATTS
Sample # 5
T & C or Flush FLUSH

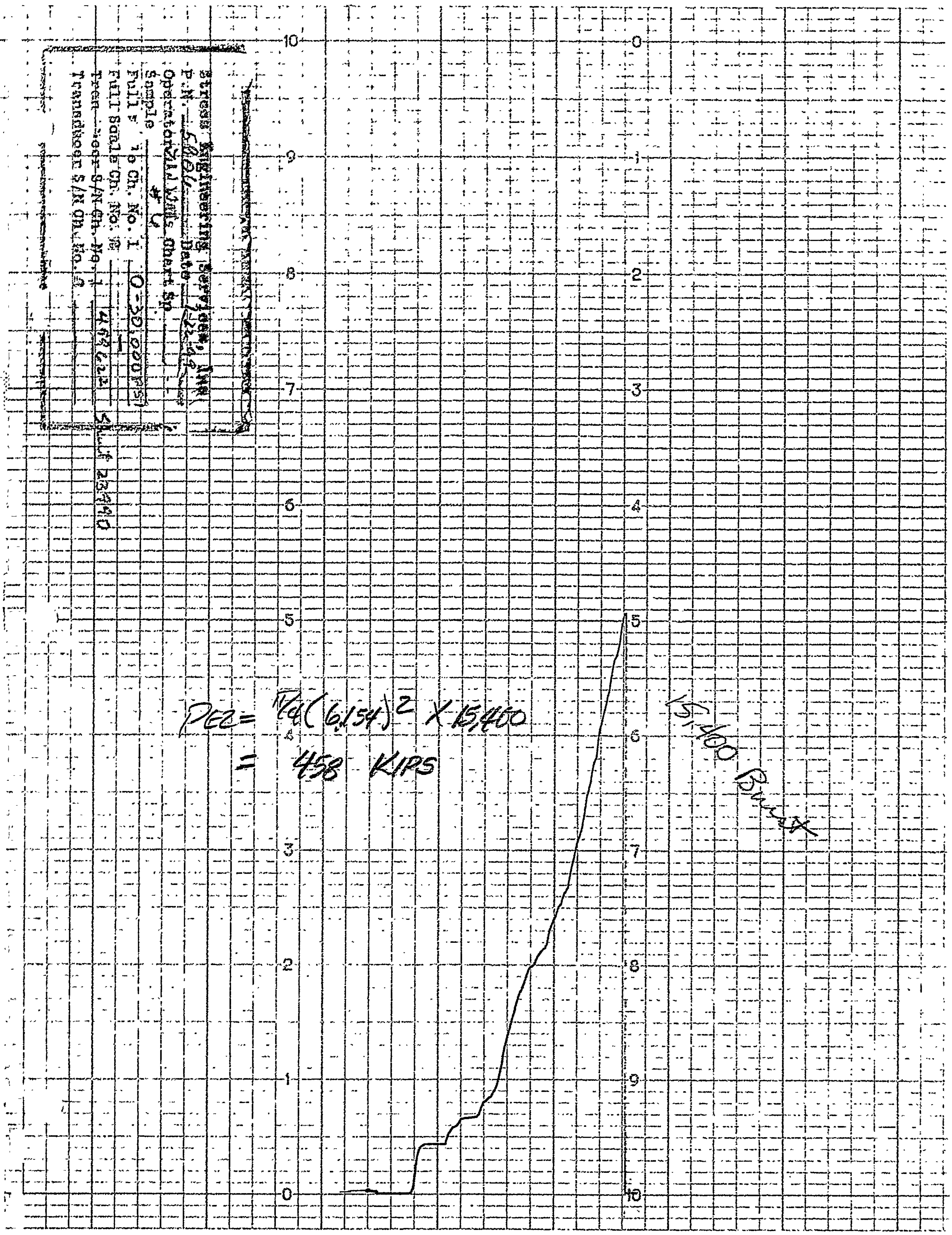
	Side PIN		Side BOX
	20 3/4" UNSUPPORTED LENGTH		20 5/8" UNSUPPORTED LENGTH
Wall 0°	0.443	**Wall** 0°	0.463
90°	0.448	90°	0.434
180°	0.428	180°	0.441
270°	0.441	270°	0.444
Avg. Wall	0.440	Avg. Wall	0.4455
OD 0°-180°	7.050	**OD** 0°-180°	7.040
90°-270°	7.046	90°-270°	7.038
Avg. OD	7.048 7.044	Avg. OD	7.039
Avg. ID	6.168 6.158	Avg. ID	6.148

(OD - 2x Avg. Wall)

$A = 9.187 \text{ in}^2$ 16%

APPENDIX N

SAMPLE 6 TEST DATA



Stress Engineering Services, Inc.
P.N. 5806 Date 7-22-94
Operator Bill Wills Chart Sp
Sample #6
Full Scale Ch. No. 1 0-30,000 PSI
Full Scale Ch. No. 2 —
Trans ducer S/N Ch. No. 1 483621
Transducer S/N Ch. No. 2
Shuff 23940
10
9
8
7
6
5
4
3
2
1
0
0
1
2
3
4
5
6
7
8
9
10
PEZ = π/4 (6.154)² × 15,400
= 458 KIPS
15,400 Burst

