Sure-Lock Mechanical Pipe Joint

Contents

1.0 Executive Summary

Sure-Lock mechanical pipe-joint technology is an alternative to welding which permits outstanding productivity, and achieves in excess of two kilometers of joined pipe per day in diameters ranging from 2-24 inches and schedules 20-80. These statistics produce linear pipeline results that are up to 10 times faster than the traditional method of welding, whether using externally coated, internally coated or non-coated pipe. Unlike welding, the mechanical joint process uses no heat to form or join the pipe. As a result, the chemical and mechanical properties of the pipe are retained. In addition, the need for expensive and time-consuming X-rays and re-working of defective welds is avoided. A further advantage of the Sure-Lock joint is its ability to deliver a "holiday-free" connection when using internally coated pipe without the need for extra processes, steps, time or materials. Given that the Sure-Lock joint process requires no application of heat, it has a distinct safety advantage when a new pipeline is being built in the proximity of existing, operating lines.

Given its features, the Sure-Lock mechanical joint provides extensive benefits by dramatically reducing the pipeline owner's "time to market" of its product and by dramatically reducing construction costs, all while reducing environmental emissions and increasing safety.

This brochure contains Sure-Lock's technical specifications and QAQC certification, test results, case history and supporting evidence for the integrity, compliance and dependability of the Sure-Lock mechanical joint. Also included are indicators of Sure-Lock's outstanding environmental performance, and outlines regarding the case history of our most recent project in Colombia as well as the approvals of PEMEX in Mexico and Tatweer Petroleum in the Kingdom of Bahrain.

The approval of Sure-Lock's mechanical joint technology for use in pipeline construction will permit a pipeline owner to deliver its product to market expediently by deploying new lines faster and drastically reducing down-time on the replacement of old pipelines. Equally important; the end user can be confident that the resulting pipeline will safeguard the environment given that the Sure-Lock mechanical joint has experienced not a single failure in service since its inception over 35 years ago.

2.0 Sure-Lock Technology

2.1 History

Sure-Lock Mechanical Joint technology was launched in Houston, Texas in 1977. The technology was successfully introduced in the Former Soviet Union thirteen years later in 1990 with outstanding results. The reliability of pipelines, and the speed at which they could be deployed was dramatically improved. To date, over 16,000 km of pipelines have been installed utilizing the Sure-Lock mechanical joint. Following introduction into the Former Soviet Union, The Sure-Lock mechanical joint was introduced in the Middle East, where numerous lines have been installed for Tatweer Petroleum in Bahrain. In addition, the Sure-Lock technology has been deployed in various parts of the Americas including Mexico and, most recently, Colombia where it was used to construct a 200km 16' natural gas pipeline in record time.

The Application

The Sure-Lock mechanical pipe-joint has pressure, mechanical and fatigue strength suitable for the same service as welded joints. The cost of a Sure-Lock joint is competitive with welding, however, separate inspections are not required and installation rates are up to ten times faster.

Typical applications include gathering and distribution systems, transmission lines and specialized pipe installations on land and offshore. Thousands of kilometers of pipe have been joined using the Sure-Lock process under a wide range of operating conditions. Sure-Lock pipe joining machines have performed on virtually every type of terrain, under severe weather conditions and in hostile environments. They have been used to install portions of offshore pipeline systems and in joining both internally and externally coated pipe.

The Process

The Sure-Lock mechanical joint involves two components; (i) the interference (metal-to-metal) fit achieved by inserting an oversized tapered end into an undersized bell end; and (ii) the epoxy seal. The interference fit is responsible for keeping the joint together, while the epoxy is responsible for keeping the joint from leaking.

The Sure-Lock process begins with a bell, or expanded area, which is formed on one end of a joint of pipe, and a taper which is formed on the opposite end. Given that the Sure-Lock pipe preparation equipment is entirely self-sufficient and mobile, this part of the process can be performed on location at a pipe mill, coating plant or any other location specified by the customer.

Each end of the pipe is formed to exacting specifications required for the Sure- Lock joint. Sure-Lock assembly equipment is used to force together the belled end of one length of pipe and tapered end of another. A thin coat of Sure-Lock epoxy is applied on the pipe-ends to be joined. The epoxy serves as a lubricant which assists in the insertion of one pipe into another. Most importantly, though, the epoxy collects within the space between the tapered end of one pipe and the belled end of the other to form the seal which is responsible for creating a leak-free connection.

The Results

The Sure-Lock process produces strong, permanent joints which can be used in the same pressure service as welded lines. This allows the pipeline system design to be based on 100% joint strength. Extensive independent evaluations under varied laboratory test conditions and in-service performance records have proven the Sure-Lock joint to be strong, reliable and leak proof. The Sure-Lock method can be used to join thin wall pipe which cannot be easily welded; and the Sure-Lock joint can carry corrosive fluid without the vulnerability of threaded couplings, or damaged internal coating resulting from high temperature produced by welding.

The Advantage of Flexibility

Pipe ends can be prepared at the pipe mill, at the pipe yard, or at the job site and then joined by a Sure-Lock assembly machine in the field. Thin wall pipe can be joined by the Sure-Lock method in cases where welding would not be feasible. The Sure-Lock process requires less equipment and labor than conventional welding. It requires no special installation procedures or unusual auxiliary equipment. The Sure-Lock pipe joining unit is carried by a side boom tractor or mounted on a lay barge. Since only a brief training period is necessary, skilled craftsmen are not needed to operate the machine. Weather delays in construction are minimized because the process can be used under more extreme conditions than welding.

3.0 Sure-Lock Assembly Equipment

3.1 Equipment Specifications

Model M-26 Assembly Machine and Power Unit (API: 2-3/8”, 2-7/8”, 3-1/2”, 4-1/2”, 6-5/8”)
Model M-48 Assembly Machine and Power Unit (API: 4-1/2”, 6-5/8”, 8-5/8”)
Model M-812 Assembly Machine and Power Unit (API 8-5/8”, 10-3/4”, 12-3/4”)
Model M-1016 Assembly Machine and Power Unit (API 10-3/4”, 12-3/4”, 14”, 16”)
Model M-1620 Assembly Machine and Power Unit (API 16”, 20”)
Model M-2024 Assembly Machine and Power Unit” (API 20”-24”)

All machines are capable of joining in excess of 2km of pipeline per single day shift depending on terrain and specific characteristics of the project in-hand.

Model 1016 shown above.

Pipe Diameter Ranges

Assembly Machine	Diameter Range
M-26	2” – 6”
M-48	2” – 8”
M-812	6” – 12”
M-1016	8” – 16”
M-1620	14” – 20”
M-2024	20” – 24”

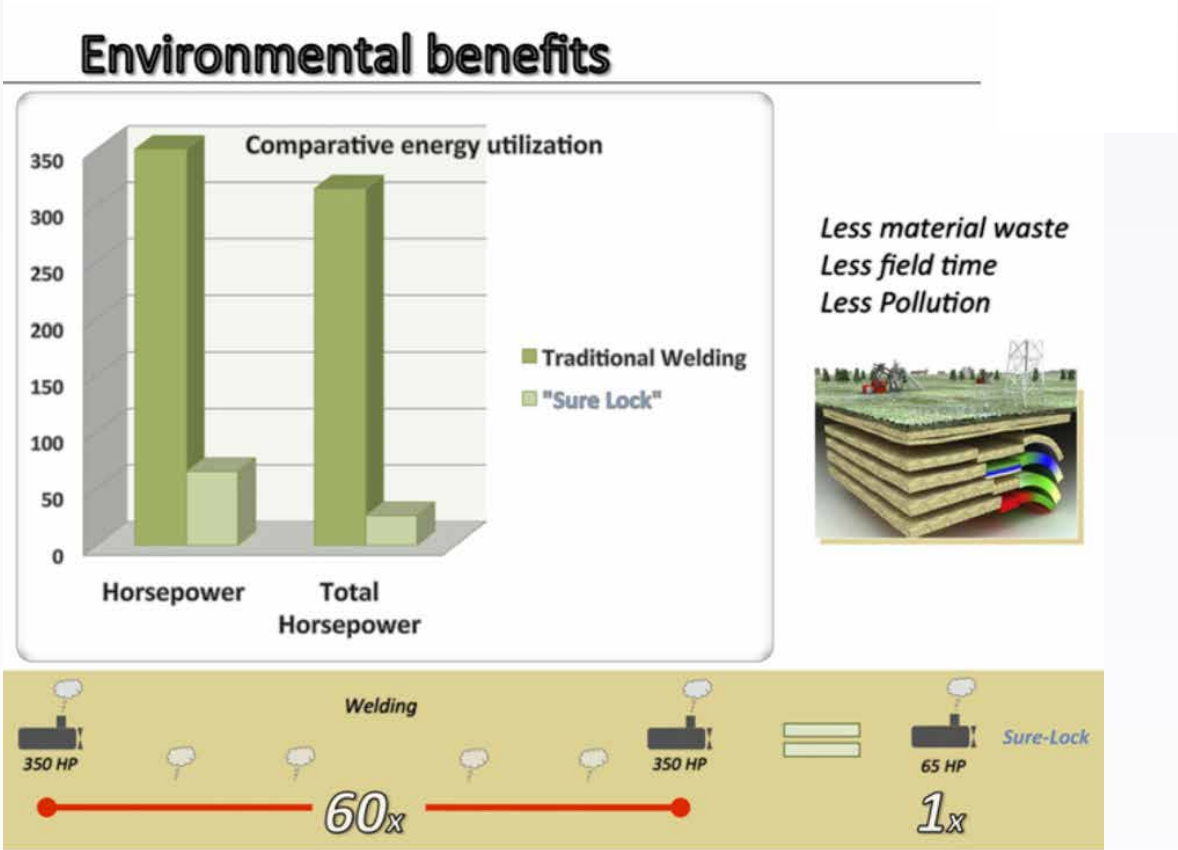
Larger equipment sets can be configured to join pipe that is 2” below their specified diameter range with the use of adapter kits.

4.0 Sure-Lock Epoxy

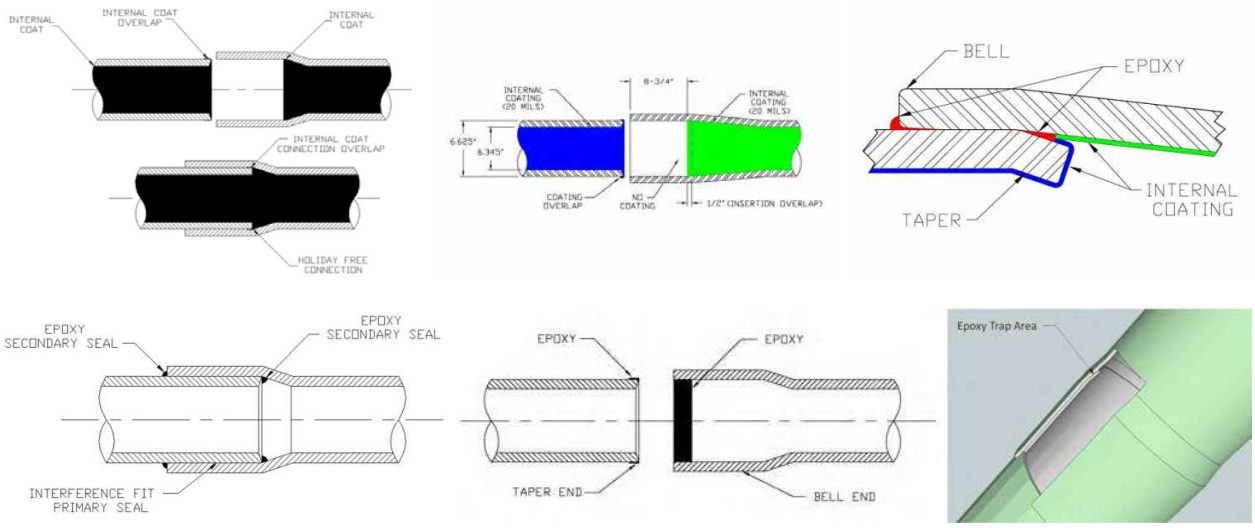
Sure-Lock epoxy has been specifically developed for use with the Sure-Lock mechanical joint system. The epoxy is inert when cured making it impervious to chemical attack and further allows the epoxy to create a “holiday-free” connection when using internally-coated pipe. In addition, the Sure-Lock epoxy is flexible, a property it retains indefinitely. This allows the seal created by the epoxy to expand and contract together with the pipe thus ensuring an indefinite “leak-free” joint.

5.0 Environmental Performance

In nearly 34 years and after more than 16,000km of Sure-Lock installations, the technology has maintained a 100% track record of “Zero-Failures in Service.” Sure-Lock mechanical joint technology is simply cleaner, faster and outstanding in its environmental measures and performance:



6.0 The Sure-Lock Mechanical Pipe-Joint Process

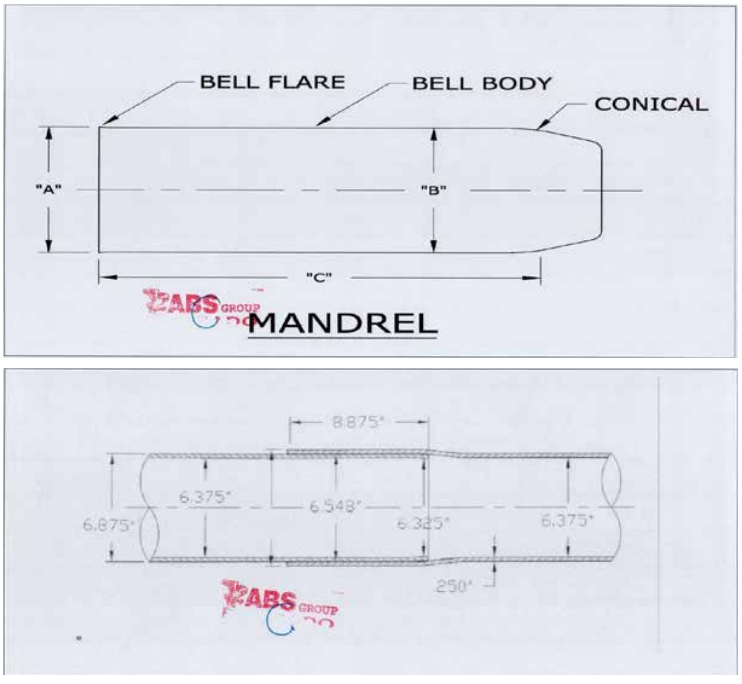


1.1. Belling

Bell-end preparation must be performed before internal coating of the pipe, and preferably before external coating. Three-layer polyethylene external coating may be applied before end-preparation but will require a 23” cutback of coating from each end of the pipe.

The bell-end is formed by forcing a lubricated mandrel into one end of the pipe. The mandrel is shaped to leave a bell-end with a uniform taper and with a short lead-in flare. The mandrel size is the same for all wall thicknesses.

The belling of pipe involves substantial elasticity strain. A lubricant is used to prevent galling between the mandrel and the pipe, to reduce the force required for belling and to minimize wear on the mandrel. A water soluble lubricant is suitable for all but the largest diameters and heaviest wall thicknesses.



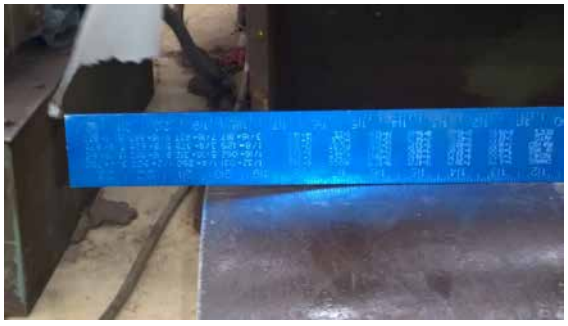
Following belling, the lubricant must be removed from the internal portion of the pipe and the soundness of the belled end should be checked visually.

Each mandrel size has specified tolerances for each pipe size managed by the Sure-Lock system.



1.2. Taper

The taper-end is formed by forcing a swedge over a short section of the opposite end of the pipe from where the bell has been formed. The slight reduction in diameter of the taper-end is intended to allow easier insertion into the bell-end and further allows the formation of a small pocket in which the epoxy collects to form the epoxy trap which seals the mechanical joint.


1.3. Pipe Assembly

Assembly involves inserting the prepared taper-end into the belled end to a controlled depth. Prior to assembly a small amount of premixed epoxy lubricant is applied around the full circumference of both ends. The depth of insertion is dependent on the circumference of the pipe to be joined (larger diameter = more insertion), is pre-marked on the taper-end and is controlled manually. The amount of interference is slightly more than elastic interference.


2. The Science behind the Mechanical Joint

The Sure-Lock joint is a controlled interference fit.

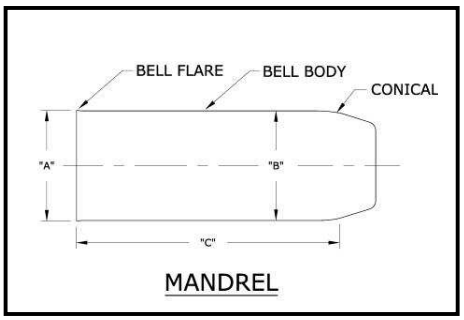
Like modern steel structures, it utilizes the strength of not only the elastic range but also the elasticity range of modern steel.

It also utilizes the particularly flat shape of the stress - strain curve of modern pipe steel under hoop expansion. This stress strain curve is significantly flatter than the “classic” view of the stress strain curve explained in basic introductions to materials technology.

A typical stress strain curve for a pipe hoop is shown on the attached graph which shows the typical stress strain behavior during belling and assembly of 4 ½ OD pipe with a wall thickness of .188”.

2.1. Belling

During the belling operation, the mandrel is forced into the pipe causing the pipe to expand. The internal diameter is increased and the pipe is strain hardened so that its normal yield stress is increased by approximately 9.1%.



MANDREL

The mandrel is sized so that after belling, the internal diameter will be smaller than the minimum outside diameter of the corresponding taper end.

When the mandrel is withdrawn, the pipe experiences elastic recovery (spring-back) with the strain (the distance along the horizontal axis) at point C, less than the strain at point B. When the mandrel is completely removed, the material will be at point C. The belled pipe-end has now yielded by 7% and has a higher yield point caused by the strain hardening effect.

The stress in the bell is zero after the mandrel is removed - the strain remains as the pipe has yielded. The pipe is belled in advance of pipe joining so that an entry flare is achieved to facilitate pipe jointing and so that the joining forces required in the field are minimized.

2.2. Joining

When the tapered end is forced into the bell during assembly, the taper end acts as a mandrel and causes the bell to expand further. Because the taper is not removed, there is no elastic recovery and the bell pipe material clamps the taper with a force related to the force required to cause the strain hardened bell to yield to accommodate the forced-in taper. At the same time, the tapered end is compressed and experiences similar, compressive stresses. The tapered end does not experience plastic yielding because it is of smaller diameter than that bell and therefore has higher hoop strength (hoop strength is a function of diameter and wall thickness). Because the tapered end always remains elastic and does not yield plastically, it undergoes minimal strain and, therefore, **does not result in reduction of pipe internal diameter.**

2.3. Epoxy Seal

Sure-Lock epoxy allows pipe assembly to take place without galling or damage to the metal. Once the epoxy cures, it creates a flexible seal which keeps the product in the line from escaping.

Sure-Lock utilizes different grades of epoxy depending on the intended temperature of line service.

Sure-Lock epoxy is available in various formulations which provide a 100% corrosion-resistant joint seal under extreme cold or hot weather conditions.

- Sure-Lock Warm Temperature Flex epoxy 105 is a highly workable mechanical pipe joint epoxy compound used exclusively for the Sure-Lock mechanical pipe joining system. Application temperatures range from [10 to 43°C] and have an initial set time of (@ 25°C) 60 minutes and a full service set time of 24 hours. It is important to note, that pipe joints can be handle tension/pull stress immediately after joining but, should not be hydrostatically tested for at least 24 hours.

- Sure-Lock Cold Temperature Flex epoxy 106 is a highly reactive polymeric mechanical pipe joint epoxy compound used exclusively for the Sure-Lock mechanical pipe joining system. Application temperatures range from [-18 to 35°C] and have an initial set time of (@ 25°C) 10 minutes and a full service set time of 24 hours. It is important to note, that pipe joints can be handle tension/pull stress immediately after joining but, should not be hydrostatically tested for at least 24 hours.

3. Hydrostatic Testing and Operating Stresses

As the pipe is pressured during hydrostatic testing, the taper and bell share the load. The taper is in compression and any high internal pressure will cause a circumferential tension in the taper wall. The compression in the taper wall is reduced but because the taper and bell share the load, the taper always remains in compression even if the internal pressure is equivalent to 100% SMYS.

Pressure Test (325mm OD x 8mm Wall)
152 ATM / 2234 PSI

The bell is in tension even without internal pressure in the pipe. When the pipe is pressured internally, this tension in the wall of the bell is increased and the bell wall may yield further. Although the bell yields, it still retains its strength (the stress strain curve) and the amount of yielding is limited to the strain experienced by the taper.

The strain experienced by the taper is minimal because the material of the taper is always in the elastic range and therefore the strain experienced by the bell is minimal. As a result, the joint remains strong and will not fail when adding internal pressure to the pipe.

4. Influence of Tolerances

A minimum interference fit is achieved by making the size of the mandrel smaller than the minimum size of the pipe which may be inserted into the bell formed by the mandrel.

Because the minimum interference is designed to meet the elasticity yield the bell on joining, the maximum interference fit involves a slightly larger amount of yielding; the clamping force is almost independent of tolerances, provided of course, that interference is achieved.

The assembly strain will vary with the diameter and wall thickness tolerances of the pipe ends. The variances in these will affect the clamping force without the addition of significant yielding. It takes little additional force (stress) to cause extra elasticity yielding (strain). Because the increment of that force is relatively small, the resulting incremental differences of clamping force are hardly affected by the amount of strain produced.

Therefore, the Sure-Lock joint can cope easily with a wide range of pipe dimensional tolerances. Provided the tolerances are such that belling and joining are possible, a sound Sure-Lock joint is achieved.

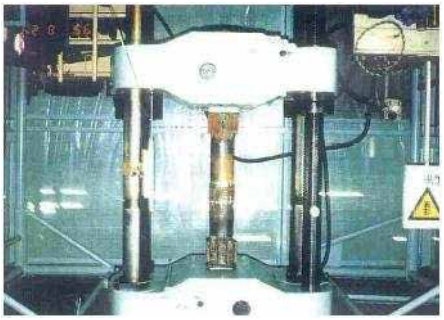
Stress Capacity of Sure-Lock Joints

5. Pressure Strength

Joints made with the Sure-Lock method have design pressure strength equal to the pipe from which they were made. This pressure strength is retained in the presence of external forces within the elastic range.

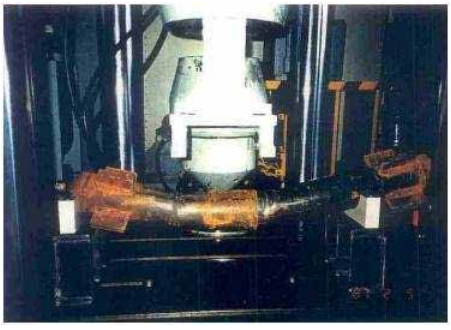
6. Tensile Strength

Joints made with the Sure-Lock method have a tensile joint strength approximately equal to the specified minimal yield stress of the pipe from which the joint is made. Joints made with the Sure-Lock method may be subjected to design loads equal to 90 percent of the SMYS of the pipe joined. A tensile load of this order implies a tensile strain of the pipeline in the order of 5/8 inch per 40 foot pipe length for X-42 pipe. The tensile strength of the joint is improved by internal pressure, and may exceed actual yield of the pipe.



7. Bend Strength

Joints made with the Sure-Lock method may be subjected to the same design bending movements as straight pipe. Bending stresses which do not cause the adjacent pipe to yield or be dented, do not affect the joint integrity, pressure strength or leak tightness of the joint.



Compliance and Codes

8. Fatigue Strength

Within the limits permitted by the pipeline codes, joints made with the Sure-Lock method have the same resistance to pulsating pressure as pipe from which they have been made. A special inquiry to test work may be required where the joints are to be subjected to severe fatigue loadings in tension or bending, but the joints made with the Sure-Lock method will have fatigue strength comparable to welded joints in most circumstances.

9. Combined Stresses

Many combinations of stresses are possible and the combination of stresses is controlled in most pipeline codes. Joints made with the Sure-Lock method are suitable for all combinations of stresses which comply with pipeline design codes.

Torsion

10. Compliance and Codes

The Sure-Lock mechanical pipe joint system has been successfully utilized in the United States for more than 33 years and Russia for more than 20 years in compliance with local norms and regulations. The Sure-Lock mechanical joint and related equipment have been designed and tested to achieve full compliance with the pipeline safety regulations of the U.S. Department of Transportation, Pipeline Safety Regulations (October 1, 1992):

Designation	Piping Code
ANSI/ASME	B31.3
ANSI/ASME	B31.4
ANSI/ASME	B31.8
U.S. Dept Of Transportation	49 CFR, Subpart F 192
U.S. Dept Of Transportation	49 CFR, Subpart F 195
CANADIAN	CAN/CSA - Z183
CANADIAN	CAN/CSA - Z184
GOSGORTECHNADZOR - RUSSIAN FEDERATION	LICENSE 10-25 / 618

11. Pipe Size and Wall Thickness

The following table summarizes the combinations of pipe grades, thicknesses and diameters which can be joined by the Sure-Lock process.

Sure-Lock equipment is currently available for sizes 2" through 24"and wall thicknesses up to schedule 80. Other grades higher than API 5l Grade X-60 may be acceptable but will require additional testing.