Stress Engineering Services

PN 5806

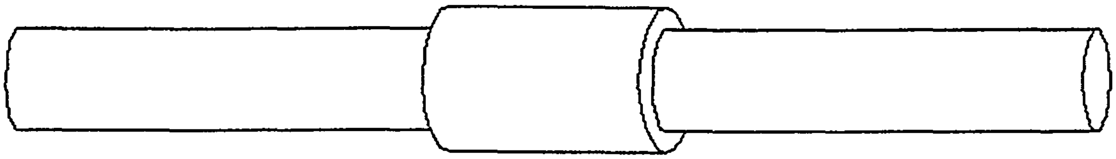
Date 7-22-99

Inspector Hd

Customer John Watts

Sample # 6

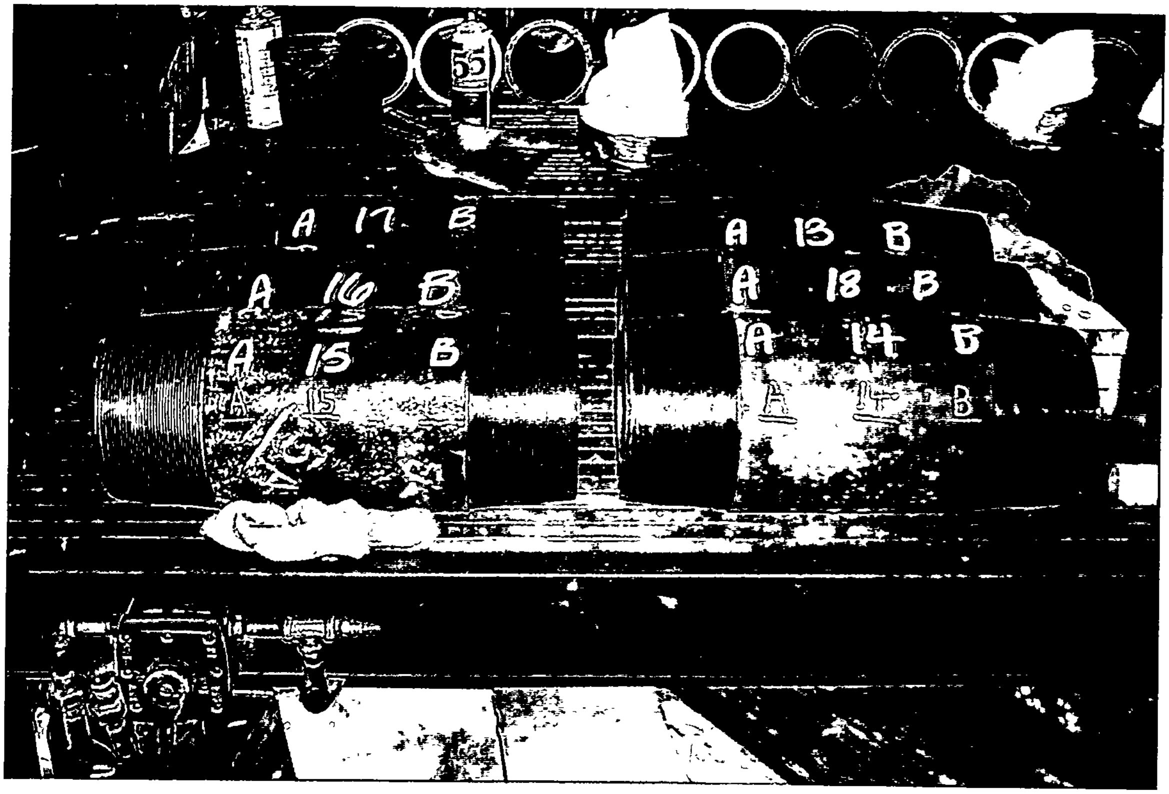
T & C or Flush Flush



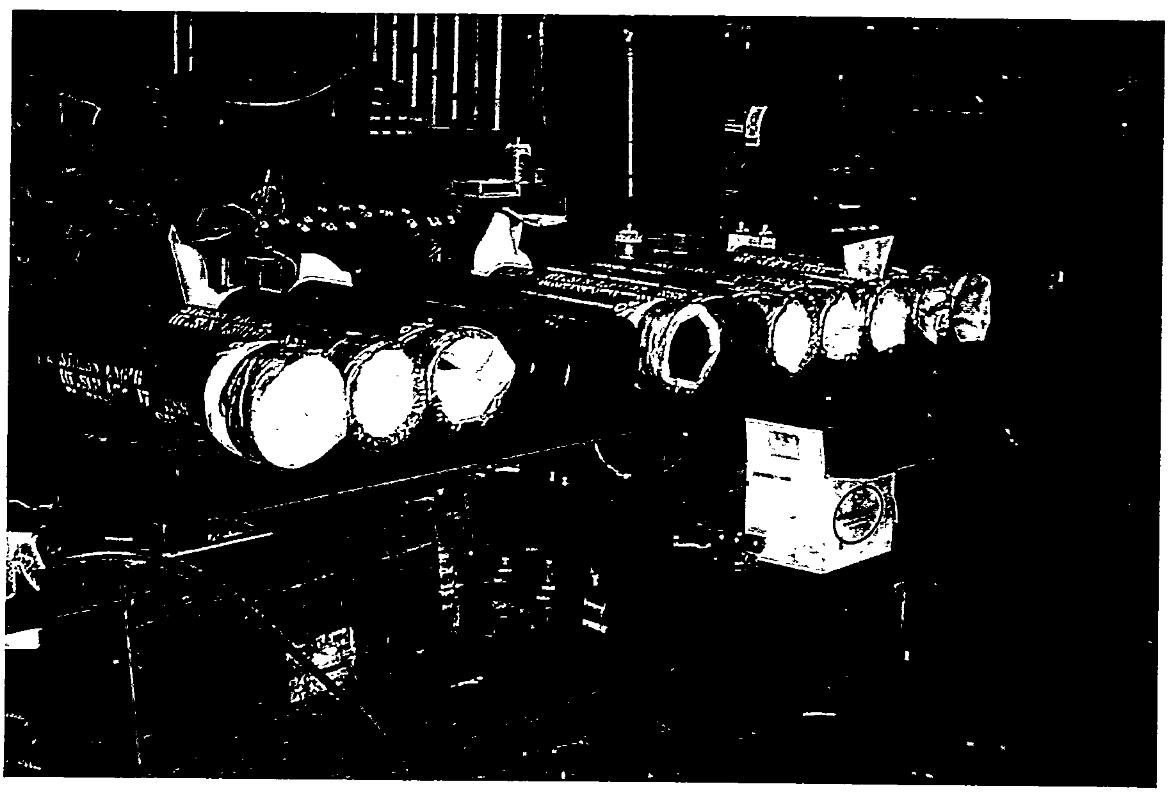
	Side Box		Side PIN
Wall 0°	.431 MIN.	**Wall** 0°	.439
90°	.445	90°	.452
180°	.457	180°	.447
270°	.458	270°	.450
Avg. Wall	.448	Avg. Wall	.447
OD 0°-180°	7.046	**OD** 0°-180°	7.052
90°-270°	7.051	90°-270°	7.046
Avg. OD	7.048	Avg. OD	7.049
Avg. ID	6.152 6.154	Avg. ID	6.155