Minimum thicknesses are not limited by any aspect of the Sure-Lock method. Pipelines joined by the Sure-Lock method can be thinner than pipelines joined by most other methods because there is no heat affected zone. .060 inch wall thickness pipe has been successfully joined using Sure-Lock equipment. Minimum thicknesses specified in design codes or by regulation may apply.

Maximum thicknesses are limited by the capacity of the Sure-Lock preparation machine used for forming the bell.

Pipe Size	2-3/8"	2-7/8"	3-1/2"	4-1/2"	6-5/8"	8-5/8"	10-3/4"	12-3/4"	16"
Maximum Wall (X-60)	.218	.276	.300	.337	.432	.500	.594	.562	.656

12. Steel Strength Grade

No specific limits apply to the maximum strength of the steel, but use of steels with specified minimum yield stress higher than X-60 is not common for the pipe of the diameter ranges which are commonly joined with the Sure-Lock method. A specific inquiry is preferred if the grade is above X-60.

13. Joining Pipe of Unequal Wall Thickness

When more than one nominal wall thickness pipe is used in a pipeline, Sure-Lock can be used to join the pipe of different wall thickness provided the heavier pipe is the bell and the lighter wall pipe is the taper end. If this is not possible, a short joint can be prepared where a short section of light wall pipe is welded to heavy wall pipe, N.D.T. performed and the short "joint" Sure-Lock connected into the pipeline where the change in wall thickness is required.

14. Pipe Specification (*API Spec 5L*)

Pipe to be used with the Sure-Lock method must meet all API dimensional and strength specifications. The pipe must meet elongation requirements for the grade purchased and must further meet elongation requirements for the full pipe circumference including the weld area of ERW pipe.

The Sure-Lock joint requires care during manufacture of the ERW pipe to ensure that trimming of the internal and external flash from the welding process is within (0.015 inches) of the true surface. The trim requirement applies to both external and internal weld flash lines.

The outside weld trim, or offset of plate edges should be preferably flush with the outside diameter of the pipe parent material. Undercutting or grooves in the outside weld should be avoided. The manufacturing tolerances of the pipe diameter and wall thickness must be equal to the tolerances required by API 5L specifications.

Pipe which receives a full length ultrasonic inspection of the longitudinal seam during manufacture is preferred. Given that belling and joining involve elongation below the material requirements imposed by API specifications, faults in the seam or pipe discovered during belling or assembly may be attributed to defects in the pipe manufacturing process, not to the Sure-Lock process.

15. Pipe Handling and Transport

In most cases pipe prepared for the Sure-Lock system should be layer loaded in order to protect the belled ends from damage in transit. This includes attaching a .25”rope loop around the belled end for offset protection.

Pipe end hooks may not be used for lifting. Lifting of pipe shall be performed by either a Pipe Sling, Pipe Grabs or Fork Lift.

16. Cathodic Protection and Pipe Locating

There are no special cathodic protection or pipe locating requirements for the Sure-Lock joints. Since the Sure-Lock connection is a metal to metal interference fit, there is no loss of electrical continuity throughout the pipe joint.

17. Hydrostatic Testing

The practice of testing petroleum pipelines up to actual yield has become common in many parts of the world, particularly for large diameter pipelines. Hydrostatic testing to actual yield has proven advantageous in eliminating faults in the pipeline which might affect future service behavior.

The integrity of the Sure-lock joints at pressures beyond yield had been established in numerous testing programs, though testing to actual yield of the pipe is not recommended given that yielded pipe is no longer suitable for pipeline service applications.

A maximum pressure equivalent to 80% of SMYS is preferred. Where testing is beyond 80% SMYS, a volume controlled test is required and a volume-strain limit of 0.2% offset is appropriate to unexpanded pipe.

18. Quality Control Pipe Manufacturing

The success of Sure-Lock joints depends on consistent compliance with three pipe manufacture features:

Pipe diameter tolerances

Pipe weld seam trim (ERW Pipe)

Pipe weld seam soundness (ERW Pipe)

Pipe should be procured to API Specification 5L, forty-fourth edition, effective October 1, 2008 or later.

Pipe mill inspection may be used to verify compliance with API Specification requirements. Provided the pipe meets API requirements, it will meet the Sure-Lock requirements.

18.1. Diameter Tolerances

Standard API pipe body tolerances must be achieved. The pipe circumference is to be checked to ensure that the average diameter meets the API tolerances.

18.2. Wall Thickness

The pipe wall thickness should be checked to ensure it meets API tolerances.

18.3. Weld Seam Trim (ERW Pipe)

The pipe long seam weld should be checked to ensure that the internal and external flash from the welding process is within 1/64 inch of the true surface.

Provided the weld upset (as opposed to flash) is rounded, this will flatten out on pipe end belling on most materials and it may not always be necessary for the upset to meet the tolerances, provided it does not produce a “channel” on joining.

The outside weld trim or offset plate edges should be flush with the outside diameter of the pipe material. Undercutting or grooves in the outside weld area should be avoided.

18.4. Ultrasonic Inspection of Weld Seam

The pipe should preferably receive a full length ultrasonic inspection of the longitudinal seam during manufacture. Care should be taken to ensure that the ultrasonic wave lengths are suitable for the wall thickness of pipe being manufactured.

19. Field Equipment Requirements

The most common method of assembly, the joint-to-joint method, requires several pieces of support equipment in addition to the Sure-Lock assembly equipment and power unit.

19.1. One (1) side boom to carry the Sure-Lock assembly equipment and to tow the power unit set on a trailer. Side boom shall be equipped with pipe bending shoe for field pipe bends.

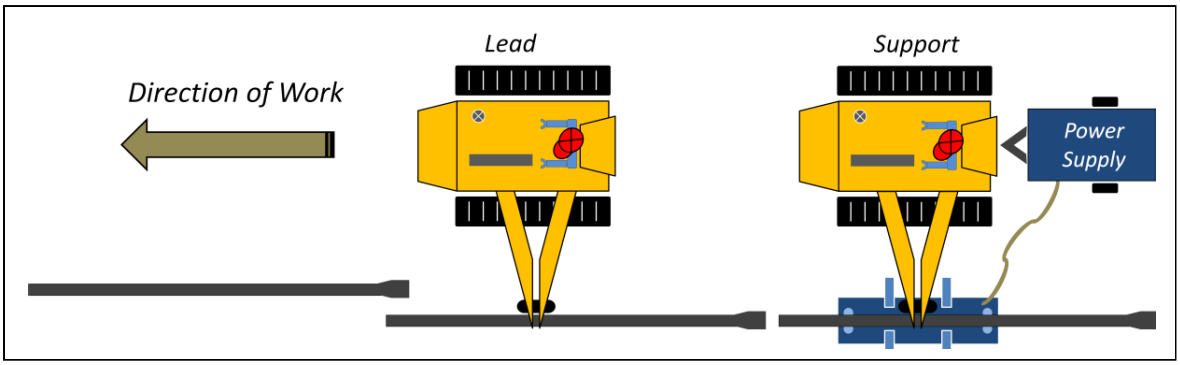
19.2. One (1) side boom to pick up one (1) joint of pipe to support the stabbing into the other joint of pipe. Side boom shall be equipped with pipe bending shoe for field pipe bends.

20. Pipe Layout

There are two methods for pipe layout and distribution at Right Of Way.

a) Lay pipe the length of the right of way route

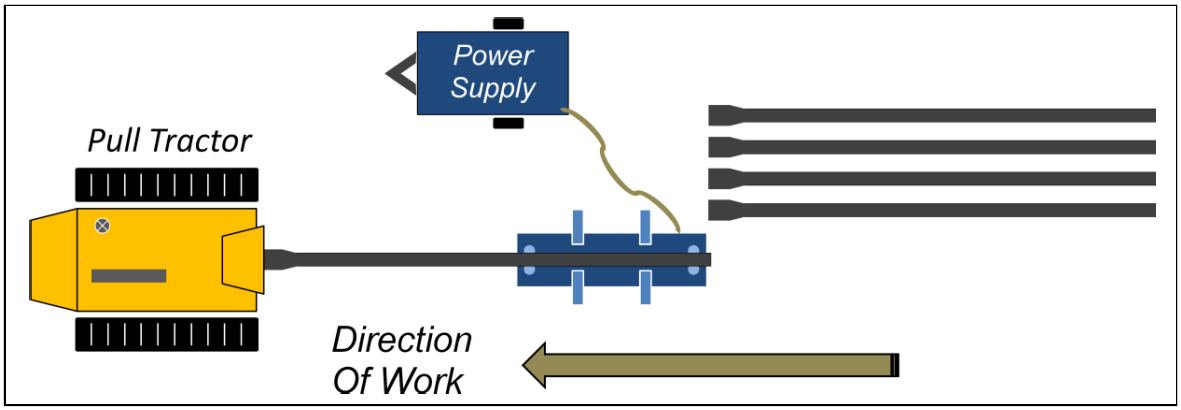
This method is referred to as the joint-to-joint method and is the most common method of mechanical joint assembly. Joint-to-joint assembly progresses down the previously distributed line of individual pipe sections with the lead vehicle moving pipe sections into the assembly machine mounted from the support vehicle. The method is shown in the following illustration.



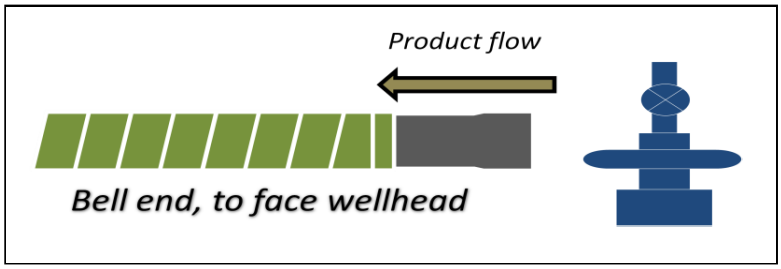
b) Stack pipe at a fixed location

This method is referred to as the Pipe Drag. Its use is normally limited to the joining of pipe sections which will be moved across an area of rough, hilly or swampy terrain that would be difficult to work through using the joint-to-joint method.

It is also utilized when weather conditions are poor and a stationary fix location is a safer alternative to traveling along the right of way. When this method is used, the machinery is stationary and the pipe sections are brought to the machine. As each new section is joined, the group of joined sections is pulled away from the assembly machine making room for the next pipe section to be added to the growing length of joined pipe. The joined pipe is at the desired or maximum length, it is pulled to the desired location. The method is shown in the following illustration. Generally the maximum length of the joined pipe that can be pulled is 400 to 800 meters depending on the terrain and size of support equipment (side-boom).

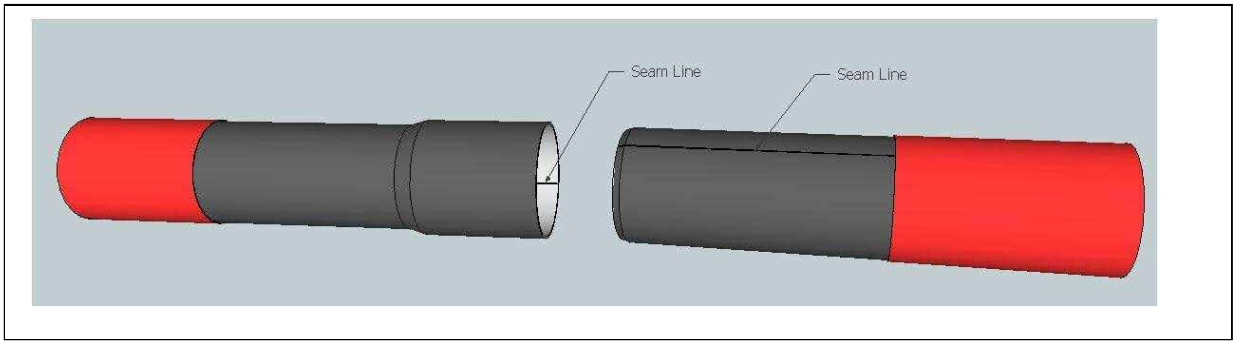


20.1. Direction of Fluid Flow originates from the end of the pipe formed as the Bell, shall face the well head. Product fluid shall flow towards the direction of the taper.



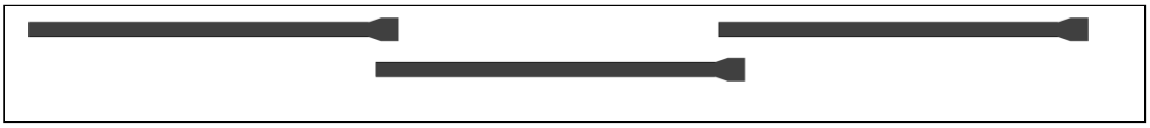
20.2. ERW pipe

When using ERW pipe, stagger (offset) seam lines to ensure that they will not align with one another evenly. Seam lines should be rotated away from each other. See illustration below.



20.3. Right of Way Pipe Distribution

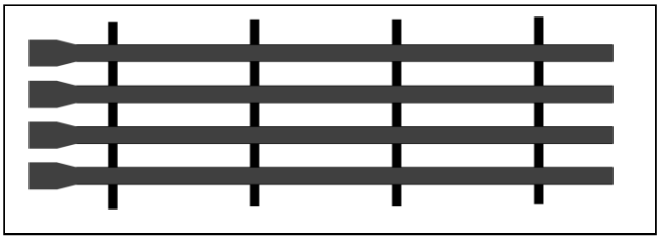
When laying out pipe along the right of way, overlap each pipe joint end the full length of the bell. See illustration below.



20.4. Pipe distribution (Stationary)

When setting up pipe for a stationary location, pipe shall be stacked on pipe racks. The number of pipe racks required would greatly depend on the amount of pipe to be installed.

Pipe rack height shall be equal to the same height of the Sure-Lock assembly equipment so that pipe set on the rack is at the same level of the assembly press pipe lifters. This will allow for easy pipe insertion and pipe drag operation. To perform this operation it is preferable that pipe roll from the pipe rack onto pipe rollers which are at the equal height of the rack. Once pipe is on the rollers, the pipe can then be rolled onto the assembly press rollers and into insertion position ready for clamping and joining.



20.5. Epoxy Mixing and Application Volume Usage

The warm weather epoxy has a pot life of approximately 40 minutes at temperatures above 25°C. Enough epoxy should be mixed to service two (2) pipe joint connections.

The Sure-Lock epoxy is a two part epoxy:

a) Hardener (Black)

b) Resin (White)

Epoxy is mixed on a one-to-one basis (50% - 50%), in a plastic container.

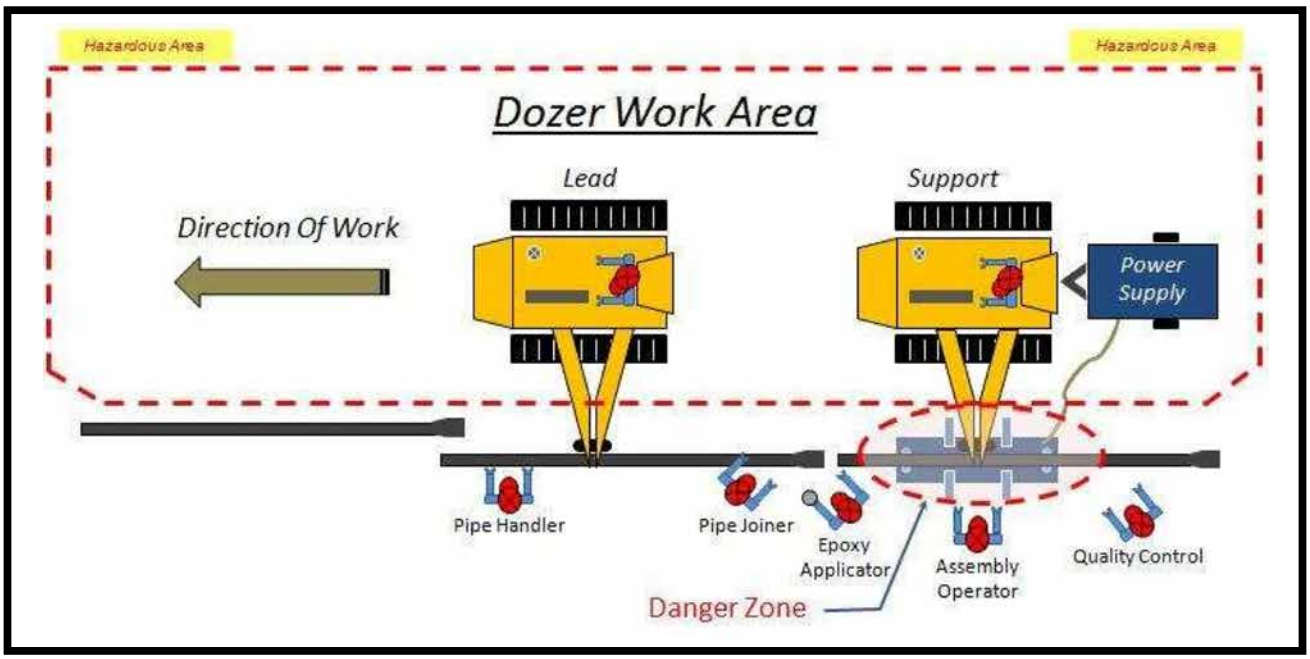
20.6. Pipe Depth Insertion Marking

Once pipe has been distributed along the right of way, pipe must be marked with a welders white chalk at the insertion depth.

Insertion Depth Marking

20.7. Assembly Procedures

Assembly procedures begin with the assembly system, support equipment and personnel in the field. The following illustration shows the typical layout of equipment and personnel.



7.0 Third Party Quality Certifications

ABS Group
SERVICES DE MEXICO, S.A. DE C.V.

DuVal Partners, LLC
16107 Kensington Dr.,Suite 406
Sugar Land Texas 77479
Tel. (512) 785-3414

At´n
Oscar Carmona/Eduardo Perez
VP Finance

Ref: PID2364983,10-3450-MX-01
REFERENCE: "Certification of Mechanical Joint Testing" **"*SURE* - LOCK"**

In reference to the certification services provided during 12th thru 16thof May 2010. The objective to testify and certify the **"The process and installation of the mechanical joint SURE-LOCK"** in a line pipe of 6" diameter x 0.6 Km of length. The pipe used as per specification NRF-001 PEMEX/Spec API 5L. This line denominated oil conducting pipe Fubreros located in sector 8 O.T-102 document # PEP-SRN-GCYN-0422-2010

This certification company has concluded the onsite inspection and by witnessing the testing of the hydrostatic testing and visual inspections conducted in accordance to (PEP) Pemex Exploration and Production specifications (norms) and thus consistent with DuVal Partners process manual "first phase"

As a result from the field test ABS Group Services de México requests the following information:

1. Hydrostatic tests official documentation
2. Technical information and documentation obtained on pipe ends (bell and taper)
3. Map of the field and existing mechanical joints
4. Document reflecting any non-conforming work, observations and recommendations
5. Document conforming machine pressures
6. Model and certificate information on the machines used to perform the SURE-LOCK mechanical joints

The indicated information is part of the certification of the Mechanical Integrity for the joints which make up the line pipe or conducting line. This line use to manage and transport hydrocarbons from Furbreros field connecting to a recollection head and for such reason is considered as the "first phase" as the "second phase" will focus on the lab testing and results needed to be done in accredited laboratories.

Cont.

EnglishTranslation

ABS Group
SERVICES DE MEXICO, S.A. DE C.V.

For Pemex/PEP the use of mechanical joint SURE-LOCK is a new innovative process and it is therefore necessary to guaranty the mechanical integrity by performing mechanical tests proposed by DUVAL and also to ensure the material microstructure due to cold expansion to the formation of the bell as well as the measurement of hardness / hardness at the points of inflexion.

Among other things this testing must have a quality dossier on the installed line by CDI. In which it includes engineered cathode protection.

At all times ABS Group would be prepared to emit a final report of the inspection as well as certificate of MECHANICAL INTEGRITY. As per the guidelines applicable SPEC. API 5L, NRF applicable, SPEC DUVAL mechanical joint process, SURE-LOCK, as well as the line pipe.

INSPECTION AND WITNESSED BY:

INSPECCION REALIZADA SIN PREJUICIO.

ING. J. ARTURO HUERTA ATENCO
REPRESENTANTE TECNICO
ABS GROUP SERVICES DE MEXICO, S.A. DE C.V.

EnglishTranslation

ABS Group
SERVICES DE MEXICO, S.A. DE C.V.

Mexico City, July 7, 2010

DuVal Partners, LLC
16107 Kensington D, Suite 406 Sugar Land
Texas 77479Ph (512) 785-3414

Attn.
Oscar Carmona/Eduardo Perez

Ref: PID2364983,10-345-MX-02
Hydrostatic Test Certification of the
SURE

In reference to the ***CERTIFICATION*** SERVICES to the ***-ABS Group Services de Mexico*** has been carried out from the day May 12 2010 Inspection, revision and verification of the work performance for the construction of the conduction line with specification NRF-001 PEMEX/Spec API 5L letter PEP-SRN-GCYN-0422-2010. O.T- 102 OF CDI.

As part of the Inspection activities ABS Group of Services de Mexico declares under penalty of truth and based on the Normative Frame ***NRF 030 PEMEX 2007, API 5 L 44 Edition, NOM-007- SECRE-2004.,*** that has been carried out on witnessing in field of the Hydrostatic Test as well as in laboratory of one specimen assembled with ***Sure-lock*** union.

1. Results obtained in the field are as follow:

Date	Hydrostatic Test	Duration	Result	Observations
15-05/2010	21 kg/cm2	24 hrs.	Acceptable	See Note 1 Note 2 Fig. 1
16-18-05/2010	21. kg/cm2	48 hrs.	Acceptable	As per ABS' requirement the test is running for 24 hrs. and as per PEP's supervision requirement the test runs for 48 hrs. See notes 3,4 See fig. 2

ABS Group
SERVICES DE MEXICO, S.A. DE C.V.

Mexico City, July 7, 2010

Note 1 In joint 28 a leak/humidity was presented minor to 0.1 ml in 10 seconds, the Sure-Lock System was corrected itself due to a two (2) Reasons (1) The Epoxy Resin got dry/time to cure. (2) The stress in the line was rearranged in the point of leakage due to the effect of hook law.

Note 2 In Figure 2 pressure is plotted (P) blue line (bottom) and temperatur e (T) red line Top, the behavior of the pressure to 24 hrs. is an unstable tendency but proportional P vs. T. this trend was due to the high temperature during the day and low temperature during the night and the presence of trapped air.

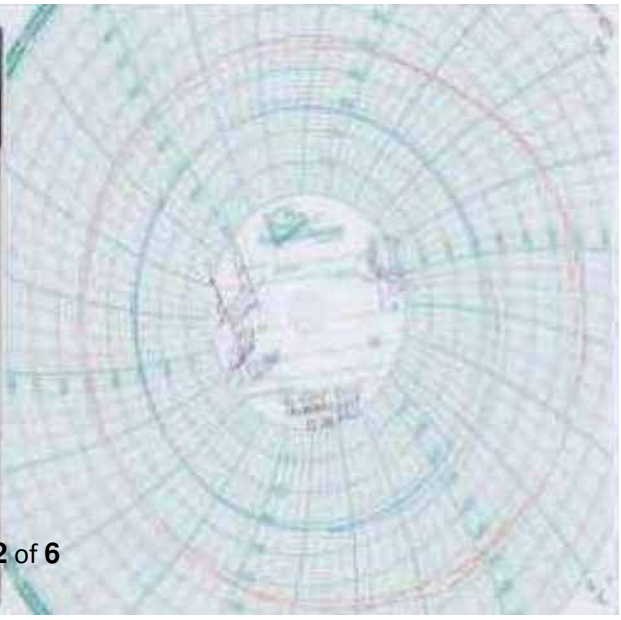
Note 3 In Figure 3 pressure is plotted (P) blue line (bottom) and temperature (T) red line Top, the behavior of the pressure to 24 hrs. and 48hrs is a stable tendency and proportional P vs. T. this trend was due to there was no temperature drop and keep high it can be seen beginning in 23.1 kg/cm2 to 24 hrs. and finish 26.6 kg/cm2 to 48 hrs. the pressure finish to 21 kg/cm2 due to temperature drop as well.

Note 4 The temperature in day one of the test begins in 60 units and finish in day 3 in 60 units reaching the initial condition.

Note 5 Only for the purposes of showing if indeed the leak in the joint 28 was eliminated pressure was raised, no leak or humidity was detected. Due to changing weather conditions and there is presence of trapped air, the trend of the graphic is still proportional **P** vs. **T** the variations of **P** are primarily due to a bad purge of the line.

Fig. 1

Fig. 2



Mexico City, July 7, 2010

2. Hydrostatic tests in laboratory were conducted according to API 5L Edition 44 in the body of the pipe.

10.2.6 Hydrostatic test

10.2.6.1 Test pressures for all sizes of SMLS pipe, and for welded pipe with $D < 457$ mm (18.000 in), shall be held for not less than 5 s. Test pressures for welded pipe with $D > 457$ mm (18.000 in) shall be held for not less than 10 s. For threaded-and-coupled pipe, the test shall be applied with the couplings made up powertight if agreed, except that pipe with $D > 323.9$ mm (12.375 in) may be tested in the plain-end condition.

10.2.6.3 Test pressures for light-wall threaded pipe shall be as given in Table 24.
10.2.6.4 Test pressures for heavy-wall threaded pipe shall be as given in Table 25.

Table 24 — Test pressures for light-wall threaded pipe

Specified outside diameter D mm (in)	Specified wall thickness t mm (in)	Test pressure MPa (psi) minimum			
		Grade			
		L175 or A25	L175P or A25P	L210 or A	L245 or B
168,3 (6.625)	7,1 (0.280)	a	a	8,3 (1 200)	9,0 (1 300)

Table 25 — Test pressures for heavy-wall threaded pipe

Specified outside diameter D mm (in)	Specified wall thickness t mm (in)	Test pressure MPa (psi) minimum			
		Grade			
		L175 or A25	L175P or A25P	L210 or A	L245 or B
168,3 (6.625)	11,0 (0.432)	a	a	16,2 (2 350)	18,9 (2 740)

ABS Group
SERVICES DE MEXICO, S.A. DE C.V.

Mexico City, July 7, 2010

The result obtained in CIATEQ laboratory for the hydrostatic test are the follows:

Date	Pressure Test	Start Time	Result	Observations
1-07-2010	596 psi.	17:30	Acceptable	Pressure Drop 3 psi.
	1074 psi.	17:50	Acceptable	Pressure Drop 3 psi.
	1507 psi.	17:55	Acceptable	Pressure Drop 5 psi.
	2049 psi	18:00	Acceptable	Pressure Drop 7 psi.
	2502 psi.	18:08	Acceptable	Pressure Drop 7 psi.
	2956 psi.	18:30	Acceptable	Pressure Drop 5 psi. See Fig. 3 Fig. 4
	2956 psi. lowered to 300 psi	18:50	Acceptable	As per ABS requirement final pressure was (2956) then lowered to 300 psi and was held for 20 minutes

Mexico City, July 7, 2010

Fig. 3 Graphic Test

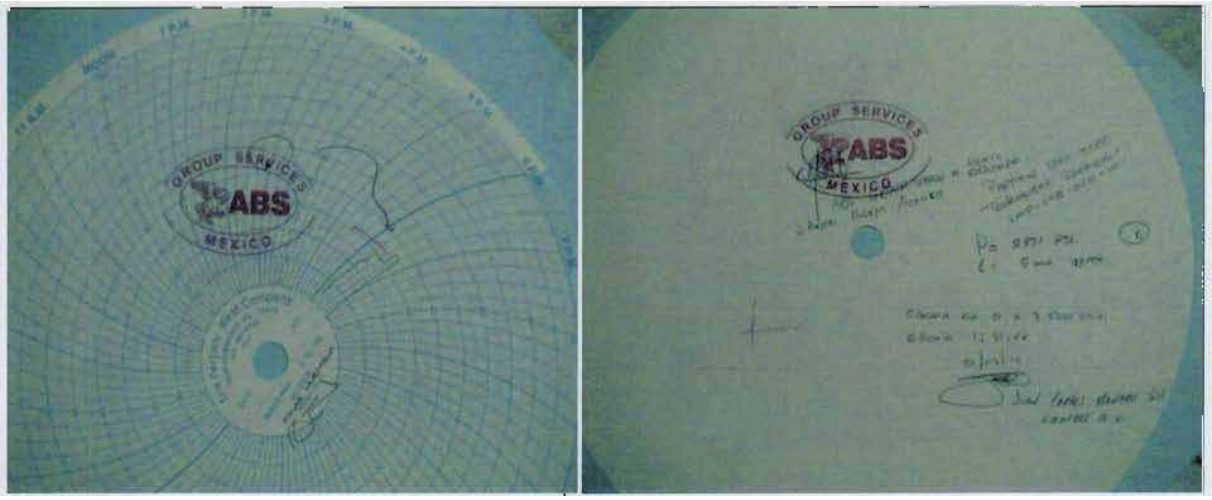
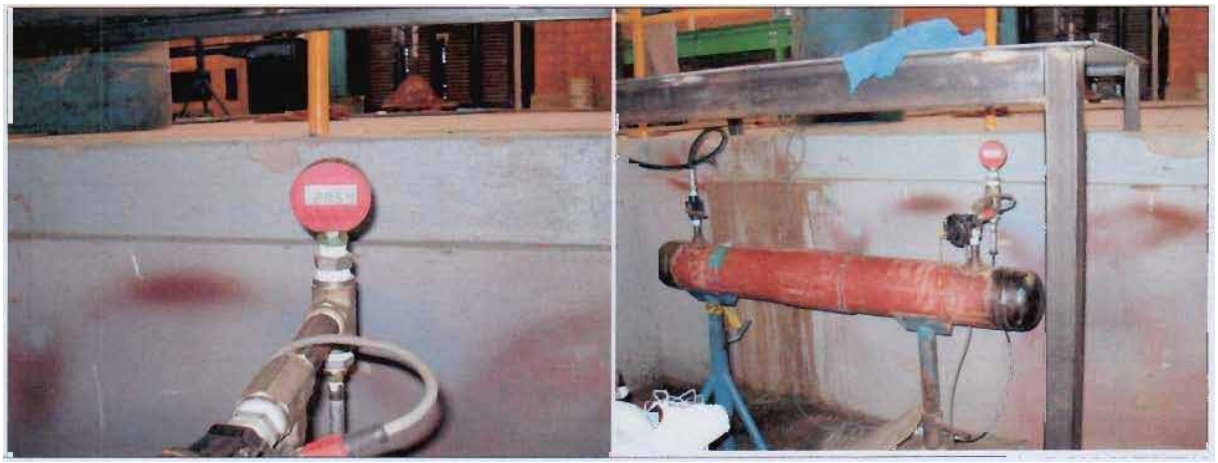


Fig. 4



ABS Group
SERVICES DE MEXICO, S.A. DE C.V.

Mexico City, July 7, 2010

CONCLUSIONS

Arising from the inspection and witnessing of nondestructive testing for hydro static Pressure ***ABS Group Services de Mexico states*** that hydrostatic testing carried out both on site as laboratory satisfactorily meet regulatory requirements of *NRF 030 PEMEX 2007, API 5L 44 Edition, NOM-007-SECRE-2004.,* no leakage detected in the ***SURE-LOCK*** *joint.*

Concluding that the leak detected on the joint 28 of the pipeline was due to lack of curing time and accommodation stress, since the sample made in the field was tested to **207 kg/cm2 (2951)** no displacement, leakage of humidity or separation was observed.

Test pressure of 207 kg/cm2 (2951 psi) achieved was approx. 127% > to 1300 psi, the value required by API for light pipe diameter 6 5/8 and wall thickness min., th 0.280 in, and 7.7% > to 2740 psi, the value required by API for heavy pipe 0.432 in.

The purpose of dropping pressure to 300 psi (21 kg/cm^2) was to simulate field conditions. No leaks were observed.

Therefore all complies with the design conditions shown in the drawing Q-200 Construcción del Gasoducto de Producción Ø x 0.637 km M.P FURBERO 1536 A INTERCONEXION FURBERO 1228.BS FURBERO 1 DEL K-0+000.00 al P.F K-0+637.577, and additional requirements from the supervision of PEP/ACEITE TERCIARIO indicating a test pressure of 16.5 kg/cm^2 (234 psi) at the ambient temperature of 30 °C.

Note Copy of all records of traceability are in the ABS Group files and will be attached to the report ABS **10-3450-MX-03**

INSPECCION REALIZADA SIN PREJUICIO.

ING. J. ARTURO HUERTA ATENCO
REPRESENTANTE TECNICO
ABS GROUP SERVICES DE MEXICO, S.A. DE C.V.

Report	No	Project No.	Date	Office:
10 – 3450 MX	03	2364983	Julio 14, 2010	MÉXICO

FACT RE-

Certification / Report: Certification and Process of Mechanical Joint Sure- D.N X 637 km from Macropera Furbero 1536 to Interconnection Furbero 1228-BS Furbero	Date: 17 May 2010
Client / Vendor: **DuVal Partners, LLC** 16107 Kensington Dr., Suite 406 Sugar Land, Texas 77479 Tel: (512) 825-7147	Order Number: O.T. 102 CDI PEP-SRN-GCYM-0422-2010
Client / Buyer: North Region, Management Of Construction and Maintenance, Assistant Management of Maintenance for Pipelines and Right Of Ways	Initiated: ---------

This document is to CERTIFY that the authorize representative of ABS Group Serv ices of Mexico S.A. de C.V. upon the request of DuVal Partners LLC., performed an onsite inspection. The objective of the inspection was witness both a field fabrication process and laboratory testing of the Sure-Lock mechanical joint system in accordance with the standard operating procedure PEP-SRN-GCYM-0422-2010 of PEMEX Exploration and Production, specially the Oil “Terciario del Golfo”.

The process was applicable to the design and construction, maintenance and construction of the land pipe for transportation and procurement of hydrocarbons. This was specifically to the general production line of 6” diameter x 0.637 km M.P. Furbero 1228. BS Furbero I of the K-0+000.00 to the P.F. K-0+637.577 from May 11 to 16 of 2010. Laboratory testing witnessed on July 1 to certify the integrity of the mechanical joint.

Witnessed By:

Eng. Salvador Quero G.	Represents Pemex Exploration and Production Eng.
Concepcion Lara D.	Represents Pemex Exploration and Production Eng.
Rafael Lagunes P.	Represents Pemex Exploration and Production
Admin. Oscar Carmona	DuVal Partners, LLC
Eng. Gabriel Guevara	DuVal Partners, LLC
Eng. Jose Luis Ortiz A.	ABS Group Services of Mexico S.A. of C.V
Eng. J. Arturo Huerta A.	ABS Group Services of Mexico S.A. of C.V

Report	No	Project No.	Date	Office:
10 – 3450 MX	03	2364983	Julio 14, 2010	MÉXICO

Statement Of Facts

1.0 The licensed representative of ABS Services of Mexico has done the inspection work to certify the integrity of the mechanical joint NOT welded of carbon steel as per the API specification 5L PSL 1/ NRF-01 PEMEX 2007 >>Pipe for transportation and procurement of hydrocarbons.<< for the process of mechanical joint Sure-Lock.

2.0 This certification has been done using the following requirements:

2.1.1. Basic Engineer -

2.1.2. -

2.1.3. Quality certificate for the pipes to be used.

2.1.4. Quality certificates of technical documents of the epoxy to be used as a seal of the joint connection.

2.1.5. Registration that acknowledges the receiving of the pipe and inspection of the facilities or field.

2.1.6. Registration and logs of fabrication of pipe prepping of the bell and tapper on a cold expansion process as per requirements and compliance of API Spec.5L Edition 44 and or Norm NRF-001 Pemex

2.1.7. Report or Design drawings of joints assembled using the Sure-Lock process.

2.1.8. Report and graph of the hydrostatic test done in the field in accordance to the intension and design of the pipe line construction

2.1.9. Laboratory results which credit the integrity of the mechanical joint in accordance to good engineering practices established DuVal API/PEMEX for hydrocarbon pipelines.

2.1.10. 1536 to interconnection with Furbero 1228 BS Furbero DEL K-0+000.00 to P.F.K-0+637.577

2.1.11. NO compliance problems were detected.

2.1.12. In closing, no issues with nonconformities.

Report	No	Project No.	Date	Office:
10 – 3450 MX	03	2364983	Julio 14, 2010	MÉXICO

As per the requirements above mentioned, ABS Group has review and witnessed the documented execution plan set forth by DuVal Partners, in addition to the actual mechanical testing done at a laboratory. This testing was completed and executed with the upmost strict

3.1.1 The design of the bell and taper end (point 2.1.1) for a joint of six inch of nominal diameter 6" corresponding to design drawing OT.102. JS6" DUV Rev. 0.

The design of the bell end is conforming to section 8 of the manufacturing paragraph 8.1 chart 2 with paragraph 9.12.3 of the API 5L Edition 44 belled ends (PSL 1 only) and also conforms to the point 9.12.3.1 which refers to belled ends and is in compliance with the configurations and dimensions for a mechanical joint "Sure-Lock". (Belled-end pipe shall be furnished with one end belled in accordance with the configuration and dimensions specified in the purchased order).

3.1.2 The field work was performed satisfactory and in accordance to the technical operating manual and construction procedures P-MPR-01/R-1. P-MPR-01/R-2, P-MPR-01/R-3 designs are satisfactory production and reproduction of mechanical joints "Sure-Lock" (point 2.1.2) as stated in (Quality Control System ISO9001).

Note 1: The welding procedures and corresponding certifications, as well as inspections on the welded end caps mechanical joints were not inspected by ABS Group but are available for review in the files of CDI.

3.1.3 All and each of the pipe lengths received at the DuVal pipe yard are property of PEP (Pemex) and were inspected as per the quality certificate and consistency (point 2.1.3) according the quality registration. No imperfections were detected on either end.

Note: The pipe with serial number 5344 did not conform to the quality control of the . It was recommended to PEP that quality control documents be collected on that particular pipe joint from Tubacero.

3.1.4 With reference to Flex Epoxy 105 and in accordance to the technical data sheet, the compression of the epoxy is 15,000 psi. The elongation is 50%, with a durometer harness of 50-60, adhesion of 1.27 mm > 1,000 psi. Given these characteristics, it makes for a great seal. The time to cure varies upon the environment in which it is used (2.1.4)

Report	No	Project No.	Date	Office:
10 – 3450 MX	03	2364983	Julio 14, 2010	MÉXICO

3.1.5 ABS Group a has performed onsite inspection and has reviewed the logs and recordings which credited the work of the assembly and construction of the pipe line (point 2.1.5, 2.1.6, 2.1.7)

RRI-01/010 Pipe inspection record receipt for land pipe to be used in the cons truction of pipeline using the Sure-Lock Joint system.

RDCE-01/010 Recorded register of Bell and Taper end dimensions of preformed Sure-Lock pipe ends.

REJ-01/010 Recorded register for the inspection and preparation of Epoxy for the Sure-lock mechanical joints.

RCJ-01/010 Recorded register for Pipe and Pipeline field layout as per Sure -Lock require-ments.

RCJ-02/010 Recorded register for the construction of pipelines and Sure-Lock pipeline joint control.

RMJ-01/010 Recorded register of site map and location of pipe joints.

PRO-LAB-01/010 Protocol of witnessed laboratory testing and samples provided.

PRO-LAB-01/010 Protocol of witnessed laboratory testing and samples provided.

3.1.6 ABS Group a has testified (Point 2.1.9), to
use that are representative of field preparation and production of a Sure-Lock Bell and Taper cold expansion process using PEP pipe. The following test were carried out:

Tension : In the conical section of the Bell, the Bell section and a section before the forma-tion portion of the Bell.

Hardness Test : In the conical section of the Bell, the Bell section and a section before the formation portion of the Bell.

Metallurgic Test : In the conical section of the Bell, the Bell section and a section before the formation portion of the Bell.

Hydrostatic Test or leak detection testing of a assembled **Sure-Lock** mechanical joint.

Report	No	Project No.	Date	Office:
10 – 3450 MX	03	2364983	Julio 14, 2010	MÉXICO

3.1.6.1 As a result of the laboratory and all protocols tested on the working zones (belled-end and transition area) full compliance is observed according to the API 5L Edition 44:

Section 9 Compliance Criteria
Paragraph 9.3 Tension Properties
Paragraph 9.10.6 Hardness Points
Paragraph 9.11.32 Wall Thickness Tolerances

NRF-001-PEMEX-2007

Section 8.2.1.1.4 Metallurgic Analysis
Paragraph 8.2.1.1.4 Grain size. The grain size should be equal or thinner then number 9

The results provided are in compliance with uniform code REG No. MET-10110 and REG No. PM-10179 from the accredited laboratory CIDESI (Industrial Intelligence and Developing Center) Accreditation MM-0031-006 expiration 2012-04-02, MM-065-006/ Expiration 2012-10-01, and Laboratory testimonial protocols were followed on all samples; PRO-LAB-01/0/10.

3.1.6.2 The results of laboratory leakage test, satisfactorily meet the criteria acceptance of API 5L Edition 44:

Section 10.2.6 Hydrostatic Test
Paragraph 10.2.6.3 Pressure testing of light wall pipe as per Chart 24, 1300 psi, Pipe Grade X52 6-
Paragraph 10.2.6.4 Pressure testing of light wall pipe as per Chart 25, 2740 psi, Pipe Grade X52 6-

Note: In the laboratory test, the pressure was taken to 2951 psi / 207 kg/cm^{2}approx.

3.1.7 As per the engineering detail and design drawing indicated in Q-200 of trench and pre fill (point 2.1.10), ABS Group has witnessed the executed field work by the company DuVal Partners LLC and has satisfactory follow the compliance the requirements of its design.

3.1.8 ABS Group declares that based on the information presented by the contractor that there were no problems as per (point 2.1.1) with the construction process using the Sure-Lock mechanical joint.

Report	No	Project No.	Date	Office:
10 – 3450 MX	03	2364983	Julio 14, 2010	MÉXICO

3.1.9 In consecutive order of 1, 2, 3, 4, shows the pipe prepping of pre-forming steps that are followed in the creation of Sure-Lock mechanical joints, prior to the fabrication or assembly of the hydro-carbon pipeline. Fig. 5, 6 and the corresponding pressure graph, Fig. 7, taken from the field test, are in accordance to the engineering requirements specified in design Q-200

Fig. 1 Forming the Bell

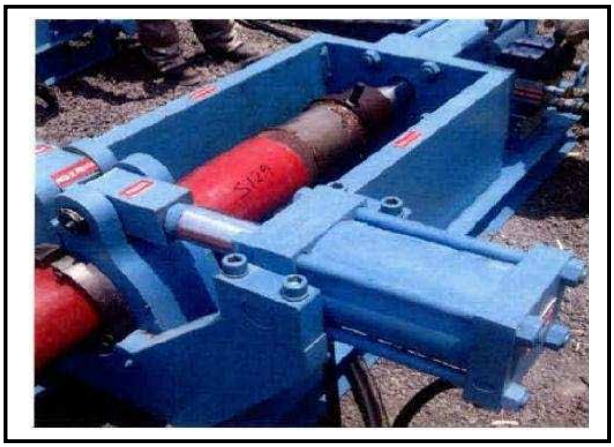
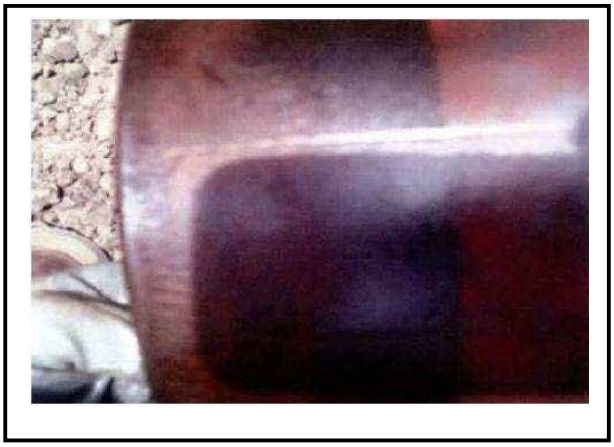


Fig. 2 Bell Formed From Cold Expansion Process

Fig. 3 Forming the Taper

Fig. 4 Taper Formed



3.1.9.1 Once the Bell and Taper ends are formed, a visual inspection is conducted. The objective of the inspection is to detect any internal defects before proceeding to the assembly with the Sure-Lock mechanical joint system.

Report	No	Project No.	Date	Office:
10 – 3450 MX	03	2364983	Julio 14, 2010	MÉXICO

Fig. 5 Fabrication of a mechanical joint using SURE-LOCK

Report	No	Project No.	Date	Office:
10 – 3450 MX	03	2364983	Julio 14, 2010	MÉXICO

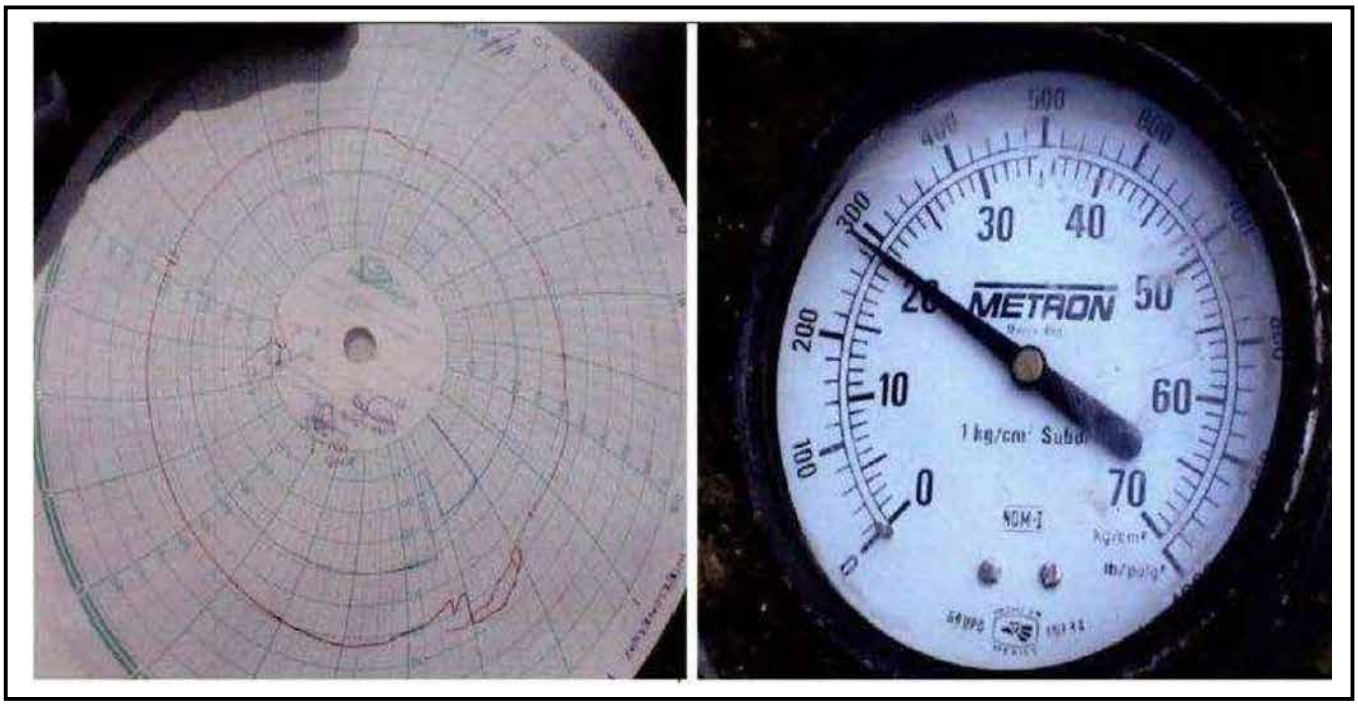
Fig. 6 Construction of a 6-5/8 Ø x 0.600 km Oil Pipeline

3.1.9.2 In the figures above, it can be seen that the transportation pipe line constructed using the Sure-Lock mechanical joint process, included an intermediate welded joint. This was in accordance to the API 1104 criteria. This intermediate joint was required by the management of PEP (Pemex)

3.1.9.3 This line was laid and supported in accordance with the established requirements from the norm NRF-030-PEMEX-2009

3.1.9.4 Once the pipeline was fabricated and completed in accordance to the Sure-Lock procedures which also included an intermediate welded joint, a hydrostatic test was performed. The test conforms to the NRF-030-2009, Paragraph 8.2.19. Test was carried out to 1.25 times the design pressure for 24 hours, with a pressure of 16.5 kg/cm^2(234.67 psi).

Fig. 7



3.1.9.5 As a requirement by the PEP supervisors, it was determined that a hydrostatic pressure greater than 20 kg/cm^2(285 psi). The result of the pressure test was satisfactory. See report ABS 10-3450-MX-02

3.1.9.5 The equipment used to performed the construction of the mechanical joints Sure-Lock are from a registered patent as indicated below:

Sure-Lock Assembly Press Machine M26 Serial # EPB026-SSJ-025
Sure-Lock Power Unit Model 121 Serial # 121-010493-1
Sure-Lock End Prep Machine M26 (Taper) Serial # EPB026-SSJ-024
Sure-Lock End Prep Machine M26 (Bell) Serial # EPB026-SSJ-023

3.1.9.6 This report has been made in the order of events as they were presented for the inspection and witness of testing, as such the complete revised documentation can be examined in the dossier prepared by DuVal Partners LLC which contains the same order of events. A copy of this document is in the archives of the ABS Group services of Mexico S.A. de C.V

Report	No	Project No.	Date	Office:
10 – 3450 MX	03	2364983	Julio 14, 2010	MÉXICO

CONCLUSIONS

ABS Group Services of Mexico, certifies that the process for conducting mechanical joints called Sure-Lock, satisfactorily meets the requirements of the specification for line pipe API 5L 44 Edition, Oct. 1 2007. ISO 3187 (modified) Natural Oil and Gas Industry, steel pipe for transportation systems and requirements of NRF-001-PEMEX-2007 Tuberia de Acero for relocation and transportation of hydrocarbons in:

Manufacturing Process for Bell Ends

Wall thickness tolerance

Mechanical integrity of Bell Tension, Hardness and Metallurgy test.

Mechanical integrity of Mechanical Joints Sure-Lock for hydrostatic pressures of up to 2961 psi (241 kg.cm^{2}approx.)

Therefore concludes that the process of Sure-Lock mechanical joints is a reproducible and reliable process for the construction of transportation pipelines called:

x 0.637 km MP FURBERO 1536 a inter connection with FURBERO 1228.BS FURBERO 1 DEL K-0+000.00 to P.F K-0+637.577. It has been built and satisfactorily inspected in accordance with the requirements states in the specifications and quality manual supplied by DuVal Partners LLC, and also in compliance requirements with the office of PEMEX-249-16000-63400-0031-242-2010.

This document was translated from an original copy. The original copy was prepared in Spanish. This translation is to be used for information purposes only.