(OD - 2x Avg. Wall)

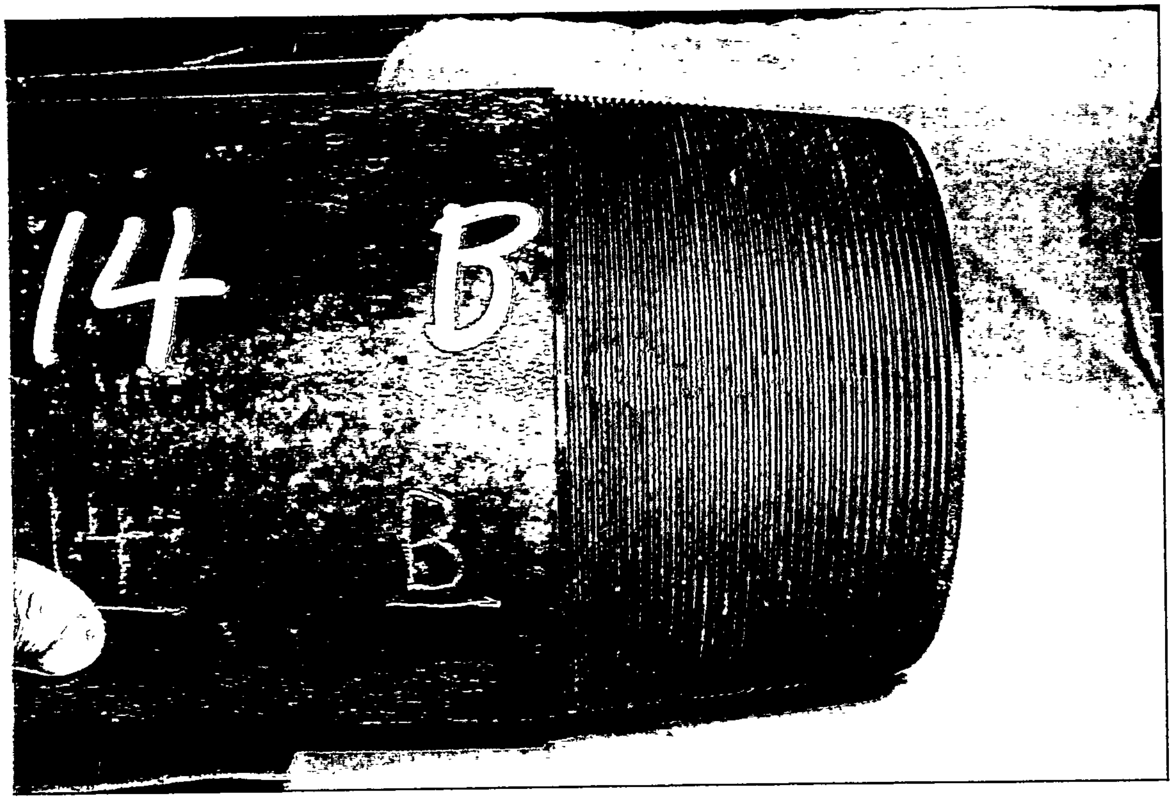
APPENDIX O
PHOTOS



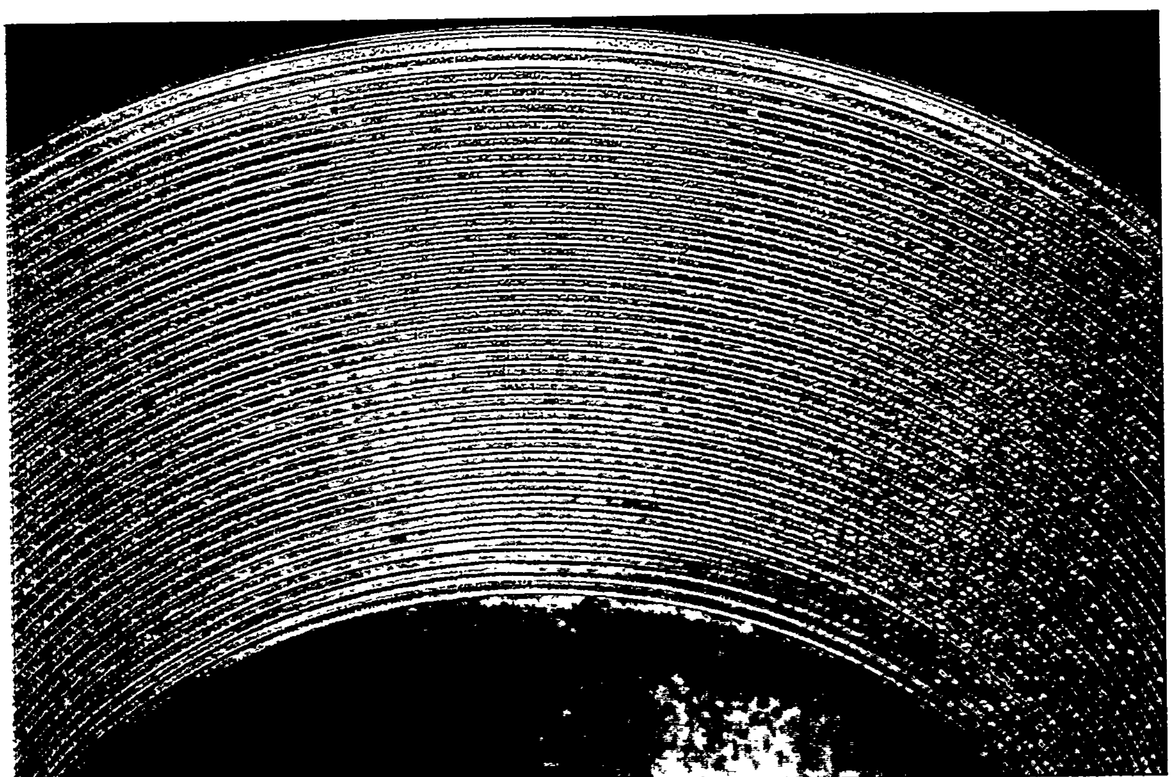
NEW COUPLINGS