INSPECCIONREALIZADA SIN PREJUICIO

ABS GROUP SERVICES MEXICO ABS

Ing. J. Arturo Huerta Atenco
Representante Técnico
ABS Group Services de México, S.A. de C.V

PEMEX
EXPLORACION Y PRODUCCION ®

Oficio

		Fecha	10 de Febrero de 2015
Remitente	**Subdirección de Servicios a Proyectos** **Gerencia de Servicios a Proyectos Región Sur**	Número	PEP-SSAP-GSAPRS 144 -2015
		Número de expediente	GSAPRS-NORMATIVIDAD
Destinatario	**Ing. Jorge Gonzalez Cabello** **Gerencia de Normalización** **Presidente del SIN y Secretario Técnico del CNPM**	Antecedentes: Número(s): Número único de expediente: Fecha(s):	PEP-SRN-GCM-SMDVA-041-20 10 NOTA INFORMATIVA 23 AGOSTO 2010 30 DE JULIO 2012
Asunto:	Inclusión en la NRF-030 el diseño y construcción de la unión mecánica "Sure-Lock"	Anexo	☒

En atención al oficio y nota informativa citados en antecedentes, le informo que en referencia a la práctica de instalación "Sure-Lock" en ductos de transporte, esta dependencia no tiene inconveniente alguno en aprobar y compartir que se incluya en los apartados de diseño y construcción de la actual etapa de revisión por el GTI y CNPMOS de la norma NRF-030-PEMEX-2009 "Diseño, Construcción, Inspección y Mantenimiento de Ductos Terrestres para Transporte y Recolección de Hidrocarburos" lo referente a la factibilidad de instalación de unión tipo "Sure-Lock" en los ductos metálicos para transporte de hidrocarburos tanto para aceite & gas.

No omito mencionarle que paralelamente a esta solicitud, personal técnico de las Gerencias de Servicios a Proyectos de las Regiones Sur y Norte, procederemos a integrar en los formatos normativos "Dice" y "Debe decir", las consideraciones técnicas que podrían analizarse en las próximas reuniones de trabajo para su posible inclusión en la NRF en cuestión, esta coordinación estará a cargo del Ing. Juan Alberto Vazquez Romero.

También es importante mencionar, que la solicitud de inclusión en la NRF-030 de la instalación de unión tipo "Sure-Lock", se basa fundamentalmente a que este proceso fue aplicado en líneas de conducción de 6" de diámetro en la Región Norte, y que fue atestiguado y aprobado en el 2012, por la empresa certificadora ABS Group Services de México, concluyendo esta, que el proceso es reproducible y confiable para la fabricación de línea de transportación de hidrocarburos, por lo que en caso de que la ingeniería de proyecto la requiera pueda ser utilizada en la construcción de líneas de conducción.

Sin más por el momento, agradeceré cualquier sugerencia al respecto.

Atentamente,

Ing. Juan Carlos Reyna Carrera
Gerente

Ing. Rodrigo Hernández Gómez.-E.D. Subdirección de Servicios a Proyectos, Vocal Titular de la SSAP ante el STN-PEP.
Ing. Eduardo Zavala Nacer.- Subdirector de Auditoría, Seguridad Industrial y Protección Industrial y Presidente Suplente del STN-PEP.
Ing. Marco A. Delgado Aviles.- Gerente de Auditoria de SASIPA y Secretario Técnico del STN-PEP.
Ing. Juan Alberto Vásquez Romero.- Grupo Multidisciplinario Técnico.- Enlace Normativo de SSAP.
Ing. Luis Ortiz Hernandez.- Representante Gerencia. Administración del Mantenimiento.- Sede México.

"2015, Año del Generalísimo José María Morelos y Pavón".

Elaboró: JAVR

[Translation]

Dated February 10, 2015

PEMEX EXPLORATION AND PRODUCTION

Subdirection of Project Services
Southern Region Project Services Management

Per the above-referenced documents, I hereby inform you that, in reference to the “Sure-Lock” installation method, as it relates to pipelines, this office has no objection in approving and stating that it be included in the “Design and Construction” sections of the current GTI and CNPMOS of the Pemex Guidelines NRF-030-Pemex 2009 “Design, Construction and Maintenance of land-based Pipelines for the Transport and Gathering of Hydrocarbons” as it relates to the feasibility of utilizing “Sure-Lock” type pipe-joints in steel pipelines for the transport of hydrocarbons, both oil and gas.

Together with this request, please be advised that technical personnel from the Management Services for Projects in the Northern and Southern Regions shall proceed to prepare documentation including a comparison table indicating the current text of the regulation and the proposed amendment thereto for its review during the upcoming workshops where the proposed amendments will be considered for inclusion in Pemex Guideline NRF-030-Pemex 2009. This coordination will be directed by Mr. Juan Alberto Vazquez Romero, P.E.

It is also important to note that the request for inclusion of the “Sure-Lock” joint in the NRF-030 is fundamentally based on the fact that this process was utilized in the joining of 6” flow lines in the Northern Region which was witnessed and approved by ABS Group Services of Mexico who concluded that the process is reproducible and dependable with respect to the construction of hydrocarbon transportation pipelines as a result of which, in the event that the engineering of a project so requires, it may be utilized in the construction of pipelines.

I am available should you have any suggestions.

Regards,

[Signature]

Juan Carlos Reyna Carrera, P.E.

8.0 Independent Third Party Test

Table of Contents

(1)

SouthWestern Laboratories

{1977 1983}

SOUTHWESTERN LABORATORIES

FORT WORTH DALLAS HOUSTON MIDLAND BEAUMONT TEXARKANA

File No. 2-7138-00

Houston, TEXAS June 29, 1977

To Porta-Tools

BUTLER TAPER JOINT, INC. CERTIFIED TEST RESULTS

WE CERTIFY THE VALIDITY OF THESE TEST RESULTS AND FURTHER CERTIFY THAT ONLY API CERTIFIED LINE PIPE WAS UTILIZED FOR THESE TESTS.

HERBERT J. GREEN, PRESIDENT
BUTLER TAPER JOINT, INTL.

6/21/93
DATED

Report of Hydrostatic Test

For Porta-Tools

Renee Armstrong
10/4/93

RENEE ARMSTRONG
NOTARY PUBLIC
STATE OF TEXAS
My Comm. Exp. 09-14-96

Identification Marks

API CERTIFIED LINE PIPE

On June 23, 1977 a section of 4-1/2" Dia. x .219" API Std. 5L Grade B pipe with a Butler Taper Joint was received to determine if the strength of the joint was equal to the strength of the pipe.

The test was conducted as directed by Mr. Major Butler of Porta-Tools as follows:

The internal yield strength of the pipe as determined by API Bulleting 5C3 Section 3 is 2980 psig.

The jointed piped section was then pressurized to these tabulated pressures:

TEST PRESSURE PSIG	TIME AT PRESSURE	REMARKS
1500	.2 min.	no leakage
2500	2 min.	84% of yield - no leakage
2800	2 min.	94% of yield - no leakage
3200	1/2 min.	no leakage
3600	1/2 min.	no leakage
3800	1/2 min.	no leakage; pipe swelling
4000	1/2 min.	no leakage; pipe swelling
4200	1/2 min.	no leakage; pipe swelling
4600	1/2 min.	no leakage; pipe swelling
4800	1/2 min.	no leakage; pipe swelling
5000	1/2 min.	no leakage; pipe swelling

The specimen was then gradually taken to failure which occurred at 6400 psig in Butler Taper Joint.

BUTLER TAPER JOINT, INC. CERTIFIED TEST RESULTS

Copies: 3 - Porta-Tools

Lab. No. 21656 pc

SOUTHWESTERN LABORATORIES

SOUTHWESTERN LABORATORIES

Report No. 31441 File No.

Houston, Texas October 1, 1980

To Butler Taper Joint Co.

Report of Hydrostatic Tests

For

Identification Marks

Surlock 2 3/8 Grade B ERW Line Pipe

Hydrostatic Test

(1) Tested to 100% specified minimum yield - 4540 lbs.-No leaks
(2) Tested to 9000 lbs-No leaks

Tensile Test

Yield Strength 35,000 lbs.
Tensile Strength 48,500 lbs. Section parted

Surlock 6 5/8 Grade B ERW Line Pipe

Hydrostatic Test

(1) Tested to 100% specified minimum yield - 2960 lbs-No leaks
(2) Tested to 5600 lbs-No leaks

Tensile Test

Yield Strength - not detected
Tensile Strength - 212,500 lbs. section parted

WE CERTIFY THE VALIDITY OF THESE TEST RESULTS AND FURTHER CERTIFY THAT ONLY API CERTIFIED LINE PIPE WAS UTILIZED FOR THESE TESTS.

HERBERT J. GREEN, PRESIDENT
BUTLER TAPER JOINT, INTL.

10/4/93
DATED

Renee Armstrong
10/4/93

RENEE ARMSTRONG
NOTARY PUBLIC
STATE OF TEXAS
My Comm. Exp. 09-14-96

Technician: Glen Maxwell

Copies: 3 - Butler Taper Joint Co. bm

SOUTHWESTERN LABORATORIES

FORM 20 — REV 3-74

SOUTHWESTERN LABORATORIES

Report No. 31540 File No. 2-1184-00

Houston, Texas October 13, 1980

To Butler Taper Joint

Report of Tension & Hydrostatic Test

For Major Butler

4 1/2" O.D. Grade B ERW Pipe

Tensile lbs. - 117,500
Hydrostatic PSIG - 6,500

2 7/8" O.D. Grade B ERW Pipe

Tensile lbs. - 68,500
Hydrostatic PSIG - 9,000

Renee Armstrong
10/14/93

RENEE ARMSTRONG
NOTARY PUBLIC
STATE OF TEXAS
My Comm. Exp. 09-14-96

WE CERTIFY THE VALIDITY OF THESE TEST RESULTS AND FURTHER CERTIFY THAT ONLY API CERTIFIED LINE PIPE WAS UTILIZED FOR THESE TESTS.

HERBERT J. GREEN, PRESIDENT
BUTLER TAPER JOINT, INTL.

10/14/93
DATED

Technician: Glen Maxwell

Copies: 3 - Butler Taper Joint Co. bm

SOUTHWESTERN LABORATORIES

Henry E Otto

SwL

SOUTHWESTERN LABORATORIES
HOUSTON, TEXAS

Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services

File No. 2-

Report No. 37904

Report Date Dec. 22, 1983

ent: Butler Taper Joint
2012 Karbach
Houston, Texas 77092

BUTLER TAPER JOINT, INC. TEXAS

ject: Tension Test of Sure Lock Pipe Joints
Specimens are made with Lone Star Steel Pipe

#1 - 2-3/8" Grade B, .154" Wall, Yield not detected, 62,500, Joint pulled apart.
#2 - 3-1/2" A-25, .216" Wall, Yield not detected, 92,600, Joint pulled apart.
#3 - 3-1/2" X-42, .216" Wall, Yield not detected, 108,000, Joint pulled apart.
#4 - 4-1/2" X-42, .188 Wall, Yield not detected, 102,000, pulled apart.
#5 - 4-1/2" Grade B, .237" Wall, Yield not detected, 122,500, Pipe pulled apart.
#6 - 4-1/2" A-25, .237" Wall, Yield not detected, 124,500 Pipe pulled apart.
#7 - 6-5/8" [illegible] .125" Wall, Yield not detected, 134,750 Joint pulled apart.

API CERTIFIED LINE PIPE TEXAS

Renee Armstrong
10/4/93

WE CERTIFY THE VALIDITY OF THESE TEST RESULTS AND FURTHER CERTIFY THAT ONLY API CERTIFIED LINE PIPE WAS UTILIZED FOR THESE TESTS.

Herbert J. Green 10/4/93

HERBERT J. GREEN, PRESIDENT, BUTLER TAPER JOINT, INTL. — DATED

NOTARY PUBLIC STATE OF TEXAS

RENEE ARMSTRONG
NOTARY PUBLIC
STATE OF TEXAS
My Comm. Exp. 09-14-96

BUTLER TAPER JOINT, INC. CERTIFIED TEST RESULTS

SOUTHWESTERN LABORATORIES

Robert Evenak

ician: Don Szymanski

pies: 3-Butler Taper Joint, Inc.
Attention: Mr. Major Bulter
Copy to Ben Rencoret BTJ's Hou. Tex ✓

37904 js

letters and reports are for the exclusive use of the client to whom they are addressed. The use of our name must receive our prior written approval. Our letters reports apply only to the sample tested and/or inspected, and are not necessarily indicative of the qualities of apparently identical

(2)

Independent Registered Professional Engineer April 1982 (Prep & Assembly)

BUTLER TAPER JOINT, INC. TEXAS

Report on Assembly and Testing of SURE-LOCK Mechanical Pipe Joints

On Wednesday, April 7, 1982, I was invited to witness a demonstration of the preparation and joining of pipe using the SURE-LOCK mechanical pipe connection method. The purpose of this demonstration was to test the new pipe preparation and assembly equipment which had been manufactured by Butler Taper Joint. The demonstration was carried out at the fabrication shop located at 4424 Dayco, Houston, Texas.

API CERTIFIED LINE PIPE TEXAS

Four test pieces of each pipe size had been pre-cut in lengths of approximately [illegible] to 30". The test pipe was stated (by Mr. Major Butler) as having the following specifications:

4" pipe: 4½" O.D., 0.237" w.t., API 5LX grade X-42, ERW

3" pipe: 3½" O.D., 0.216" w.t., API 5LX grade X-42, ERW

The end preparation consisted of deformation of the pipe by either "belling" or "tapering" one end of each test piece. This was done in machines equipped with interchangable precision forming mandrels. Using hydraulic pressure from the central power source, the forming mandrels were pressed into (for belling) or over (for tapering) one end of the pipe for a gauged and controlled length.

One belled test piece and one tapered test piece were then prepared for assembly. The tapered end was coated with a pre-mixed sealing epoxy compound (composition unknown) for a length of approximately 2 inches. The two test pieces were then placed in the assembly machine and were forced together for the pre-set length of the joint. After the assembly, one 4" joint and one 3" joint were end-capped and fitted for a hydrostatic pressure test.

On Thursday, April 8, 1982, I returned to the shop to observe the hydrostatic tests on the two assembled pipe joints. The 4" pipe joint was filled and pressured to 5500 psig and the 3" joint was filled and pressured to 6000 psig. In each test, the final pressure was held for approximately 5 minutes. There were no indications of failure of any nature in the tested joints.

It may be noted that the test pressures exceed the Internal Pressures at Specified Minimum Yield (IP @ SMY). For the 3" pipe, the IP @ SMY = 5[illegible] psig and for the 4" pipe, the IP @ SMY = 4424 psig. This can be explained by the probability that the pipe steel had an actual grade in the range of 50[illegible] psig.

James E. Merrill

J. E. Merrill, P. E.

STATE OF TEXAS
JAMES E. MERRILL
25061
REGISTERED
PROFESSIONAL ENGINEER

BUTLER TAPER JOINT, INC. CERTIFIED TEST RESULTS

WE CERTIFY THE VALIDITY OF THESE TEST RESULTS AND FURTHER CERTIFY THAT ONLY API CERTIFIED LINE PIPE WAS UTILIZED FOR THESE TESTS.

Herbert J. Green — 10/4/93

HERBERT J. GREEN, PRESIDENT
BUTLER TAPER JOINT, INTL.

DATED

Renee Armstrong 10/4/93

NOTARY PUBLIC STATE OF TEXAS

RENEE ARMSTRONG
NOTARY PUBLIC
STATE OF TEXAS
My Comm. Exp. [illegible]

(3)

SouthWestern Laboratories

{1985}

SwL SOUTHWESTERN LABORATORIES
P.O. BOX 8768, 222 CAVALCADE, HOUSTON, TEXAS 77009
Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services

File No. 2-1161-00
Report No. S5021-2
Report Date 02/21/85

Client: BUTLER TAPER JOINT, INC.
7600 W. Tidwell, Suite 114
Houston, Texas 77040
Attention: Mr. Major G. Butler

BUTLER TAPER JOINT, INC. CERTIFIED TEST RESULTS

WE CERTIFY THE VALIDITY OF THESE TEST RESULTS AND FURTHER CERTIFY THAT ONLY API CERTIFIED LINE PIPE WAS UTILIZED FOR THESE TESTS.

HERBERT J. GREEN, PRESIDENT
BUTLER TAPER JOINT, INTL

10/4/93
DATED

Project: Hydrostatic Pressure Test of Surelock Joint

Renee Armstrong 10/4/93

RENEE ARMSTRONG, NOTARY PUBLIC STATE OF TEXAS My Comm. Exp. 09-14-96

MATERIAL

One 4 1/2-inch-Grade B-seamless-schedule 80 pipe specimen with surelock joint was received for testing by Southwestern Laboratories, Inc. on February 20, 1985. This pipe specimen had reportedly been tested for bend and sag bend at Rice University Mechanical Engineering Laboratory by Doctor Merwin.

TEST PROCEDURE

The surelock joint was pressurized with water to various pressure levels and held for various lengths of time while being checked for leaks, on February 20, 1985.

TEST RESULTS

The surelock joint was pressurized to 500 psi for two minutes, and then to 2,000 psi for two minutes, and then to 3,400 psi for two minutes, and then to 4,420 psi for three minutes, and then to 5,240 psi for four minutes. The Surelock joint was then depressurized to 0 psi and pressurized to 5,240 psi for three minutes, and then depressurized again to 0 psi and pressurized to 5,760 psi for three minutes.

There was no leaking from the surelock joint at any of these pressure levels.

WITNESSES

The pressure test was witnessed by Hugh G. Bourhill, with Lloyd's Register of Shipping, and by Major G. Butler and Benjamin Rencoret, with Butler Taper Joint, Inc.

API CERTIFIED LINE PIPE

SOUTHWESTERN LABORATORIES

Technician: Bob Blanck

Robert J Blanck

Copies: 3-Butler Taper Joint, Inc.

RDK

ckl


SOUTHWESTERN
LABORATORIES

(4)

Quality Valve &

Machine Works Inc

{1993}

Quality VALVE & MACHINE WORKS, INC.
RT. 8, BOX 6 • HUNTSVILLE, TEXAS 77340 • (713)291-8146

CERTIFICATION OF HYDROSTATIC TESTING

PRODUCT: 114MM O.D., 8MM WALL LINE PIPE
GOST STANDARD 8731-87, 8732-78
STEEL GRADE 20 (Manufactured in Russian Federation)
Sample furnished by Tatneft Production Association
[4.5" O.D. x .300" WALL THICKNESS]

CUSTOMER: BUTLER TAPER JOINT, INC.

HYDROSTATIC TEST DATA

PRESSURE: 4500 PSI (306.18 ATMOSPHERES)

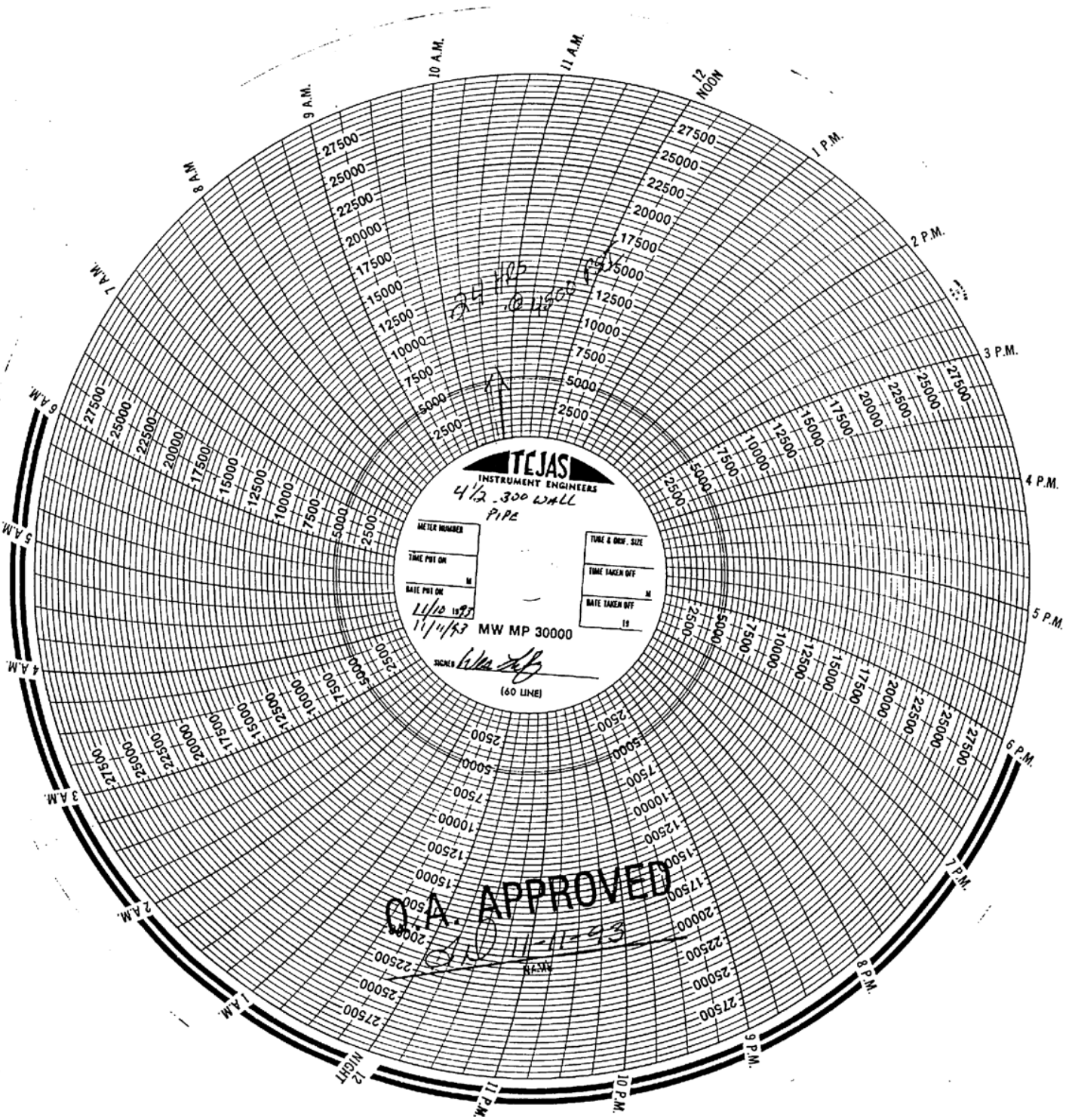
DURATION (HRS): 24 HRS.

TESTED BY: Randy Stephens

	Approved	Rejected	Date
Assembly Foreman	Wes Laftin		11-11-93
Chief Inspector	J Ke Lamb		11-11-93
Q.A. Manager	Dave Dodd		11-11-93

DESCRIPTION: 114MM O.D., 8MM WALL, RUSSIAN STEEL PIPE SAMPLES, MARKED STEEL GRADE 20, WERE PREPARED AND ASSEMBLED IN OUR TEST FACILITY. THE PIPE ENDS WERE FORMED (BELLED AND TAPERED) ON BUTLER MODEL 26 END PREPARATION MACHINES AND ASSEMBLED WITH A BUTLER MODEL 26 ASSEMBLY MACHINE. BUTLER EPOXY WAS UTILIZED AS A SEALANT. ALL WORK WAS CONDUCTED NORMALLY WITHOUT INCIDENT. ALL WORK STEPS WERE WITNESSED BY QUALITY VALVE & MACHINE WORKS QUALITY CONTROL PERSONNEL.

BTJTEST.DOC


TEJAS
INSTRUMENT ENGINEERS
4½ .300 WALL
PIPE
METER NUMBER
TIME PUT ON
DATE PUT ON
TUBE & ORIF. SIZE
TIME TAKEN OFF
DATE TAKEN OFF
MW MP 30000
(60 LINE)
Q.A. APPROVED
RF-MW

(5)

TATNEFT INSTITUTE BUGULMA (RUSSIA)

{1994}

TATNEFT / BUTLER
MECHANICAL JOINT TEST DATA
ALL TESTS CONDUCTED AT TATNIPINEFT INSTITUTE
BUGULMA, TATARSTAN, RUSSIA

TEST SCOPE: PRESSURE TEST OF FIVE JOINT SAMPLE TO DESTRUCTION
SAMPLE PREPARED USING BUTLER MODEL 24 ASSEMBLY MACHINE
LINE PIPE PROVIDED BY JOINT STOCK COMPANY TATNEFT

TESTING DATE: 27 MAY 1994

TEST LOCATION: TATNIPINEFT INSTITUTE, BUGULMA, TATARSTAN

TEST SAMPLE: 114 MM OUTSIDE DIAMETER PIPE, 4.5 MM WALL THICKNESS, WELDED PIPE
FIVE (5) JOINT SAMPLE PREPARED BY TATNIPINEFT ON 26 MAY 1994
USING A BUTLER MODEL 24 MECHANICAL JOINT ASSEMBLY MACHINE.
THE PIPE USED WAS CONSIDERED TO BE OF POOR QUALITY, WITH A
INCONSISTENT WELD SEAM AND NON CONFORMING WELD CROWN HEIGHT.