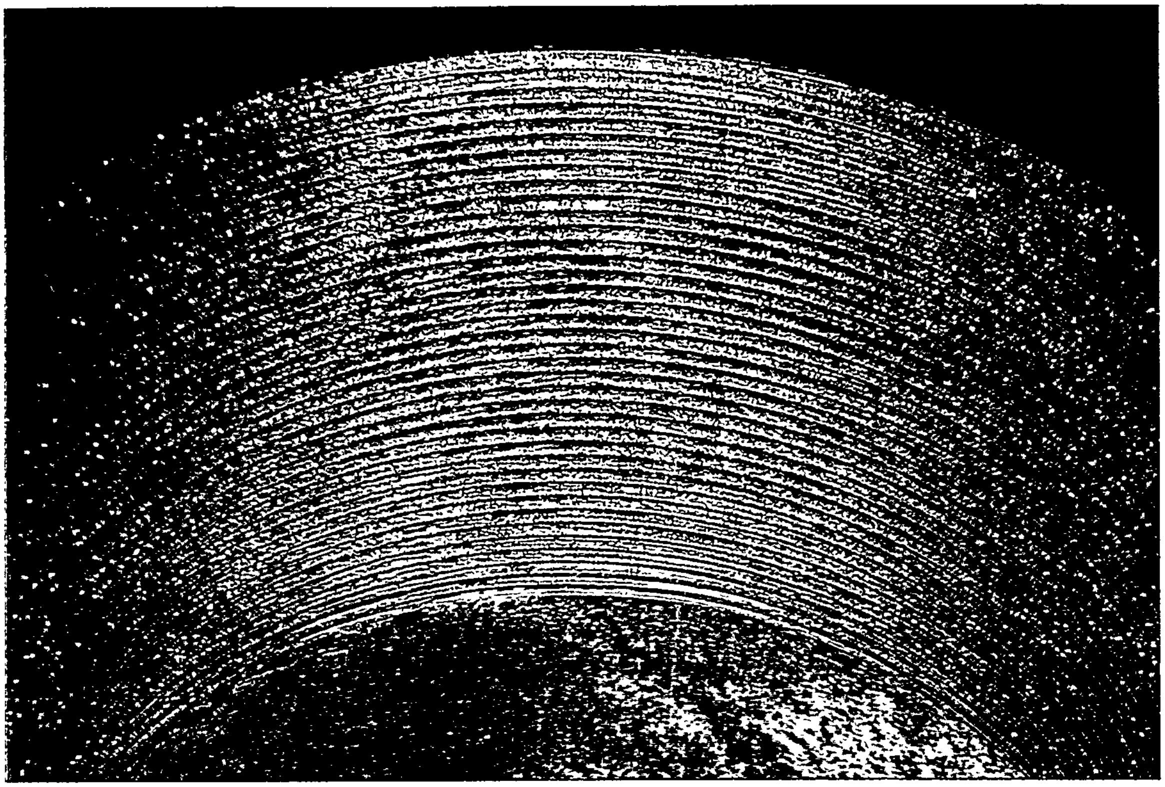
NEW PUP JOINTS



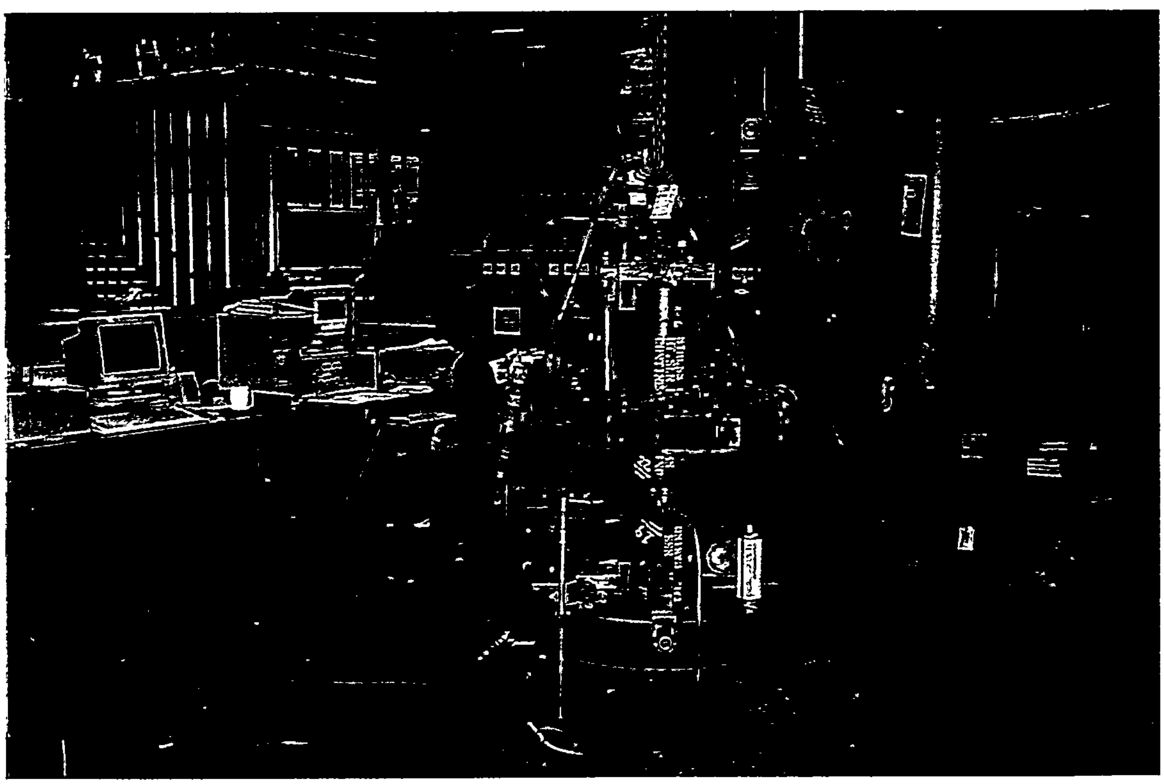
NEW PIN THREADS



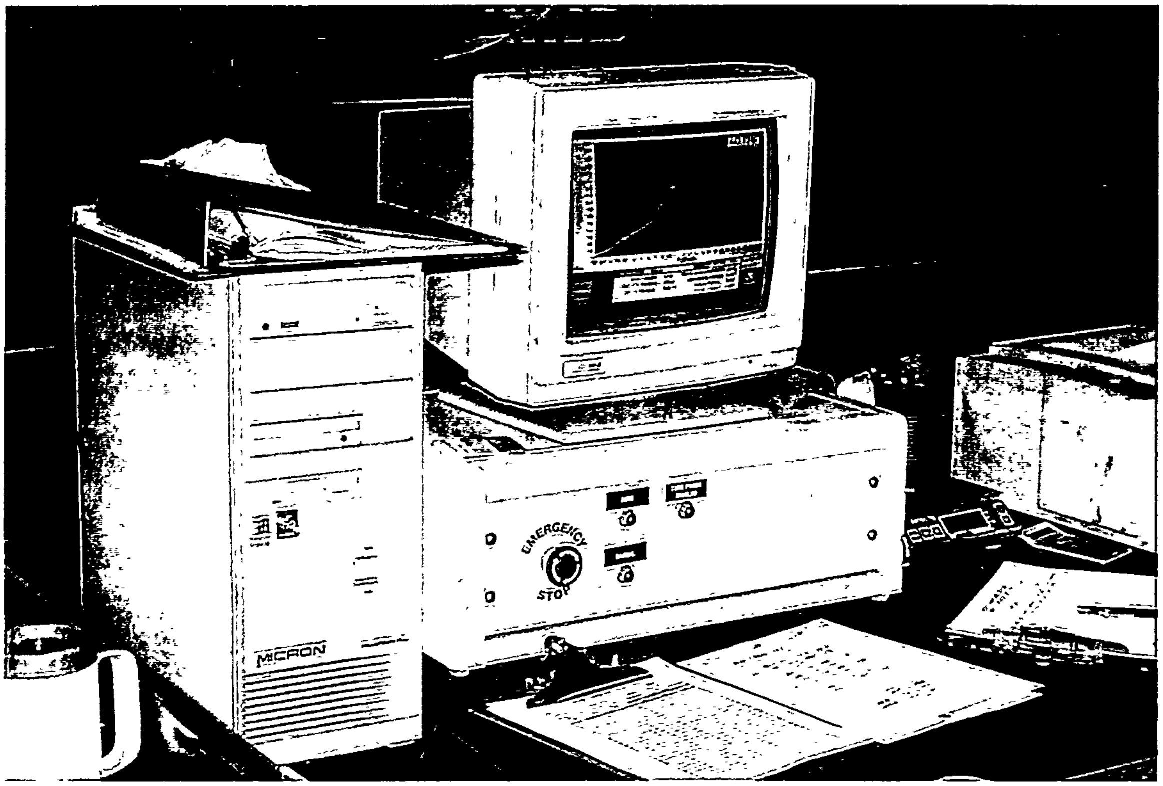
NEW BOX THREADS



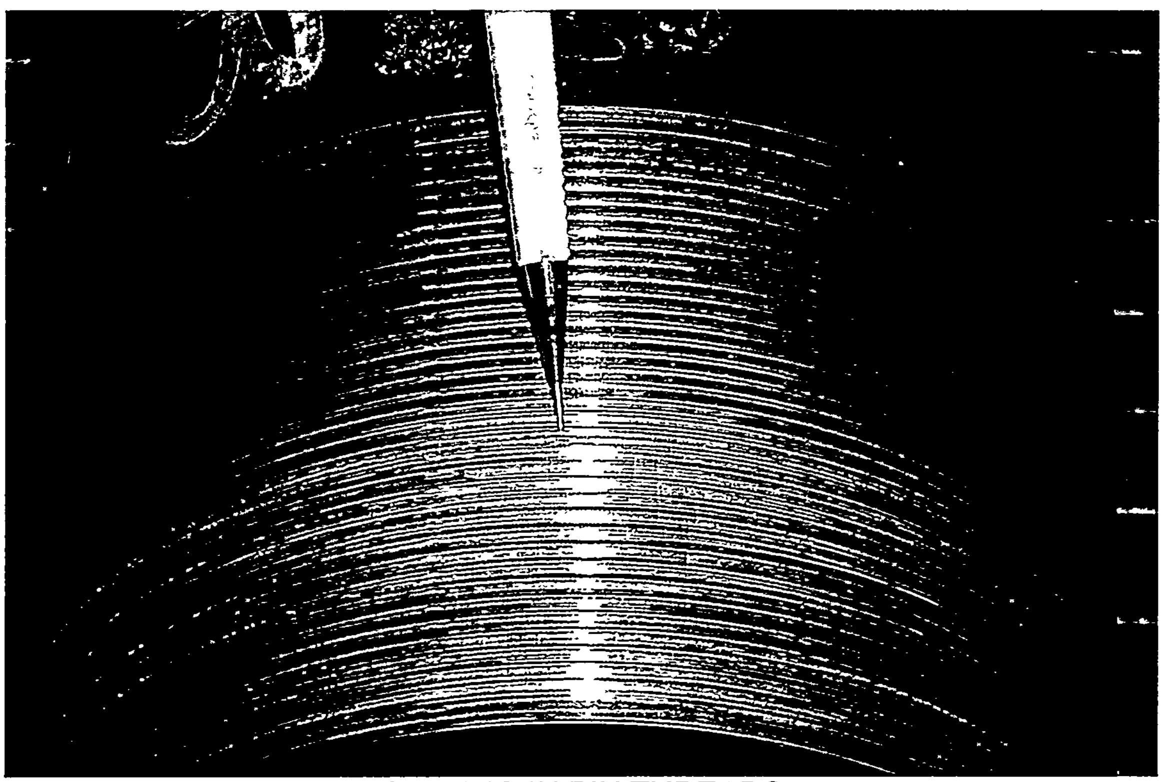
BOX WITH THREAD LUBRICANT APPLIED BEFORE ASSEMBLY