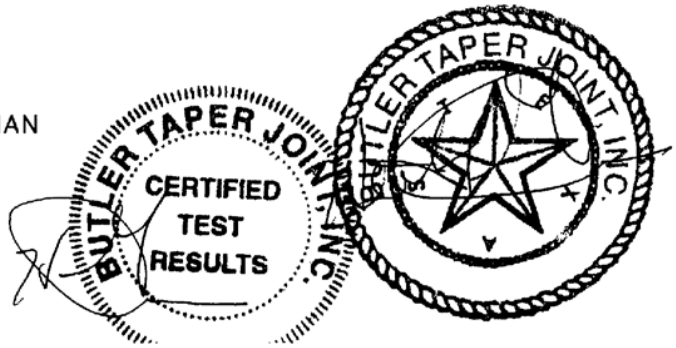
JOINT	1		2		3		4		5		END
	J	P	J	P	J	P	J	P	J	P	
MEASUREMENT POINTS	1	2	3	4	5	6	7	8	9	10	

J = MECHANICAL JOINT
P = MID SECTION OF PIPE BETWEEN JOINTS

MEASUREMENTS TAKEN BEFORE DURING AND AFTER PIPE SAMPLE YIELD:

MEASUREMENT POINT	PRIOR TO TEST (IN MILLIMETERS)	WHEN YIELDED (IN MILLIMETERS)	NEXT DAY (UNDER NO PRESSURE)
1 J	121.67	121.67 (+.00)	121.67 (-.00)
2 P	115.31	115.57 (+.27)	115.31 (-.27)
3 J	121.67	122.43 (+.76)	122.17 (-.26)
4 P	115.06	115.82 (+.76)	115.06 (-.76)
5 J	121.67	122.43 (+.76)	121.92 (-.51)
6 P	115.32	115.82 (+.50)	115.32 (-.50)
7 J	121.41	121.79 (+.38)	121.54 (-.25)
8 P	114.81	115.32 (+.51)	115.06 (-.26)
9 J	121.79	122.17 (+.38)	122.05 (-.12)
10 P	115.06	115.57 (+.51)	115.57 (-.00)

OFFICIAL TEST DOCUMENT IN RUSSIAN LANGUAGE CONTAINS TATNIPINEFT INSTITUTE OFFICIAL SEAL



АНАЛИЗ РЕЗУЛЬТАТОВ ИЗМЕРЕНИЙ

ПЯТИСТЫКОВОГО СОЕДИНЕНИЯ ИЗГОТОВЛЕННОГО НА СБОРОЧНОМ

АГРЕГАТЕ 24 "БАТЛЕР"

Дата испытаний – 27 Мая 1994 года

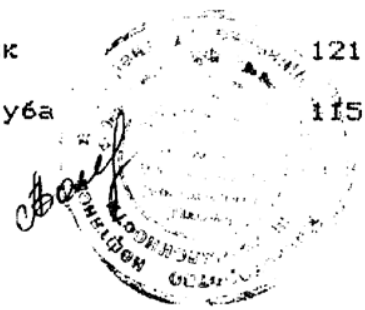
Место проведения – ТАТНИПИНЕФТЬ, г. Бугульма

Предмет испытаний – Пятистыковой образец соединения изготовленний по технологии фирмы "Батлер" из сварной трубы диаметром 114 мм, толщиной стенки 4,5 мм и неудаленным продольным гратом.

Стыки	1		2		3		4		5	
Места измерений	1	2	3	4	5	6	7	8	9	10

ТАБЛИЦА ИЗМЕРЕНИЙ ВНЕШНЕГО ДИАМЕТРА (мм)

МЕСТО ИЗМЕРЕНИЯ	ПЕРЕД ИСПЫТАНИЕМ	ПРИ 150 АТМ	НА СЛЕДУЮЩИЙ ДЕНЬ (без давления)
1 стык	121.67	121.67 (+ 0.00)	121.67 (– 0.00)
2 труба	115.31	115.54 (+ 0.27)	115.31 (– 0.27)
3 стык	121.67	122.43 (+ 0.76)	122.17 (– 0.26)
4 труба	115.06	115.82 (+ 0.76)	115.06 (– 0.76)
5 стык	121.67	122.43 (+ 0.76)	121.92 (– 0.51)
6 труба	115.32	115.82 (+ 0.50)	115.32 (– 0.50)
7 стык	121.41	121.79 (+ 0.38)	121.54 (– 0.25)
8 труба	114.81	115.32 (+ 0.51)	115.06 (– 0.26)
9 стык	121.79	122.17 (+ 0.[illegible])	[illegible].05 (– 0.12)
10 труба	115.06	115.57 (+ [illegible])	[illegible] (– 0.00)



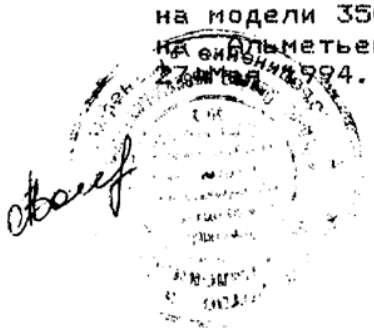
ТАТНЕФТЬ/БАТЛЕР

РЕЗУЛЬТАТЫ ИСПЫТАНИЙ МЕХАНИЧЕСКИХ СОЕДИНЕНИЙ

ДАТА	ДИАМЕТР ТРУБ мм	ТОЛЩИНА СТЕНКИ мм	ДАВЛЕНИЕ Атм	РЕЗУЛЬТАТ
25 05 94	89 (сварная)	6	150	Утечек нет
27 05 94	114 (сварная)	4,5	135	Утечек нет
27 05 94 прим.1	114 (сварная)	4,5	100 150	Утечек нет Утечка в районе неудаленного грата
31 05 94	168 (сварная)	6	150	Утечек нет
31 05 94	168 (сварная)	7	150	Утечек нет
31 05 94	273 (бесшовная)	9	100	Утечек нет
31 05 94 прим.2	273 (бесшовная)	9	100	Утечек нет
01 06 94	89 (бесшовная)	7	200 300	Утечек нет Утечек нет

Примечание 1 : Пятистыковый образец сварной трубы с неудаленным продольным гратом.
При достижении давления в 150 Атм наблюдалось изменение диаметра трубы в пределах от + 0,25 мм до + 0,75 мм.

Примечание 2 : Подготовка концов и соединение данного образца осуществлялось на модели 350 калибровочного агрегата "Батлер", установленно-
на Альметьевском заводе по производству МПТ ПО "Татнефть"
27 мая 1994. Образец подготовлен 30 Мая 1994.



TATNEFT / BUTLER
MECHANICAL JOINT TEST DATA
ALL TESTS CONDUCTED AT TATNIPINEFT INSTITUTE
BUGULMA, TATARSTAN, RUSSIA

TEST DATE	PIPE OUTSIDE DIAMETER (IN MILLIMETERS)	PIPE WALL THICKNESS (IN MILLIMETERS)	TEST PRESSURE (IN ATMOSPHERES)	TEST RESULTS
27.5.94	89 MM (WELDED PIPE)	6 MM	150	NO LEAKS (PASSED)
27.5.94	114 MM (WELDED PIPE)	4.5 MM	135	NO LEAKS (PASSED)
27.5.94 (1)	114 MM (WELDED PIPE) NOTE: TAKE SAMPLE TO DESTRUCTION	4.5 MM	100 150	NO LEAKS (PASSED) PIPE YIELDED JOINT PASSED TEST SEE PAGE TWO (2)
31.5.94	168 MM (WELDED PIPE)	6 MM	150	NO LEAKS (PASSED)
31.5.94	168 MM (WELDED PIPE)	7 MM	150	NO LEAKS (PASSED)
31.5.94	273 MM (SEAMLESS PIPE)	9 MM	100	NO LEAKS (PASSED)
31.5.94 (2)	273 MM (SEAMLESS PIPE)	9 MM	100	NO LEAKS (PASSED)

NOTE (1): FIVE JOINT SAMPLE OF HEAVY SEAMED PIPE WITH EXCESSIVE WELD CROWN. PIPE YIELDED UNDER PRESSURE AT 150 ATMOSPHERES. MEASURED YIELD RANGED FROM .25 MM TO .76 MM.

NOTE (2): PIPE ENDS FORMED AND JOINED USING BUTLER MODEL 350 CALIBRATION MACHINE INSTALLED AT JOINT STOCK COMPANY TATNEFT 27 MAY 94. SAMPLE PREPARED ON 30 MAY 94.

OFFICIAL TEST DOCUMENT IN RUSSIAN LANGUAGE CONTAINS TATNIPINEFT INSTITUTE OFFICIAL SEAL

(6)

Quality Concepts Inspection Company

{2004}

ISO 9002
Certificate Number: 30689.3

Quality Concepts
INSPECTION COMPANY, INC.

HYDROSTATIC TEST DESCRIPTION

TEST REPORT NUMBERS N68953-1 AND N68953-2

TEST DATE: JANUARY 27, 2004

CUSTOMER: BUTLER TECH INTERNATIONAL LLC

CUSTOMER INFORMATION:

BUTLER TECH SURE-LOCK MECHANICAL PIPE JOINTS AS FOLLOWS:

ONE EACH, 12-3/4" DIAMETER X .375" WALL MECHANICAL PIPE JOINT
PIPE SPECIFICATION: API 5L GRADE B, X-42

ONE EACH, 16" DIAMETER X .375" WALL MECHANICAL PIPE JOINT
PIPE SPECIFICATION: API 5L GRADE B, X-42

TEST DESCRIPTION:

12-3/4" DIAMETER X .375" WALL MECHANICAL PIPE JOINT:

INITIATED HYDROSTATIC TEST AT 500 PSI AND INCREASED PRESSURE IN 500 PSI INCREMENTS. HELD PRESSURE AT EACH 500 PSI INCREMENT TO ASSURE NO LEAK OR OTHER FAILURE OF MECHANICAL PIPE JOINT. PIPE DEMONSTRATED YIELDING AT APPROXIMATELY 3000 PSI. PRESSURE INCREASED TO AND HELD AT 3300 PSI CUSTOMER SPECIFIED TEST PRESSURE. NO LEAKS OR PIPE JOINT SEPARATION. TEST CHART PROVIDED.

16" DIAMETER X .375" WALL MECHANICAL PIPE JOINT

INITIATED HYDROSTATIC TEST AT 500 PSI AND INCREASED PRESSURE IN 500 PSI INCREMENTS. HELD PRESSURE AT EACH 500 PSI INCREMENT TO ASSURE NO LEAK OR OTHER FAILURE OF MECHANICAL PIPE JOINT. PIPE DEMONSTRATED YIELDING AT APPROXIMATELY 2200 PSI. PRESSURE INCREASED TO AND HELD AT 2450 PSI CUSTOMER SPECIFIED TEST PRESSURE. NO LEAKS OR PIPE JOINT SEPARATION. TEST CHART PROVIDED.

TEST CERTIFIED BY MR. DAVID DOWN, SNT-TC-1A LEVEL III INSPECTOR

SIGNATURE:

DAVID DOWN
QUALITY CONCEPTS INSPECTION CO., INC.
ISO 9002 CERTIFIED
7825 Hillmont Houston, Texas 77040 (713) 690-2703

ISO 9002
Certificate Number: 30689.3

Quality Concepts

INSPECTION COMPANY, INC.

HYDROSTATIC TEST REPORT# N68953-1

CUSTOMER: BUTLER TECH INTERNATIONAL LLC PO# 543021

MATERIAL: API 5L GB / X-42 HT# A44273 PCS 1

CUSTOMER INFO: 12-3/4" DIA X .375" WALL MECHANICAL PIPE JOINT

SPECIFICATION: HYDROSTATIC TEST @ 3300 PSI

****

INSTRUMENT: Oil & Gas Measurement Equip. CALIBRATION DATE: 01/23/04

CHART S/N: MP-5000

****

COMMENTS: 1 PC PASSED (NO LEAKS/NO JOINT SEPARATION)

****

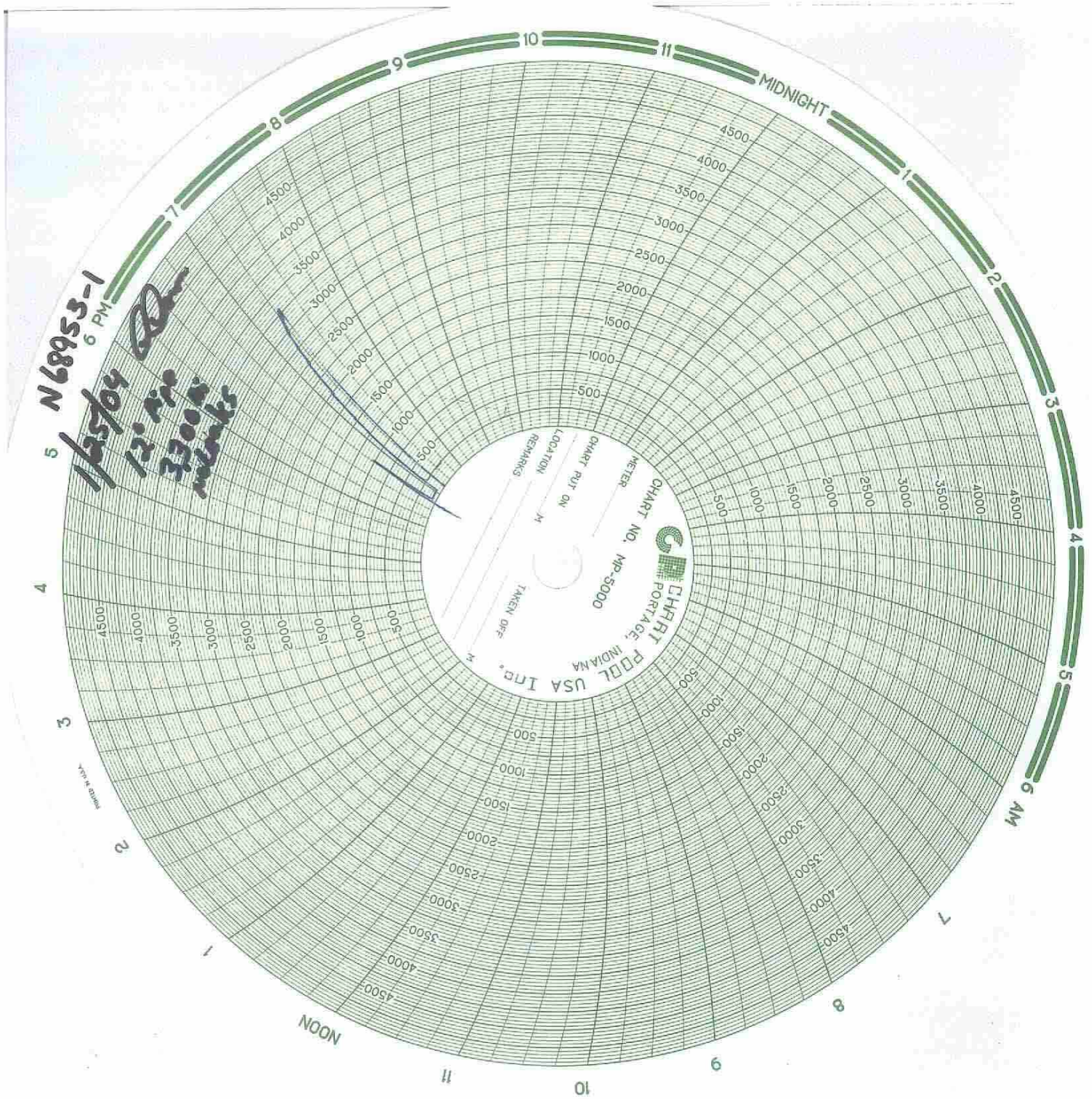
TEST EQUIPMENT USED TO CALIBRATE IS TRACEABLE TO NATIONAL BUREAU STANDARDS AND CERTIFICATES ARE ON FILE, CONFORMING TO MIL-STD-45662.

****

RESULTS:		
1	N/A	N/A
Pc's Acceptable	Pc's Recordable	Pc's Rejectable

OPERATOR: DAVID DOWN Date: 01/27/04 SNT-TC-1A LEVEL III

7825 Hillmont Houston, Texas 77040 (713) 690-2703


MIDNIGHT
NOON
6 PM
6 AM
CHART POOL USA Inc.
CHART PORTAGE, INDIANA
CHART NO. MP-5000
METER
CHART PUT ON
LOCATION
REMARKS
TAKEN OFF
N68953-1

ISO 9002
Certificate Number: 30689.3

Quality Concepts

INSPECTION COMPANY, INC.

HYDROSTATIC TEST REPORT# N68953-2

CUSTOMER: BUTLER TECH INTERNATIONAL LLC PO# 543021

MATERIAL: API 5L GB / X-42 HT# B65583 PCS 1

CUSTOMER INFO: 16" DIA X .375" WALL MECHANICAL PIPE JOINT

SPECIFICATION: HYDROSTATIC TEST @ 2450 PSI

****

INSTRUMENT: Oil & Gas Measurement Equip. CALIBRATION DATE: 01/23/04

CHART S/N: MP-5000

****

COMMENTS: 1 PC PASSED (NO LEAKS/NO JOINT SEPARATION)

****

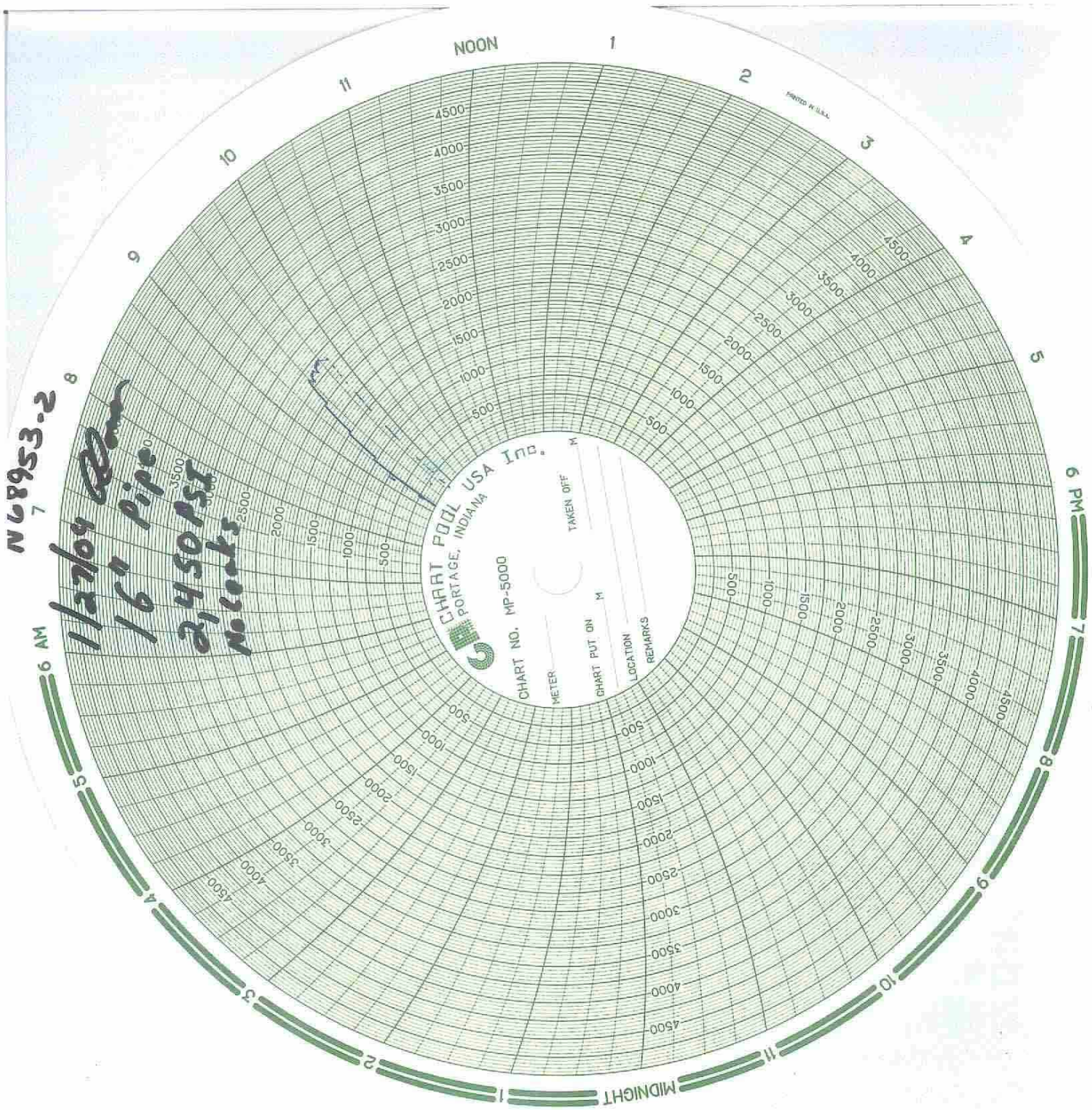
TEST EQUIPMENT USED TO CALIBRATE IS TRACEABLE TO NATIONAL BUREAU STANDARDS AND CERTIFICATES ARE ON FILE, CONFORMING TO MIL-STD-45662.

****

RESULTS:		
1	N/A	N/A
Pc's Acceptable	Pc's Recordable	Pc's Rejectable

OPERATOR: DAVID DOWN Date: 01/27/04 SNT-TC-1A LEVEL III

7825 Hillmont Houston, Texas 77040 (713) 690-2703


NOON
MIDNIGHT
6 AM
6 PM
CHART POOL USA Inc.
PORTAGE, INDIANA
CHART NO. MP-5000
METER
CHART PUT ON
TAKEN OFF
LOCATION
REMARKS
N 6953-2
11/2 Hour @
16" Pipe
2450 PSI
No Leaks

(7)

SouthWestern Laboratories

(Rice University, Houston TX)

{1985}

REPORT ON

BENDING TESTS OF SURE-LOCK TAPER JOINTS

FOR

BUTLER TAPER JOINT, INC.

John E. Merwin

February 18, 1985

SwL **SOUTHWESTERN LABORATORIES**

Materials, environmental and geotechnical engineering, nondestructive, metallurgical and analytical services

222 Cavalcade St. • P.O. Box 8768, Houston, Texas 77249 • 713/692-9151

January 18, 1985

BUTLER TAPER JOINT COMPANY
2012 Karbach
Houston, Texas 77092

Attention: Major Butler

Gentlemen,

Testing procedures conducted by Southwestern Laboratories are carried out on equipment which is calibrated as required per Southwestern Laboratories Quality Assurance Manual to National Bureau of Standards traceability. Testing conducted for BUTLER TAPER JOINT, INC., is therefore traceable to those standards. Published test data can be directly compared to material requirements to determine an acceptance or rejection criteria. Our data can be compared to codes or standards such as ASME, ASTM, AWS and API.

Very truly yours,

SOUTHWESTERN LABORATORIES, INC.

Robert D. Koester

Robert D. Koester, P.E.
Manager, Metals/Metallurgical
Engineering Division

RDK/ckl

cc: Brian Trembley

Bending Tests of Sure-Lock Taper Joints

Butler Taper Joint, Inc. has a patented Sure-lock Taper Joint process for joining line pipe. In order to determine the suitability of these joints for off-shore pipe laying operations, bending tests were conducted on two joints, one joining 4 inch schedule 40 pipe and one joining 4 inch schedule 80 pipe.

In order to conduct the tests, a loading frame was designed and fabricated to permit four point loading with a six foot overall span, two foot shear spans, and a two foot pure moment span in which the joint would be centered. This frame was installed in a 110 kip MTS closed loop servo-hydraulic load frame as shown in Figure 1. Loads were determined by a load cell with an accuracy of ¼% of full scale. Two methods were used to indicate curvature. For the initial small curvatures, electrical resistance strain gages were attached to the pipe, and the curvature determined from the relation that the curvature is equal to the strain divided by the outside radius of the pipe. For larger curvatures, the curvature was determined by measuring the central deflection relative to the inner supports using a LVDT linear displacement transducer. For a pure moment span, the curvature is equal to 8 times the deflection divided by the square of the pure moment span.

There were several reasons for using two methods of calculating curvatures. First, the deflection method is inherently not accurate for very small deflections. Also, the deflections measured initially were affected by the clearances in various supports. Curvatures calculated from strains are accurate for small curvatures, but as the curvature increases, the pipe begins to oval and this ovaling affects the measured strains.

To check the operation of the load frame and measurement system, a piece of 4 inch schedule 40 A53 line pipe was tested. As expected, the curvature calculated from deflections was inaccurate until a

curvature of about 0.002 1/inches was reached. After this, curvatures determined by both strain gages and deflections agreed to within about 2% until a curvature of about 0.009 1/inches. At this point, the strains were too large to be measured with the instrumentation as set up.

The two joints were tested on February 14, 1985. The tests were performed in the Ryon Laboratory at Rice University, Houston, Texas by John E. Merwin (Professor in the Department of Civil Engineering) and assisted by Hugh L. Hales (technician). These tests were conducted on the basis of a private arrangement between Merwin and Butler Taper Joint, Inc. Major G. Butler, Benjamin Rencoret, and Ren Clark were present as representatives for Butler Taper Joint, Inc., and Peter D. Brock was the representative for Lloyd's Register of Shipping.

The schedule 40 pipe was X42 steel with a nominal outside diameter of 4.50 inches and 0.237 inch wall thickness. The schedule 80 pipe was Grade B 35 ksi steel with a nominal outside diameter of 4.50 inches and 0.337 inch wall thickness.

In order to simulate the effect of overbend before the sag bend in an off-shore pipe laying operation, the shedule 40 pipe was first bent to a strain of 0.00126 at a moment of 9.15 kip-ft. The pipe was unloaded and rotated 180° so that the test could be continued with bending opposite to the initial direction. Figures 2 and 3 show plots of moment versus curvature based on strains and deflections. Strains in excess of 2% were reached in the pipe. It should be noted that the strains determine the curvature in the pipe near the joint while the deflections determine an average "curvature" in the moment span. Since the joint is stiffer than the pipe, curvature becomes a somewhat arbitrary definition over a length that has changes in stiffness. The roughness of the curves in all probability is not a physical phenomenon in the pipe or joint but is related to friction in the bearings in the load frame.

The procedure for the schedule 80 pipe was similar to the schedule 40 test. The initial bend was to a strain of 0.00127 at a moment of 14.6 kip-ft. Figures 4 and 5 show the moment versus curvature plots for the schedule 80 pipe. Again, strains in the pipe in excess of 2% were reached.

From a structural point of view, both joints performed satisfactorily. The minimum radii of curvatures achieved, approximately 12 feet for the schedule 40 and 11 feet for the schedule 80, are far more severe than would be expected in practice. Both joints were still capable of supporting increases in the moment at the termination of the tests. The only visible damage was cracks in the excess epoxy sealer that was present at the lips of the bell ends. Further tests of these bent joints are planned by Butler Taper Joint, Inc. to determine if this bending has had any adverse effects on the ability of these joints to contain pressure.