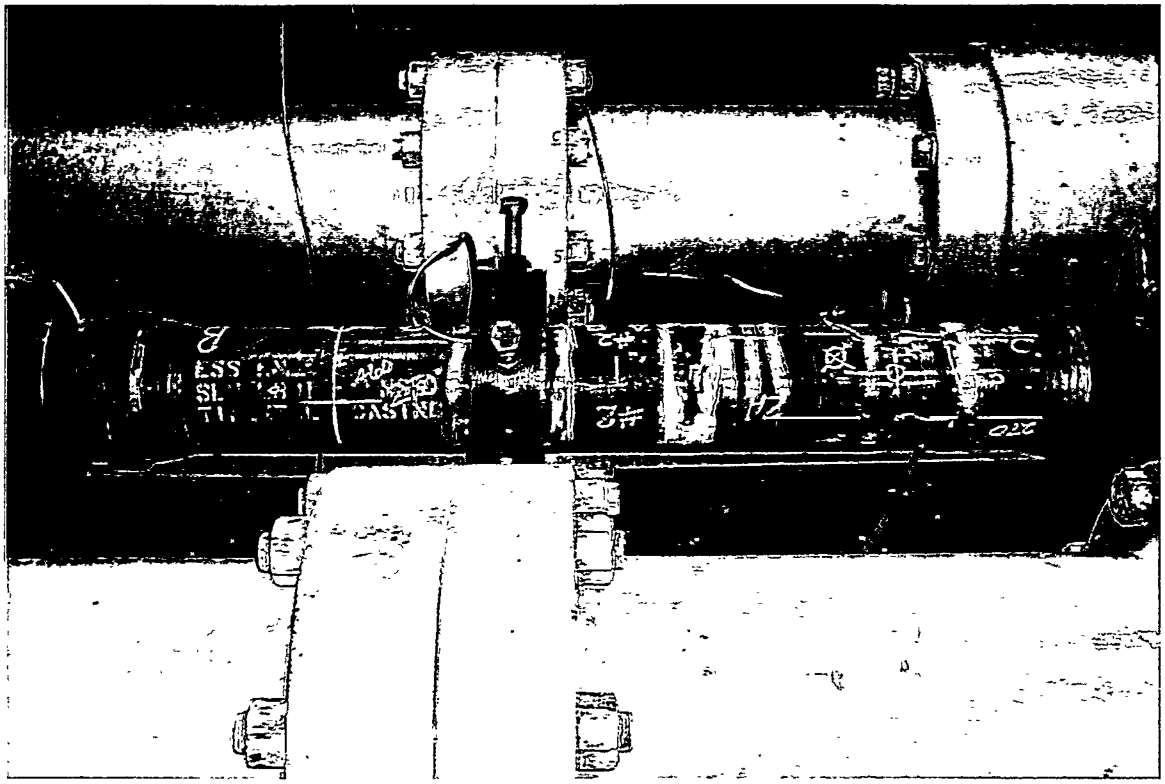
POWER TONG USED FOR MAKEUP/BREAKOUT



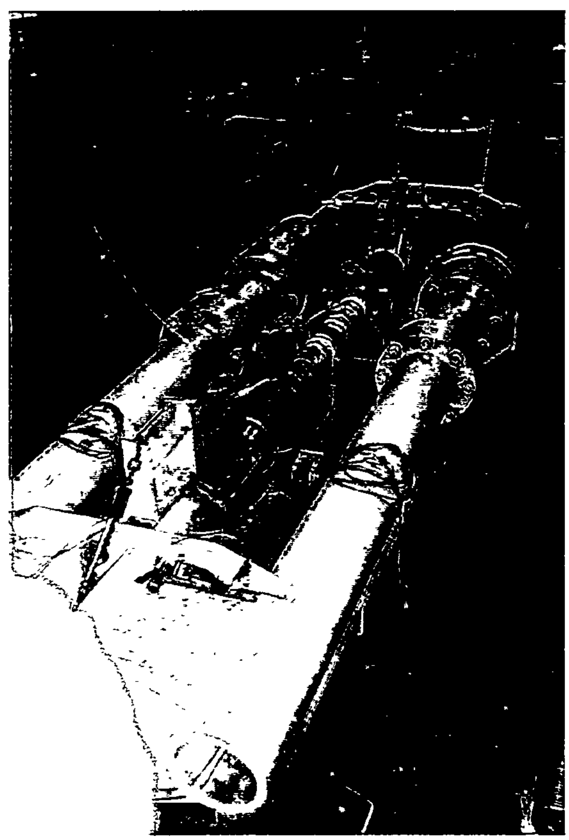