API 5L X PIPE

John E. Mewin

BUTLER TAPER JOINT, INC.
CERTIFIED TEST RESULTS

WE CERTIFY THE VALIDITY OF THESE TEST RESULTS AND FURTHER CERTIFY THAT ONLY API CERTIFIED LINE PIPE WAS UTILIZED FOR THESE TESTS.

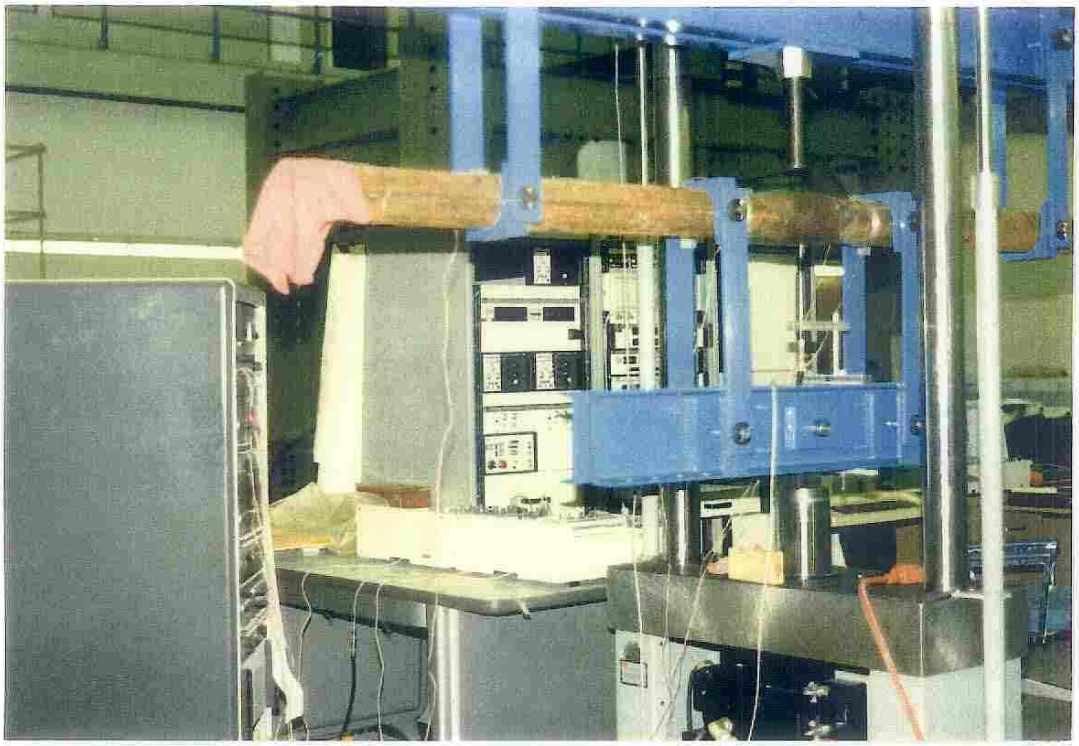
HERBERT J. GREEN, PRESIDENT
BUTLER TAPER JOINT, INTL.

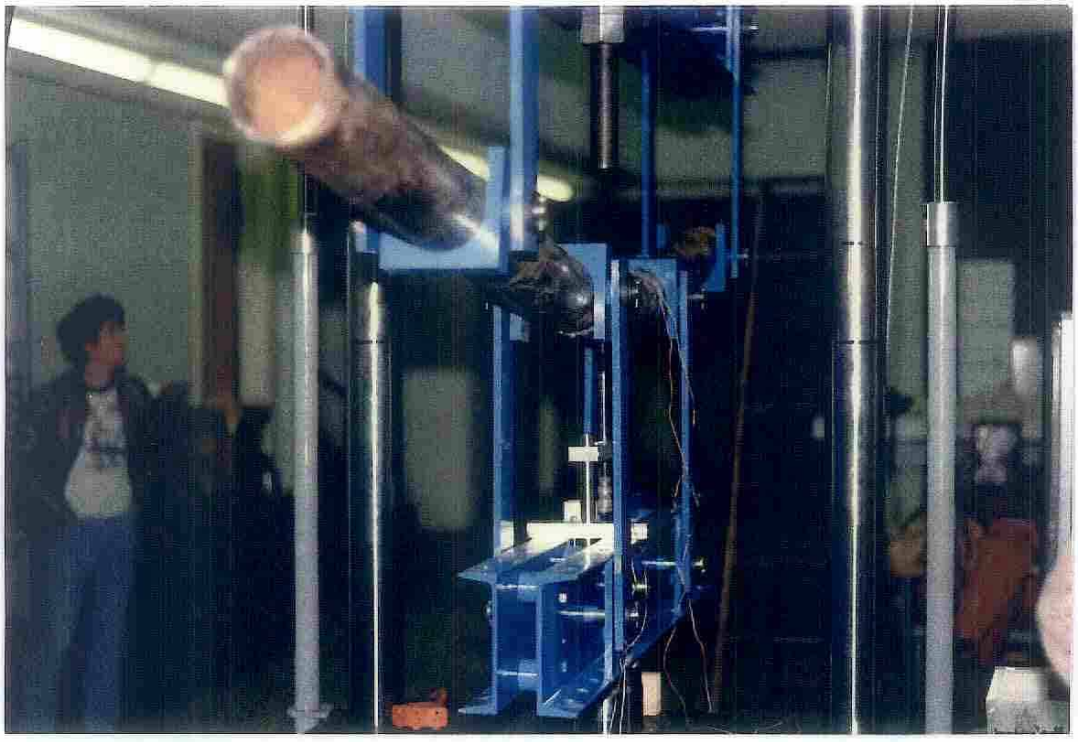
10/4/93
DATED

Renee Armstrong
10/4/93

NOTARY PUBLIC STATE OF TEXAS

RENEE ARMSTRONG
NOTARY PUBLIC
STATE OF TEXAS
My Comm Exp. 09-14-96





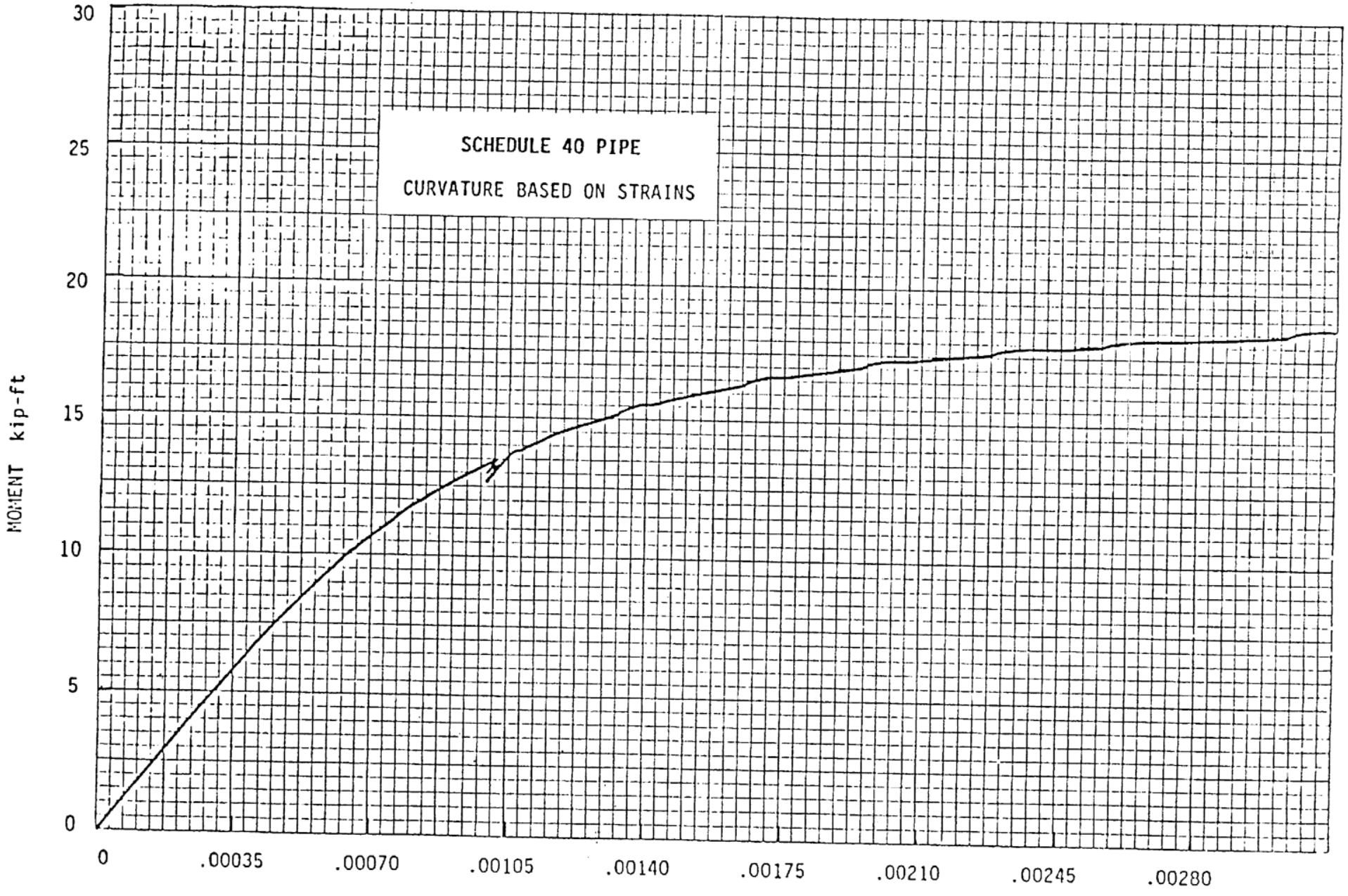

SCHEDULE 40 PIPE
CURVATURE BASED ON STRAINS
MOMENT kip-ft
30
25
20
15
10
5
0
0
.00035
.00070
.00105
.00140
.00175
.00210
.00245
.00280
CURVATURE 1/inch

Figure 2

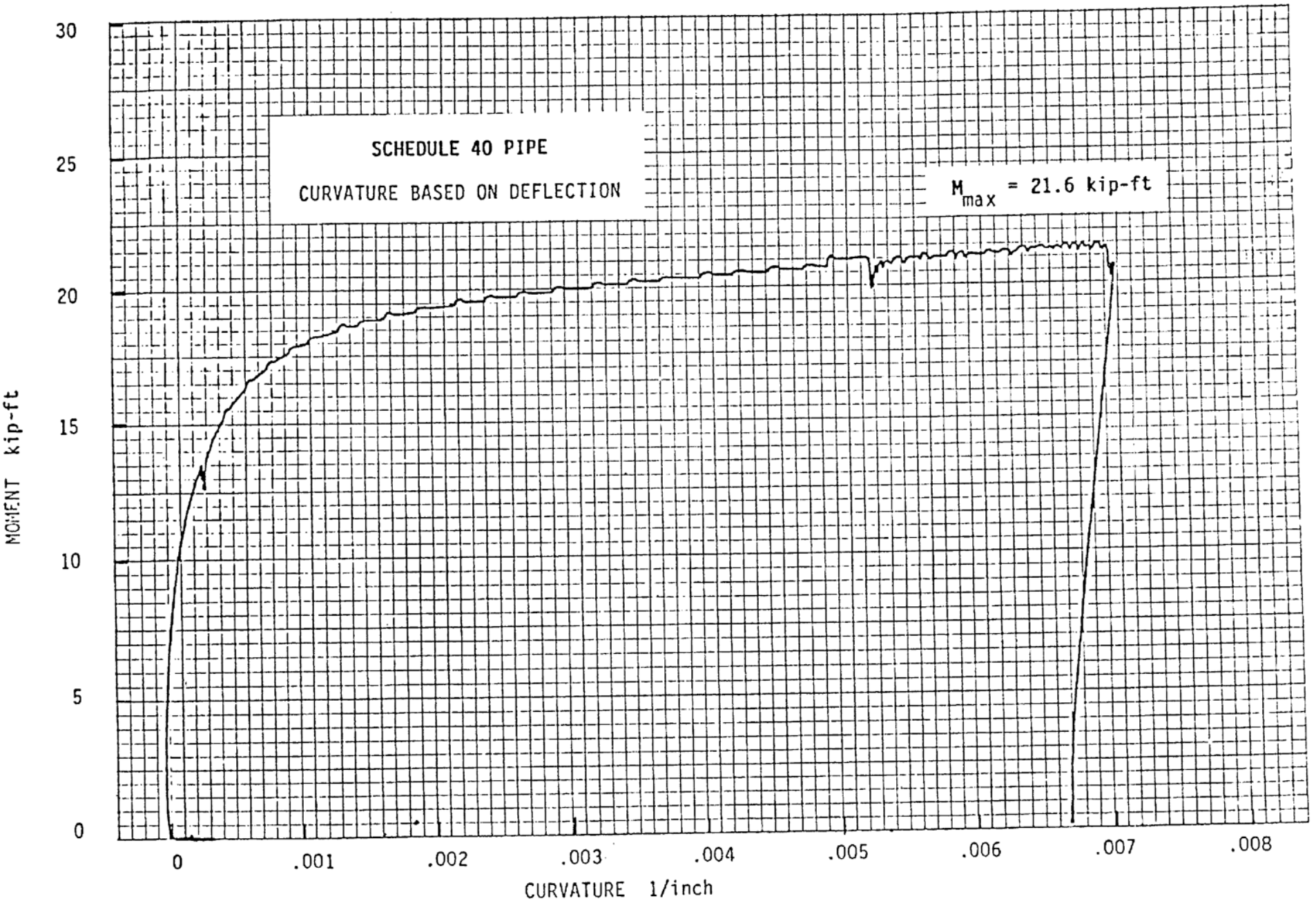


Figure 3

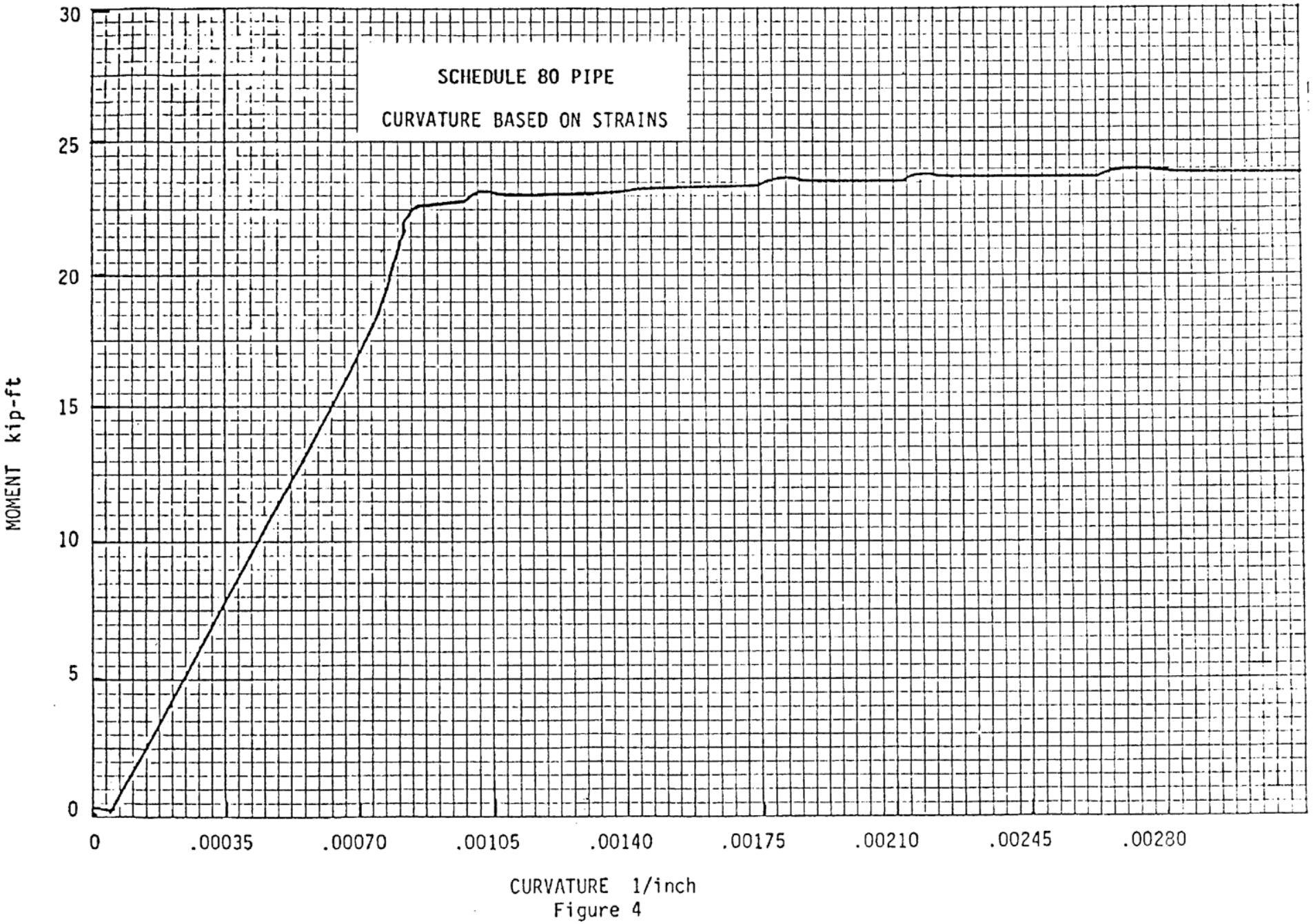


Figure 4

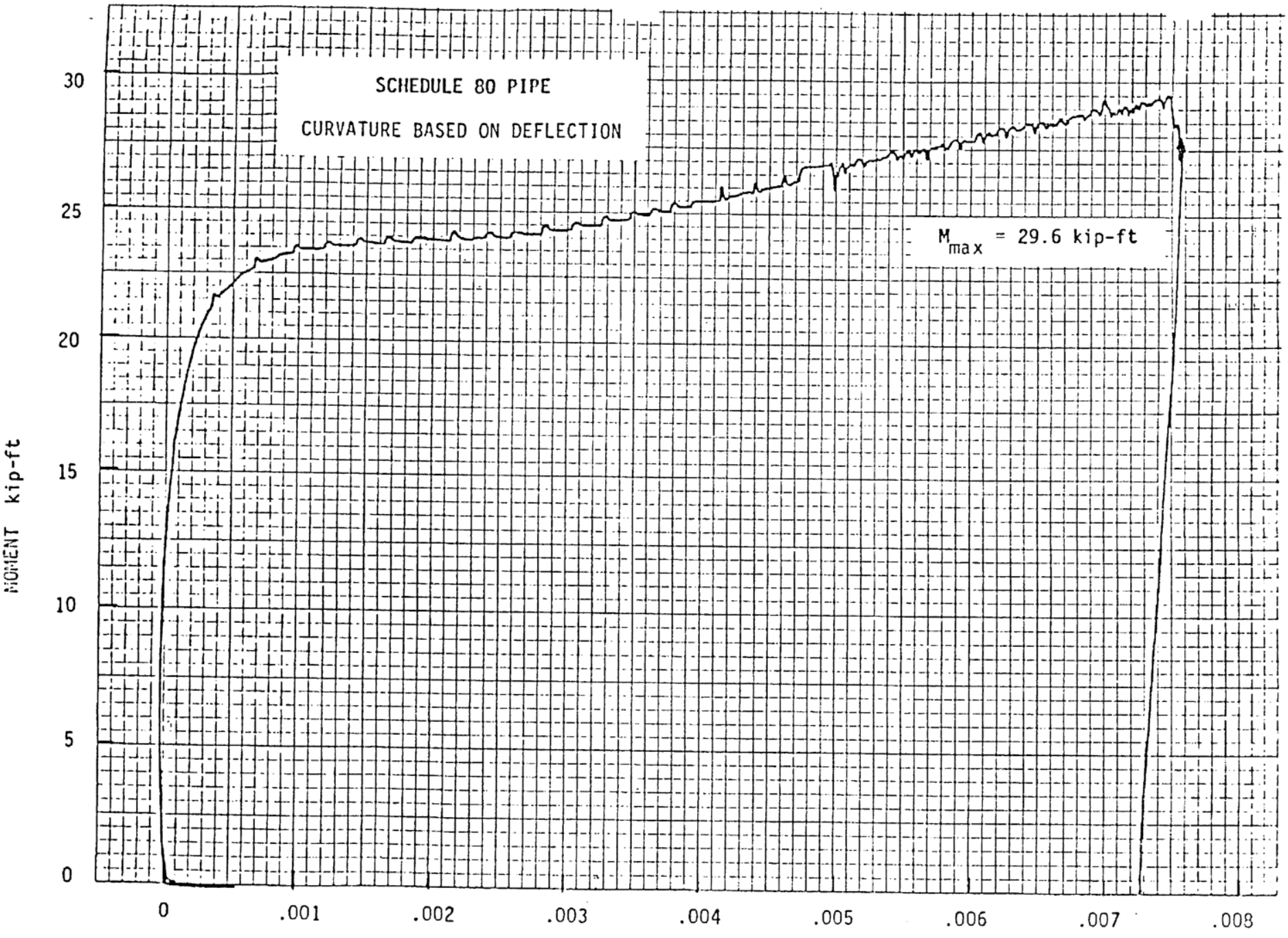
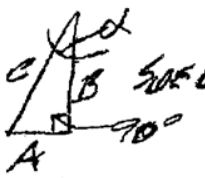


Figure 5

BASED ON 5W LAB TEST PADS



$SOH\ B = \sqrt{C^2 - A^2}$

FOR SCH 40:

$B = \sqrt{(144)^2 - (36)^2}$

$= \sqrt{20736 - 1296}$

$= \sqrt{19440}$

$= 139.427"$

$X = R - B$

$= 144 - 139.427$

$= 4.573$

FOR SCH 80:

$B = \sqrt{(132)^2 - (36)^2}$

$= \sqrt{17424 - 1296}$

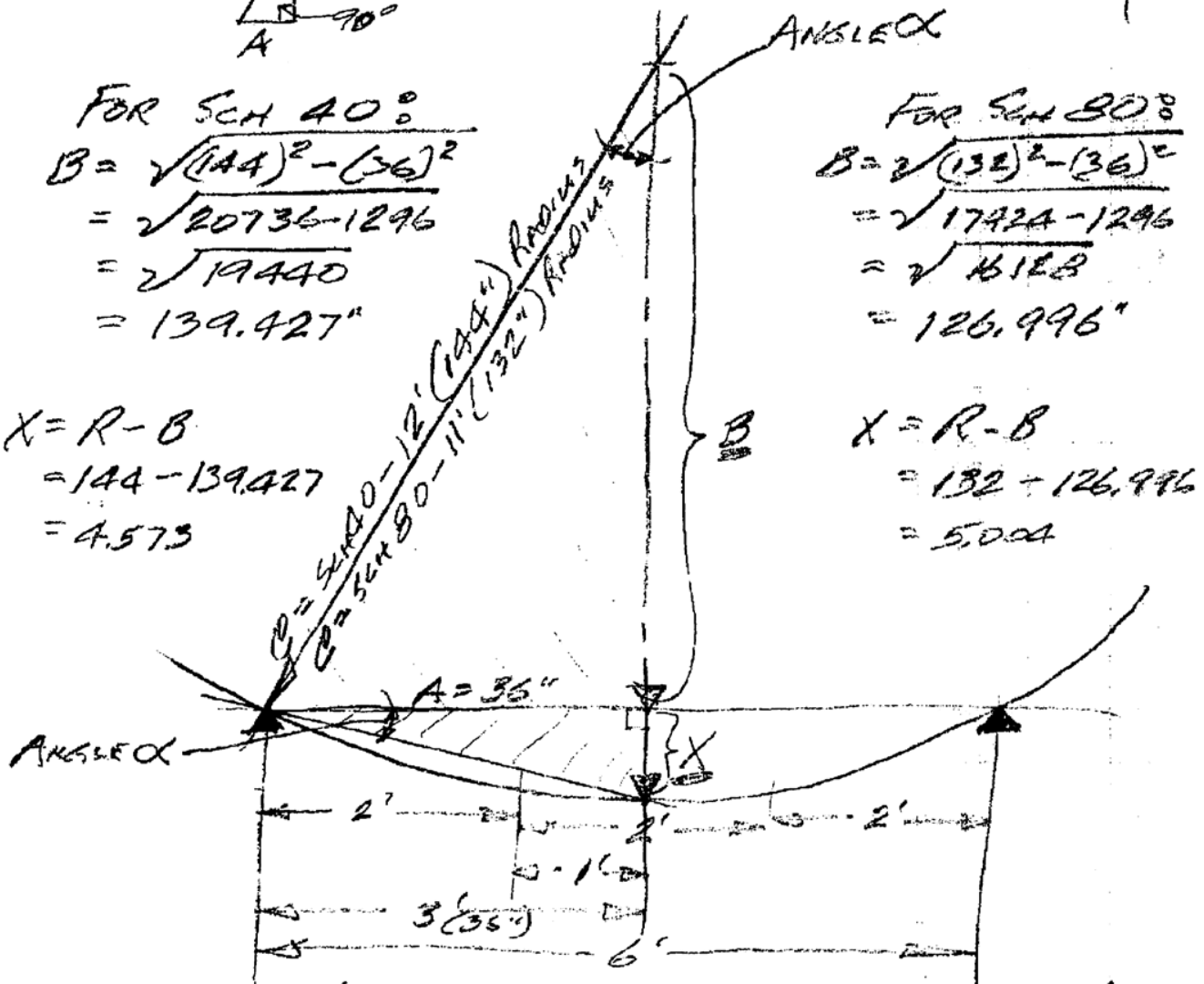
$= \sqrt{16128}$

$= 126.996"$

$X = R - B$

$= 132 - 126.996$

$= 5.004$



TANGENT $\alpha = \frac{X}{36}$

$= \frac{4.573}{36}$

$= .127028$

FROM TRIG. TABLES

α APPROX $= 7°14\frac{1}{2}'$

TANGENT $\alpha = \frac{X}{36"}$

$= \frac{5.004}{36}$

$= .13900$

α APPROX $= 7°55'$

AVERAGING THE APPROX ANGLES YIELDS APPROX 7½

(8)

Sumitomo Metal Technology

{1996}

Mechanical Test Results of Butler Joint

March 1996

SUMITOMO METAL TECHNOLOGY ,INC.