COMPUTER CONTROL FOR MAKEUP/BREAKOUT

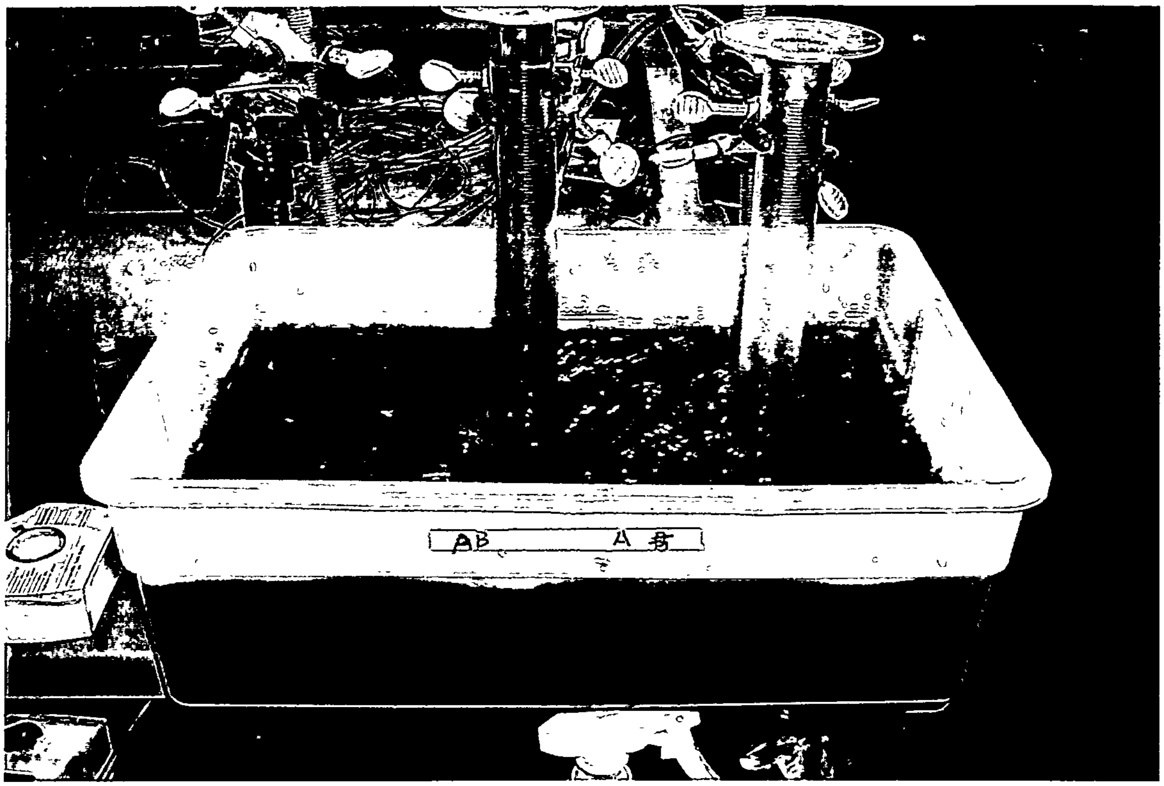


GALLING IN PIN THREADS

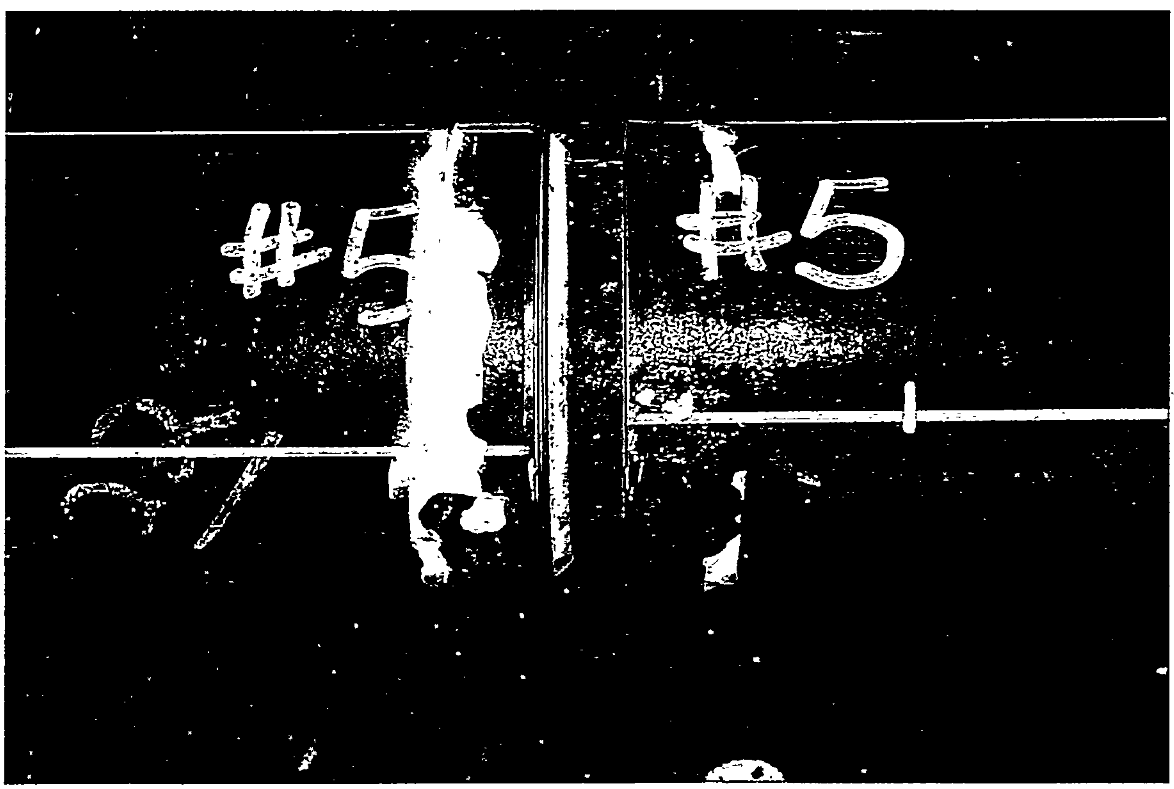


SAMPLE SETUP FOR SERIES B TEST

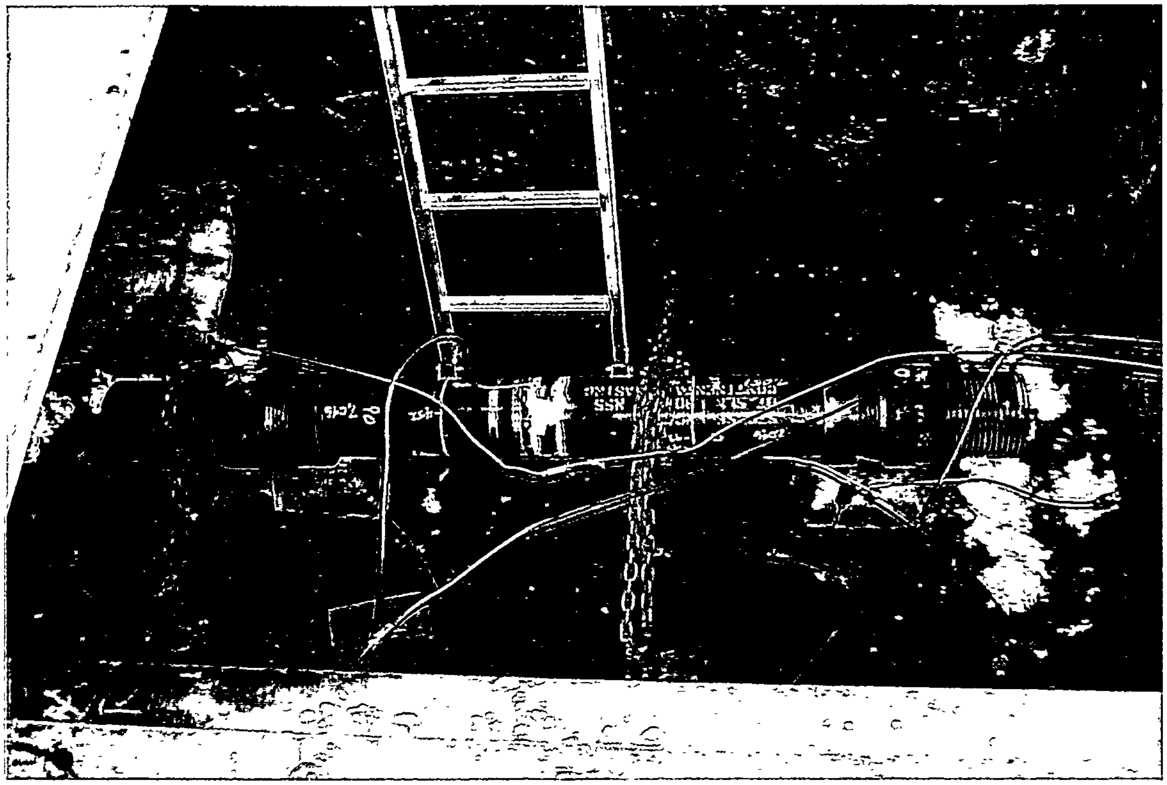




LEAK SHOWN BY BUBBLE TUBE



SAMPLE 5 FAILURE



SAMPLE 6 FAILURE TEST