Table 4 Tensile Test Result of Testsd Pipe

No	Dia. (OD) (mm)	Thick. (mm)	Area of Section (mm^2)	Yield Strength		Tensile Strength		Elongation (G.L.:50mm) (%)
				Load (KN)	Stress (N/mm^2)	Load (KN)	Stress (N/mm^2)	
1	60.3	3.91	693	251	362	348	501	48

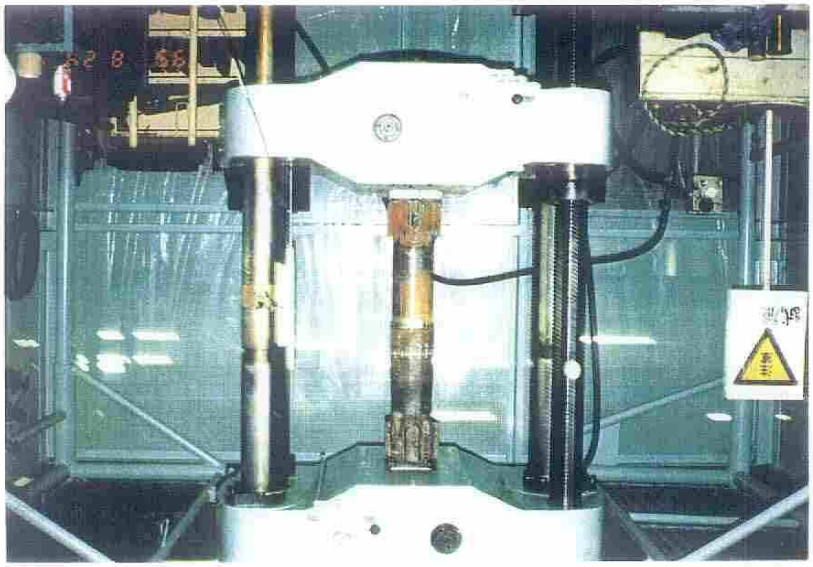
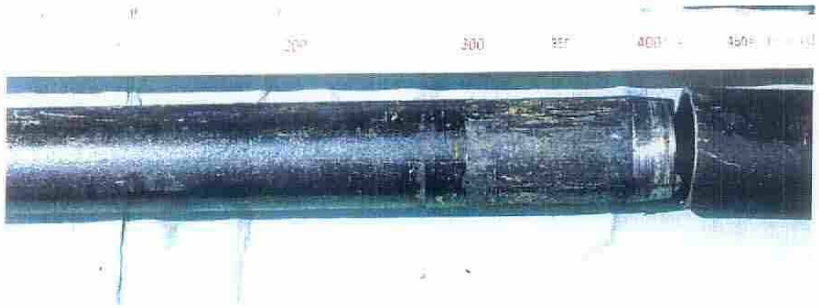
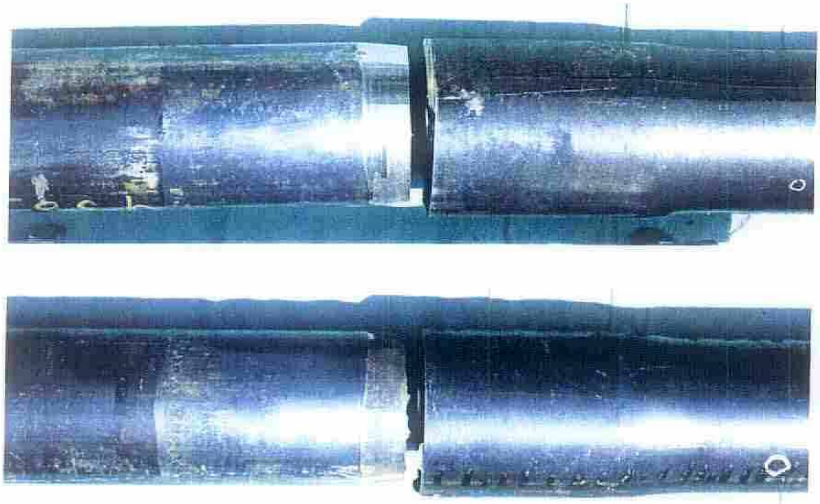


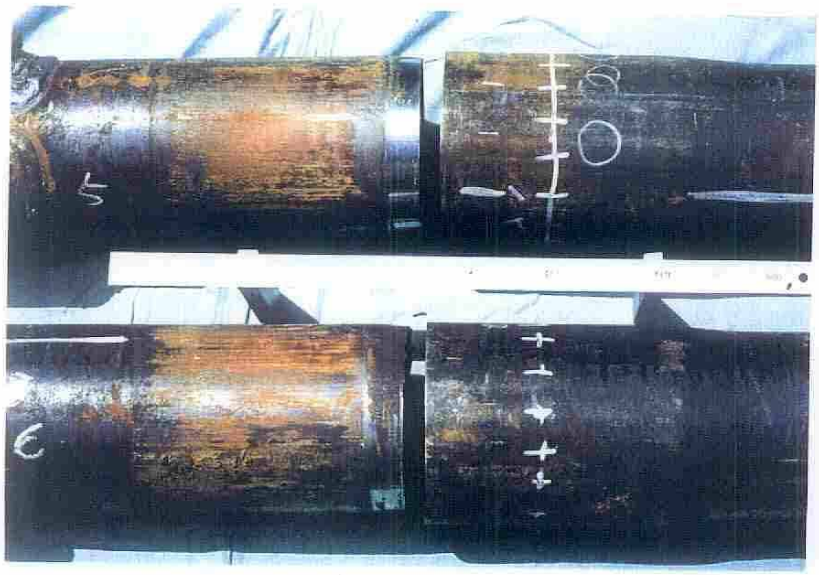
Photo.1 Appearance of Tensile Tests



φ60.3×t3.9



φ114.3×t4.7



φ168.0×t6.4

Photo.2 Appearance of Specimens After Tensile Test

1. Tested Material

Table 1 Chemical Analysis of Tested Materials

Specification of Material	Diameter (OD) (mm)	Thickness (mm)	Chemical Analysis (wt%)						
			C	Si	Mn	P	S	Cu	Al
API 5L X42 GrB	60.3	3.9	0.22	0.19	0.72	0.010	0.002	0.01	0.020
	114.3	4.7	0.09	0.08	0.48	0.013	0.008	0.01	0.039
	168.3	6.4	0.09	0.02	1.15	0.015	0.004	0.01	0.039

Table 2 Mechanical Properties of Tested Materials

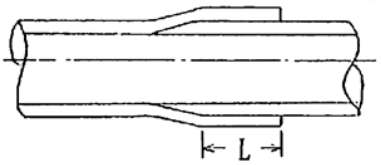
Specification of Material	Diameter (OD) (mm)	Thickness (mm)	Yield Strength (N/mm^2)	Tensile Strength (N/mm^2)	Elongation (%)
API 5L X42 GrB	60.3	3.9	348	486	43
	114.3	4.7	441	473	31
	168.3	6.4	409	467	37

2. Test Items
   (1) Tensile Test
   (2) Fatigue Test
   (3) Bend Test
   (4) Burst Test
   (5) Torsion Test

3. Test Results
   3.1 Tensile Test
   (1) Testing Machine : Universal Testing Machine (Load : Max.200KN and 300KN)
   (2) Test Results

Table 3 Tensile Test Results of Butler Joints

No.	Dia. (OD) (mm)	Thick. (mm)	Area of Section (mm^2)	Maximum Load (KN)		Tensile Strength (N/mm^2)		Position of Fracture	Length of Insertion L (mm)
1	60.3	3.91	693	254	Ave. 255	367	Ave. 369	Fitting Zone	90
2	60.1	3.94	695	257		370			
3	114.5	4.74	1634	659	Ave. 653	403	Ave. 400	Fitting Zone	140
4	114.3	4.74	1633	646		396			
5	168.1	6.35	3233	1240	Ave. 1251	384	Ave. 387	Fitting Zone	210
6	168.2	6.38	3245	1261		389			



3.2 Fatigue Test

(1) Testing Machine : Hydraulic Servo-Controlled Testing Machine (Load : Max. 200tonf)

(2) Test Condition

Loading Method : Axial Load Controll-Pulsating Fatigue and Sine Curve

Internal Pressure : 5kgf/cm² (Air)

(3) Test Results

Table 5

3.3 Bend Test

(1) Testing Machine : Universal Testing Machine (Load : Max. 100tonf)

(2) Bending Method : 4 Points and 3 Points Bending

(3) Internal Pressure : 5kgf/cm² (Air)

(4) Test Results

Table 6 Bend Test Results of Butler Joints

No.	Diameter (OD) (mm)	Thickness (mm)	Bending Method	Maximum Bending Angle	Bending Angle at Air Leak
1	114.3	4.7	4 Points	24.2°	24.2° (No Leak)
2	114.3	4.7	3 Points	17.4°	14.0°

3.4 Burst Test

(1) Testing Machine : Combined Load Testing Machine (Tension and Compression : Max. 2000tonf
Stroke: Max. 350mm
Hydraulic Pressure : Max. 3000kgf/cm²)

(2) Test Results

Table 7 Burst Test Results of Butler Joints

No.	Diameter (OD) (mm)	Thickness (mm)	Pressure at Water Leak (kgf/cm²)
1	60.3	3.9	595
2	114.3	4.7	380
3	168.0	6.4	365

Note : $1kgf/cm^2 = 9.80665 \times 10^4$ Pa(N/m^2)

Table 5 Fatigue Test Results of Butler Joints

No.	Diameter (OD) (mm)	Thichness (mm)	Area of Section (mm²)	Frequency (Hz)	Load (tonf)		Stress (kgf/mm²)		Stress Range σ_R (kgf/mm²)	Stress Ratio R (σ min / σ max)	Number of Cycles N (cycle)	Leak of Air	Position of Fracture
					P max	P min	σ max	σ min					
1	60.3	3.9	691	2	10.9	1	15.9	1.4	14.5	0.09	187710	No Leak	Weld Zone *1
2	60.3	3.9	691	2	13.6	1	19.7	1.4	18.3	0.07	1231010	No Leak	Weld Zone *1
3	60.3	3.9	691	2	15.3	1	22.1	1.4	20.7	0.06	64730	No Leak	Weld Zone *1
4	60.3	3.9	691	2	15.3	1	22.1	1.4	20.7	0.06	1064632	No Leak	Base Metal

Note *1 Specimens were damaged at weld zone of chucking jig and tests were stopped.

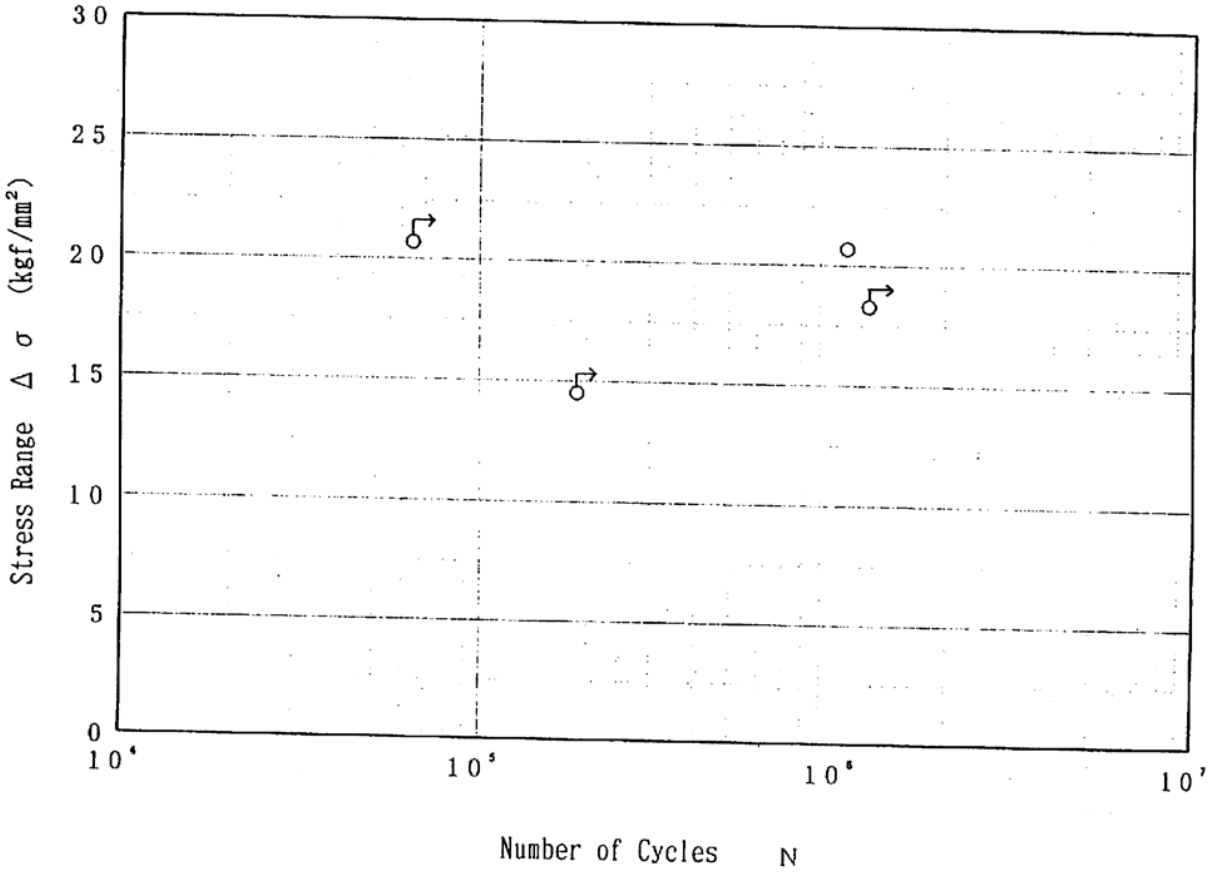


Fig.1 Relation of Stress Range and Number of Cycles

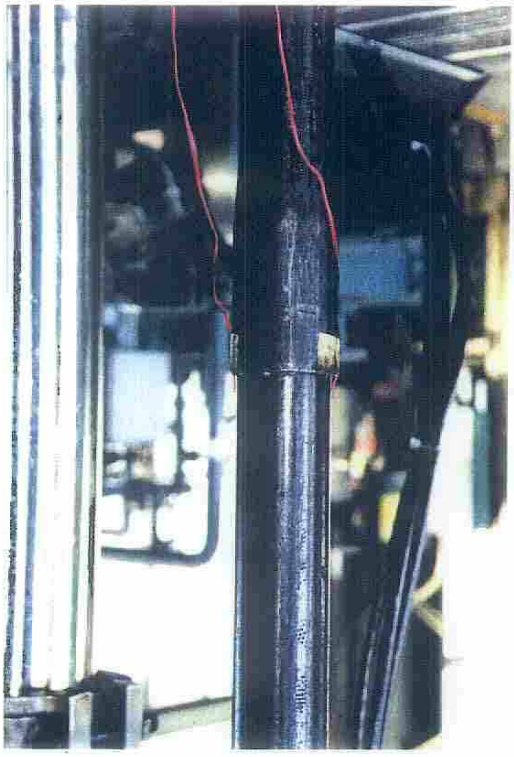


Photo.3 Appearance of Fatigue Test

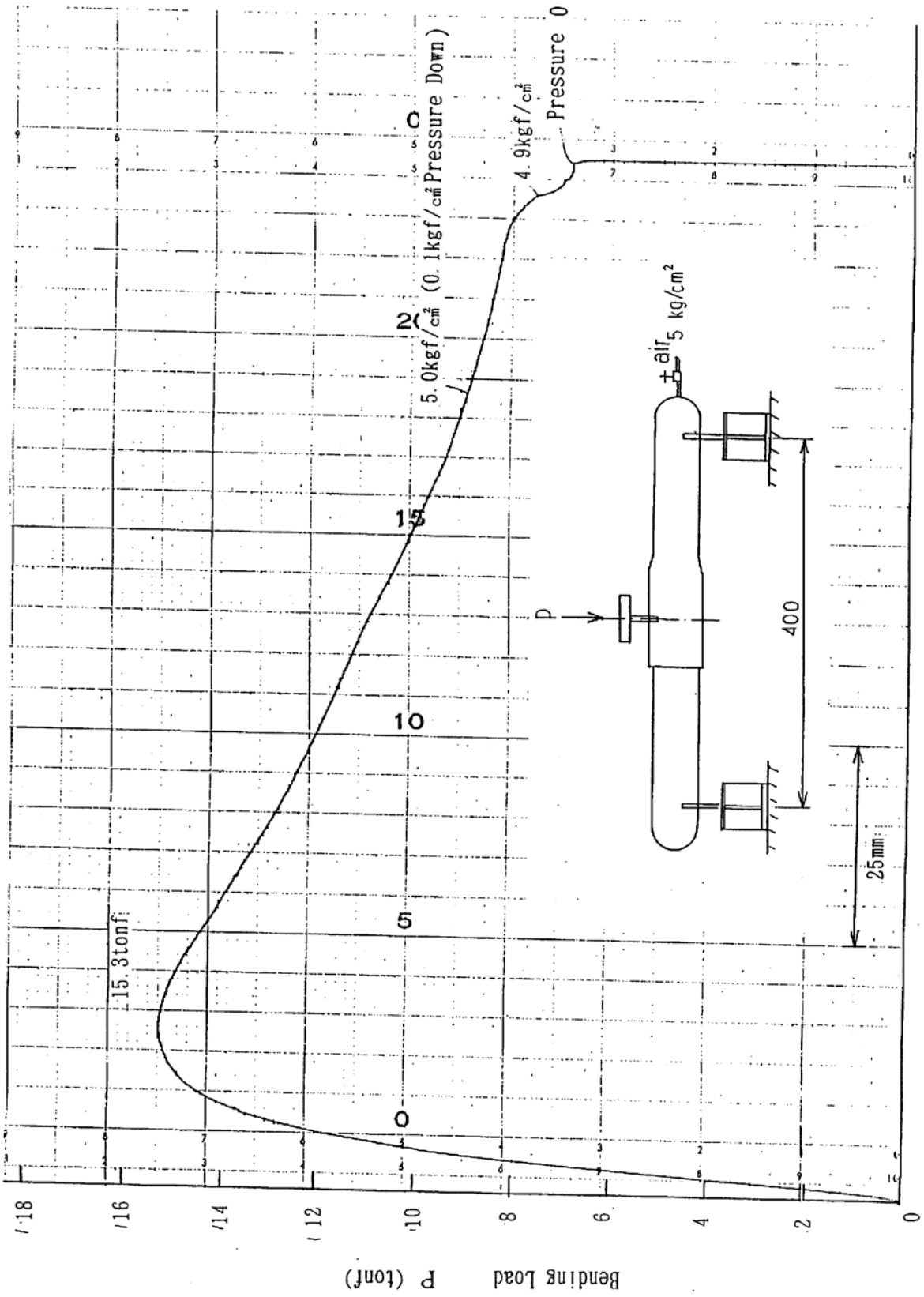


Fig.2 Bend Test Result of Butler Joint (3 Points Bending)

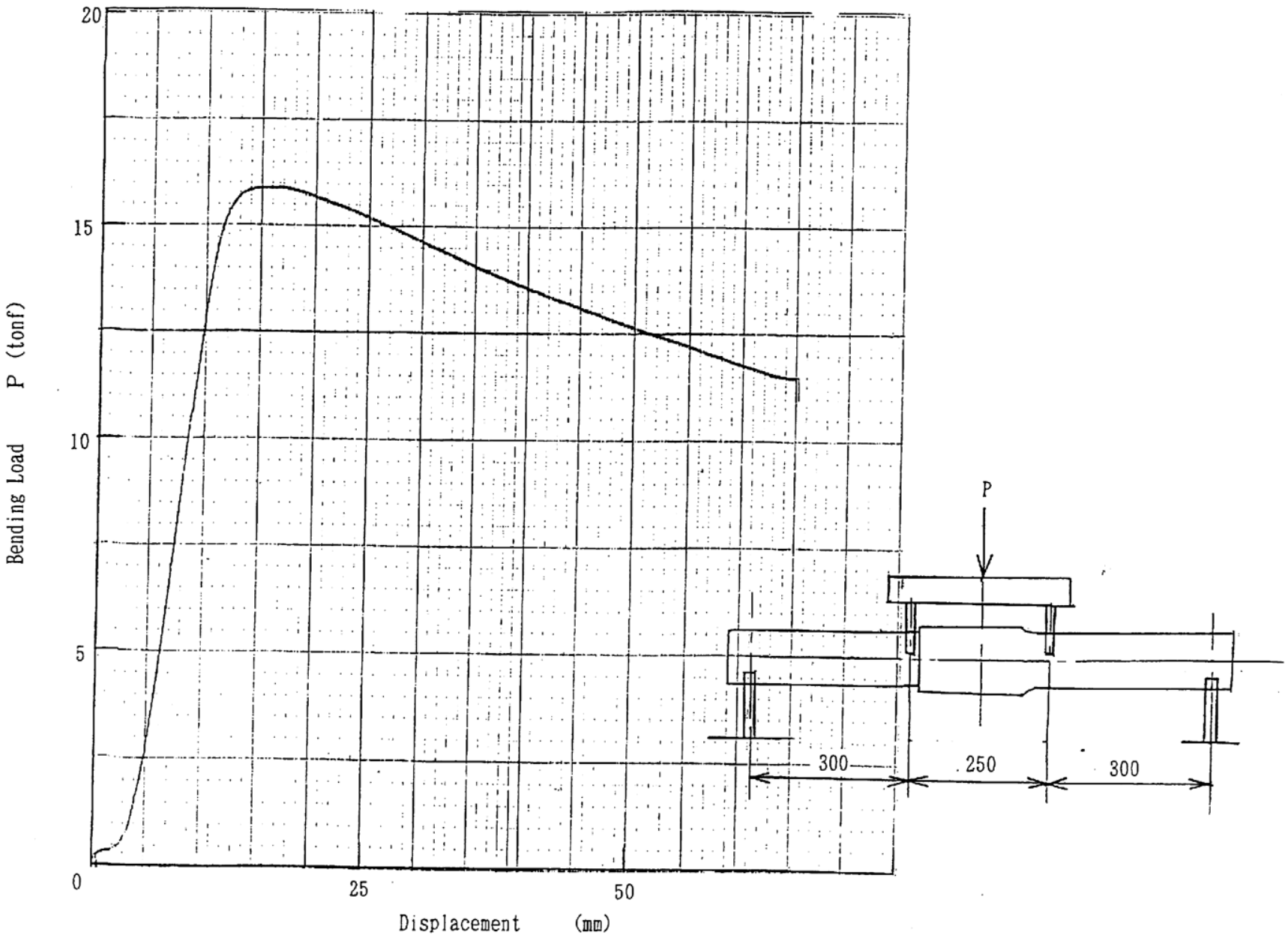


Fig.3 Bend Test Result of Butler Joint (4 Points Bending)

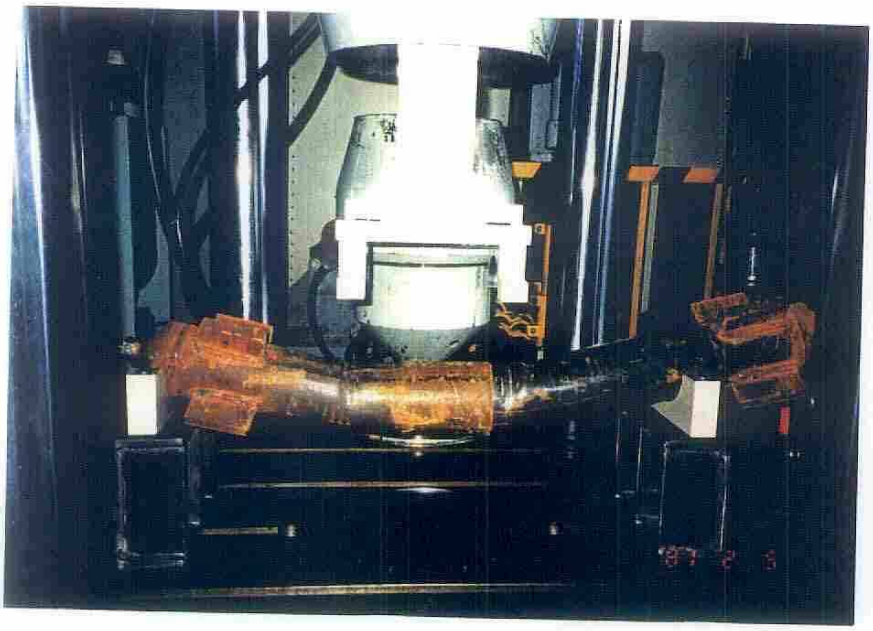
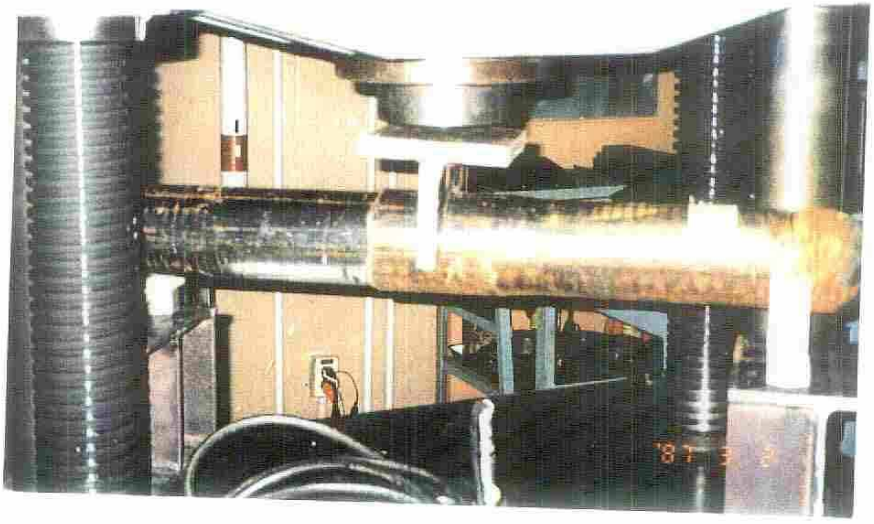


Photo. 4 Appearance of Bend Test (4 Points)



Appearance before Bend Test

Appearance after Bend Test

Photo. 5 Appearance of Bend Test (3 Points)

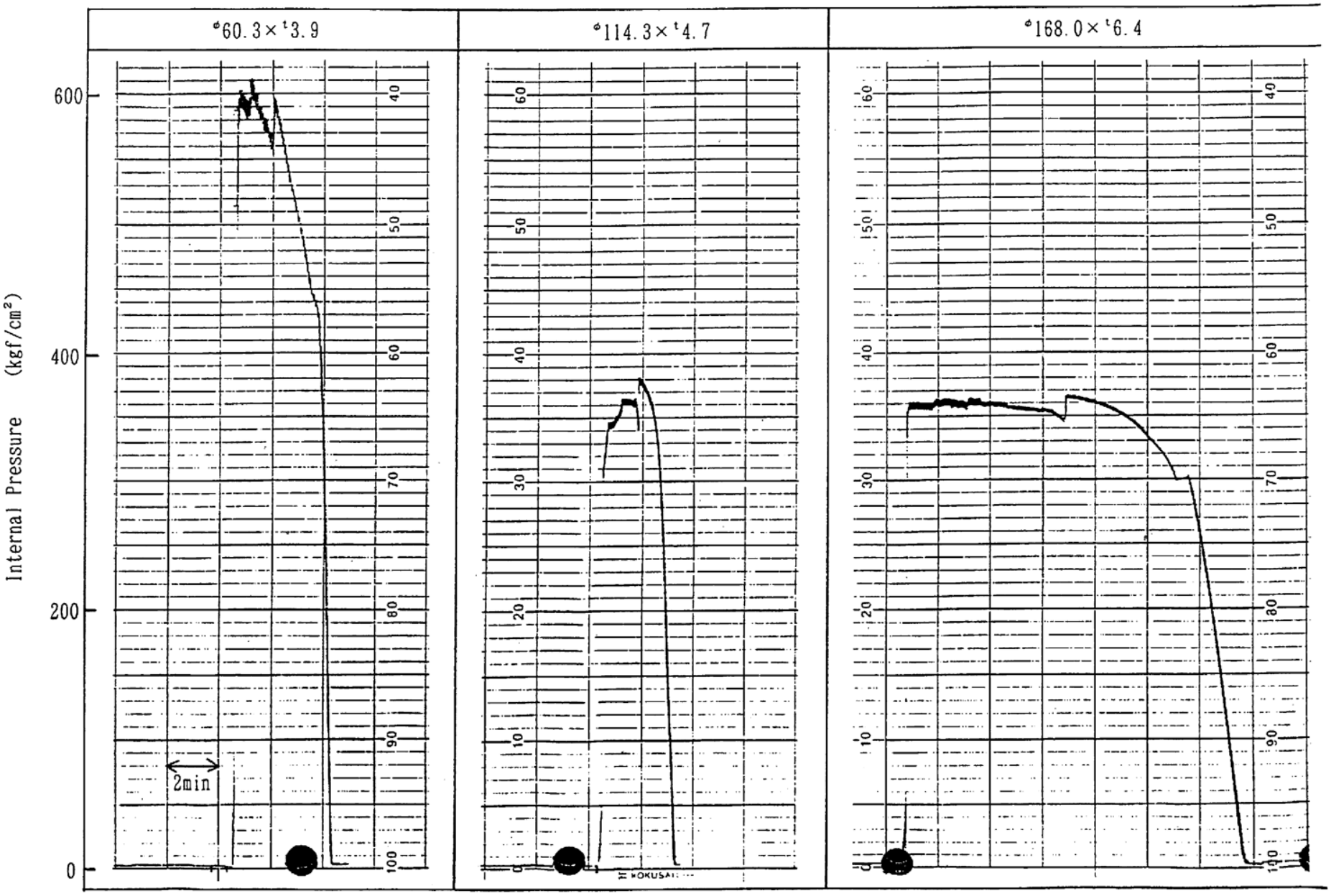


Fig.4 Burst Test Results of Butler Joints

φ60.3×t3.9

φ114.3×t4.7

φ168.0×t6.4

Photo.6 Appearance of Specimens Before Burst Test

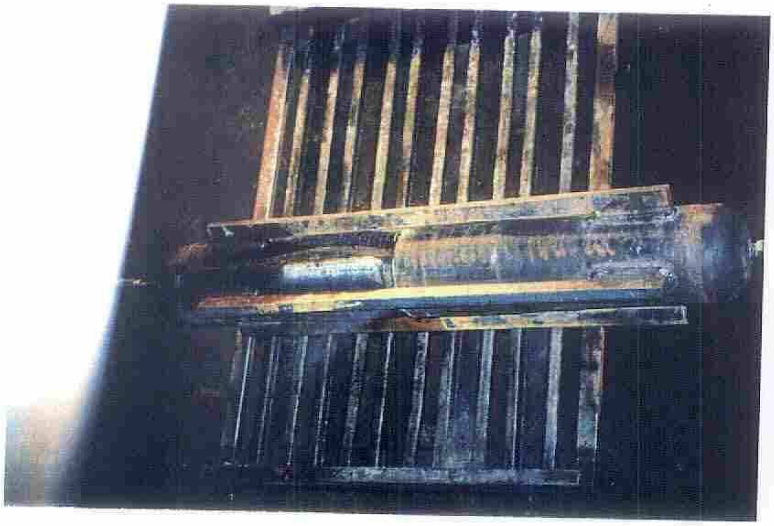


Photo. 7 Appearance of Specimen after Burst Test

3.5 Torsion Test

(1) Testing Machine : Hydraulic Powered Tong Unit (Torque : 25000ft-lb(3500kg-m)
Make up r.p.m : 2-r.p.m)

(2) Test Result

Table 8 Torsion Test Result of Butler Joint

No	Diameter (O.D) (mm)	Thickness (mm)	Maximum Torque (ft-lb)	Turns
1	114.3	4.7	16187	0.37

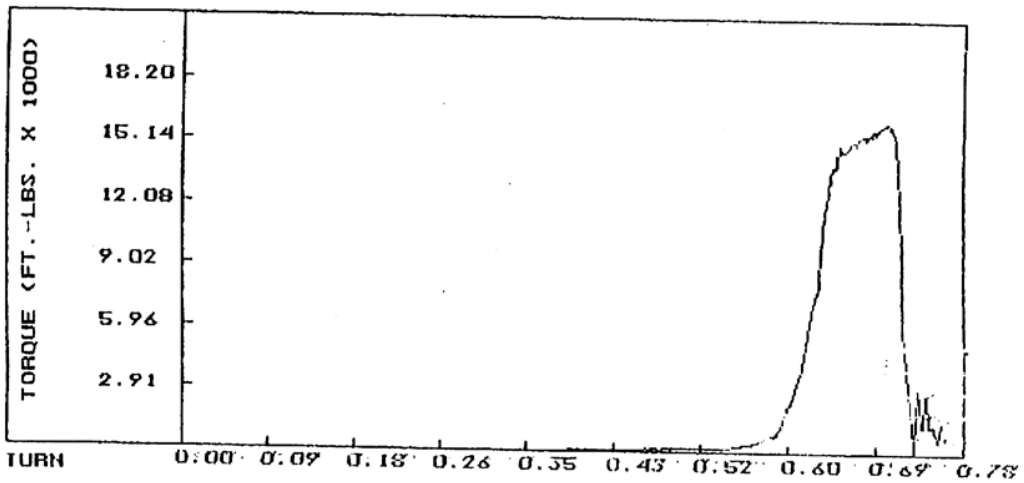


Fig.5 Torque - Turn Graph

Photo. 8 Appearance of Torsion Test

(9)

VNIIGAS

All Russian Scientific Research Institute For Natural Gas

RUSSIAN JOINT STOCK COMPANY "GASPROM"
VNIIGAS - ALL RUSSIAN SCIENTIFIC RESEARCH INSTITUTE
FOR NATURAL GASES AND GAS TECHNOLOGIES

SUMMARY OF THE TEST REPORT ON SURE LOCK MECHANICAL PIPE JOINTS

PURPOSE OF TEST PROGRAM : THE FOLLOWING TEST PROGRAM WAS CARRIED OUT IN 1998 TO DETERMINE THE POSSIBILITY OF USING BUTLERS' MECHANICAL JOINT SYSTEM WITHIN RUSSIAN NATURAL GAS INDUSTRY.

NUMBER OF JOINTS TESTED: THE PROGRAM OF THE TESTING WAS PERFORMED ON **20 "SURE LOCK" JOINTS** WHICH WERE MANUFACTURED UTILIZING BUTLER MODEL 26 ASSEMBLY PRESS MACHINE INSTALLED AT THE PIPE PREPARATION FACILITY OF RUSSIAN OIL COMPANY "BASHNEFT".

TYPE OF THE PIPE: PIPE JOINTS TEST SAMPLES WERE MADE FROM THE RUSSIAN GOST 8732-78 STANDARD SEAMLESS PIPES 114 MM OD AND 6 MM WALL THICKNESS, STEEL GRADE 20. THE OFFICIAL PIPE MILL CERTIFICATE WAS PROVIDED TO ASSURE THE QUALITY OF THE PIPES.

TYPES OF TESTS PREFORMED: THE COMPLETE TEST PROGRAM IMITATED THE CLOSE VIRTUAL REAL LOADS WHICH MAY OCCUR IN PIPELINE DURING REAL OPERATIONS. FOLLOWING TYPES OF TESTS WERE PREFORMED:

STATIC	**AXIAL PULL APART TEST**
	BEND TEST
	TORSION TEST
CYCLE	**PULL APART TEST**
	BEND TEST
	THERMAL TEST

PRESSURE TEST AFTER SEVERAL BENDING STRAINS

THE DISTRIBUTION OF THE MECHANICAL JOINTS SPECIMEN FOR TESTING:

AXIAL PULL APART TEST	**3 SPECIMEN**
BEND TEST	**3 SPECIMEN**
TORSION TEST	**2 SPECIMEN**
CYCLE PULL APART TEST	**3 SPECIMEN**
CYCLE BEND TEST	**4 SPECIMEN**
CYCLE THERMAL TEST	**2 SPECIMEN**
PRESSURE TEST	**3 SPECIMEN**

DURING ALL TESTS ALL THE INTERNAL PRESSURES OF THE SPECIMEN WAS 30 ATM.
THE MAXIMUM TEST LOADS ON THE JOINTS FOR THE CYCLE TESTS WERE 0.9 FROM THE GUARANTEED YIELD POINT OF THE PIPES (STEEL 20 YIELD POINT = 25 kgs/mm2 , MAXIMUM TEST LOAD = 22.5 kgs/mm2.)
EACH CYCLE TEST CONSISTED OF 200 CYCLES.

THE TEST CRETERIAS : PLASTIC DEFORMATION
DESTRUCTING OF THE JOINT OR THE PIPE BODY
LEAKS
COMPLETING THE THE AMOUNT OF THE CYCLES

THE TEST RESULTS INDICATED THAT NONE OF THE SPECIMEN JOINTS LEAKED OR WERE DESTRUCTED DURING THE TESTS.

RUSSIAN JOINT STOCK COMPANY "GASPROM"
VNIIGAS - ALL RUSSIAN SCIENTIFIC RESEARCH INSTITUTE
FOR NATURAL GASES AND GAS TECHNOLOGIES

SUMMARY OF THE TEST REPORT ON SURE LOCK MECHANICAL PIPE JOINTS

PULL APART TESTS

STATIC

STATIC PULL APART TEST WAS PREFORMED ON 3 SPECIMEN. THE TESTING WAS PREFORMED UNTIL SPECIMEN DESTRUCTION, LEAKS OR SPECIMEN PLASTIC DEFORMATION.

DURING THIS TYPE OF TEST WHEN THE PULL APART LOAD REACHED ITS MAXIMUM POINT (F max) THE JOINTS STARTED TO "OPEN" (PIN SECTION MOVED OUT OF THE BELLED SECTION). IN SPITE OF "OPENING" THE JOINTS NO LEAKS WERE DETECTED. THE TEST WAS ACCOMPLISHED AFTER THE JOINTS STARTED TO "OPEN".
AFTER THE TESTS THE JOINTS WERE PRESSURE TESTED AT 50 ATM, NO LEAKS WERE DETECTED.

No.	F max (kg)	σ max (kg/mm2)	Specimen deformation (%)	Size of the joints "opening" (mm)	Test pressure (ATM)	Test result
1	59400	29.2	0.2	0.038	50	No leak
2	50900	25	0.2	0.038	50	No leak
3	55000	27	0.2	0.075	50	No leak

CYCLE

CYCLE PULL APART TEST WAS PREFORMED ON 3 SPECIMEN. THE TESTING WAS PREFORMED UNTIL SPECIMEN DESTRUCTION, LEAKS OR SPECIMEN PLASTIC DEFORMATION.
THE MAXIMUM PULL APART FORCE IN THIS TEST WAS HOLD AT 0.9 FROM THE YIELD POINT OF THIS TYPE OF PIPE AND WAS EQUAL **σmax = 22,5 kilograms/mm2.**
THE ASYMMETRY COEFICCIENT OF THE CYCLE WAS **R = 0**.
WHILE THE CYCLE TEST WAS PREFORMED THE PRESSURE INSIDE THE TESTED SPECIMEN WAS HOLD AT 30 ATM AND THE PRESSURE DEVIATIONS WAS MONITORED ALL THROUGH THE TEST. THE TEST WAS ACCOMPLISHED AFTER ALL 200 CYCLES WERE APPLIED ON EACH OF THE SPECIMEN.
NO LEAKS OR PRESSURE DEVIATIONS IN THE SPECIMEN WERE DETECTED DURING THE TEST ITSELF,OR DURING THE POST TEST PRESSURE TEST AT 50 ATM.

No.	σ max (kg/mm2)	Frequency Hz	Number of cycles	Pressure in the specimen (ATM)	Post test pressure (ATM)	Test result
4	22.5	0.2	200	30	50	No leak
5	22.5	0.2	200	30	50	No leak
6	22.5	0.2	200	30	50	No leak

RUSSIAN JOINT STOCK COMPANY "GASPROM"
VNIIGAS - ALL RUSSIAN SCIENTIFIC RESEARCH INSTITUTE
FOR NATURAL GASES AND GAS TECHNOLOGIES

SUMMARY OF THE TEST REPORT ON SURE LOCK MECHANICAL PIPE JOINTS

BEND TESTS

STATIC

THE STATIC 4 POINT BEND TEST WAS PERFORMED ON 3 SPECIMEN. THE DISTANCE BETWEEN THE OUTER SUPPORTS WAS 1104 MM, AND THE DISTANCE BETWEEN INNER SUPPORTS WAS 346 MM.
THE TESTING WAS PREFORMED UNTIL LEAKS OR SPECIMEN PLASTIC DEFORMATION.
WHILE THIS TEST WAS PREFORMED THE PRESSURE INSIDE THE TESTED SPECIMEN WAS HOLD AT 30 ATM AND THE PRESSURE DEVIATIONS WAS MONITORED ALL THROUGH THE TEST. NO LEAKS OR PRESSURE DEVIATIONS IN THE SPECIMEN WERE DETECTED DURING THE TEST ITSELF, OR DURING THE POST TEST PRESSURE TEST AT 50 ATM.

No.	F max (kg)	F t (kg)	H max mm	H r mm	Test pressure (ATM)	Test result
7	18200	12200	26	16.5	50	No leak
8	16800	10200	25	14	50	No leak
9	14600	12800	25	14	50	No leak

F max - THE MAXIMUM BEND LOAD ON THE SPECIMEN
F t - THE BEND LOAD WHEN THE YIELD POINT OF THE PIPE WAS PASSED
H max - THE MAXIMUM BEND APPLIED ON THE SPECIMEN
H r - THE REMANENT BEND OF THE SPECIMEN

CYCLE

THE CYCLE 4 POINT BEND TEST WAS PERFORMED ON 4 SPECIMEN. THE DISTANCE BETWEEN THE OUTER SUPPORTS WAS 1104 MM, AND THE DISTANCE BETWEEN INNER SUPPORTS WAS 346 MM.
THE TESTING WAS PREFORMED UNTIL LEAKS OR SPECIMEN PLASTIC DEFORMATION.
FIRST TWO SPECIMEN (# 10 AND # 11) WERE TESTED AT THE 11000 KG BEND LOAD, WHICH EQUALS 0.9 OF THE YIELD POINT.
THE SPECIMEN # 12 AND # 13 WERE TESTED AT THE EXTREME CYCLE BEND LOADS.
WHILE THIS TEST WAS PREFORMED THE PRESSURE INSIDE THE TESTED SPECIMEN WAS HOLD AT 30 ATM AND THE PRESSURE DEVIATIONS WAS MONITORED ALL THROUGH THE TEST. NO LEAKS OR PRESSURE DEVIATIONS IN THE SPECIMEN WERE DETECTED DURING THE TEST ITSELF, OR DURING THE POST TEST PRESSURE TEST AT 50 ATM.

No.	F max (kg)	NUMBER OF CYCLES	Test pressure (ATM)	Test result
10	11000	1 - 200	50	No leak
11	11000	1 - 200	50	No leak
12	11000	1 - 200		
	14000	201 - 400		
	16000	401 - 600	50	No leak
13	18400	1 - 43	50	No leak

F max - MAXIMUM BEND LOAD OF THE CYCLE

RUSSIAN JOINT STOCK COMPANY "GASPROM"
VNIIGAS - ALL RUSSIAN SCIENTIFIC RESEARCH INSTITUTE
FOR NATURAL GASES AND GAS TECHNOLOGIES

SUMMARY OF THE TEST REPORT ON SURE LOCK MECHANICAL PIPE JOINTS

TORSION TEST

TORSION TEST WAS PERFORMED ON 2 SPECIMEN (# 14 AND # 15).
THE TESTING WAS PREFORMED UNTIL LEAKS OR SPECIMEN PLASTIC DEFORMATION OR DESTRUCTION. WHILE THIS TEST WAS PREFORMED THE PRESSURE INSIDE THE TESTED SPECIMEN WAS HOLD AT 30 ATM AND THE PRESSURE DEVIATIONS WAS MONITORED ALL THROUGH THE TEST.
IN BOTH CASES THE TORSION LOADS OF 0.9 OF THE YIELD POINT (APPROX. 5 000 KG) WAS APPLIED ON BOTH OF THE SPECIMEN. NO DEVIATIONS IN THE INTERNAL PRESSURES, LEAKS AND APPEARANCE OF THE SPECIMEN WERE DETECTED.
AFTER THAT IT WAS DECIDED TO INCREASE THE TORSION LOAD TO THE EXTREME IN ORDER TO DESTROY THE PIPE OR TO TWIST THE JOINT.
SPECIMEN # 14 FIRST TWISTED AT THE TORSION LOAD OF 6900 KG (WHICH IS 1.24 OF THE Y.P.), THE LOAD CONTINUED TO INCREASE AND THE SECOND TWIST OCCURRED AT THE LOAD OF 7300 KG (WHICH IS 1.31 OF THE Y.P.) AND ONLY AFTER THIS THE CONSTANT DECREASE OF THE LOAD WAS RECORDED.
SPECIMEN # 15 FIRST TWISTED AT THE TORSION LOAD OF 7600 KG (WHICH IS 1.37 OF THE Y.P.)THE LOAD CONTINUED TO INCREASE AND THE SECOND TWIST OCCURRED AT THE LOAD OF 4500 KG (WHICH IS 0.81 OF THE Y.P.) AND ONLY AFTER THIS THE CONSTANT DECREASE OF THE LOAD WAS RECORDED.
THE LEAKS ON BOTH SPECIMEN OCCURRED DURING THE FIRST TWIST, WHICH OCCURRED AT THE LOADS WAY PASS THE YIELD POINTS OF THE PIPES.

CYCLE THERMAL TEST

CYCLE THERMAL TEST WAS PREFORMED ON 2 SPECIMEN (**# 16** AND **# 17**). THE TESTING WAS PREFORMED UNTIL SPECIMEN DESTRUCTION, LEAKS OR SPECIMEN PLASTIC DEFORMATION.
1 THERMAL CYCLE CONSISTED OF HEATING UP THE SPECIMEN UP TO + 80 C AND COOLING IT DOWN TO + 20 C. 200 THERMAL CYCLES WERE APPLIED ON EACH OF THE SPECIMEN.
WHILE THE CYCLE TEST WAS PREFORMED THE PRESSURE INSIDE THE TESTED SPECIMEN WAS HOLD AT 30 ATM AND THE PRESSURE DEVIATIONS WAS MONITORED ALL THROUGH THE TEST.
THE TEST WAS ACCOMPLISHED AFTER ALL 200 CYCLES WERE APPLIED ON EACH OF THE SPECIMEN.
NO LEAKS OR PRESSURE DEVIATIONS IN THE SPECIMEN WERE DETECTED DURING THE TEST ITSELF,OR DURING THE POST TEST PRESSURE TEST AT 50 ATM.

PRESSURE TEST AFTER SEVERAL BENDING STRAINS

THIS TEST WAS PREFORMED ON 3 SPECIMENS. EACH OF THEM WAS BENDED SEVERAL TIMES, AND PRESSURE TESTED AFTER EACH BENDS. THE BENDS WERE MADE IN A DIFFERENT DIRECTIONS TO IMITATE THE MOVEMENTS OF THE PIPELINE DURING OPERATION. THE TEST RESULTS WERE RECORDED IN THE CHART PROVIDED HERE DOWN :

RUSSIAN JOINT STOCK COMPANY "GASPROM"
VNIIGAS - ALL RUSSIAN SCIENTIFIC RESEARCH INSTITUTE
FOR NATURAL GASES AND GAS TECHNOLOGIES

SUMMARY OF THE TEST REPORT ON SURE LOCK MECHANICAL PIPE JOINTS

PRESSURE TEST AFTER SEVERAL BENDING STRAINS (CHART)

SPECIMEN No.		1 ST BEND	2 ND BEND	3 RD BEND	4 TH BEND
18	F (kg)	14500	15800	15600	16600
	H max (mm)	27	43.5	40.5	38
	H r (mm)	16	32	29	27
	P (ATM)	40	80	120	260
19	F (kg)	16800	16800	19000	19000
	H max (mm)	25	32	26	26
	H r (mm)	14	21	15	15
	P (ATM)	80	130	150	260
20	F (kg)	18300	18800	18700	18600
	H max (mm)	24	39	29	26
	H r (mm)	13	28	19	15
	P (ATM)	80	120	150	260

F - BENDING STRAIN
H max - THE MAXIMUM BEND APPLIED ON THE SPECIMEN
H r - THE REMANENT BEND OF THE SPECIMEN
P - PRESSURE TEST AFTER THE BENDS

NO LEAKS OR PRESSURE DEVIATIONS IN THE SPECIMEN WERE DETECTED DURING ALL THE PRESSURE TESTS.

CONCLUSION OF THE TEST PROGRAM : BASING ON THE POSITIVE TEST RESULTS BUTLER JOINTS AND MECHANICAL ASSEMBLY SYSTEM WERE RECOMMENDED FOR WIDE APPLICATION WITHIN RUSSIAN NATURAL GAS INDUSTRY.

END OF THE TEST SUMMARY

9.0 Russian Federation Certifications

PROCESS / CONSTRUCTION CERTIFICATION
RUSSIAN FEDERATION

ФЕДЕРАЛЬНЫЙ
ГОРНЫЙ И ПРОМЫШЛЕННЫЙ
НАДЗОР РОССИИ
(Госгортехнадзор России)

А. Лукьянова ул., д.4, корп.8, Москва, 105066
Телефон: (095) 263-97-75 Факс: (095) 261-60-43
E-mail:gosnadzor@gosnadzor.ru
www.gosnadzor.ru
ОКПО 00029618, ОГРН 1027739610425
ИНН/КПП 7710124814/770101001

03.03.2004 № 10-03/230

На № 425/1-2004 от 02.03.04

Генеральному директору
ООО «НГБ-Энергодиагностика»

В.А. Надеину

Уважаемый Владимир Александрович!

Управление по надзору в нефтяной и газовой промышленности рассмотрело представленную ООО «НГБ-Энергодиагоностика» «Инструкцию по проектированию, строительству, реконструкции и ремонту нефтегазопроводов с применением технологии «Батлер»» согласовывает ее с учетом замечаний и предложений экспертизы.

Начальник Управления
по надзору в нефтяной и
газовой промышленности С.Н. Мокроусов

Исп.: Пашков Н.Е., тел.: 265-77-86

Process/Construction Certification
Russian Federation

Federal Service for Environmental, Industrial and Nuclear Supervision (GozGorTechNadzor of Russia)

To General Director of OOO "NGB-Energodiagnostika" **(Go-**
V.A. Nadein

A. Luk'yanova ul., d.4, korp 8, Moscow, 105066
Tel: (095) 263-97-75 , Fax: (095) 261-60-43
E-mail: gosnadzor@gosnadzor.ru www.gos-nadzor.ru

OKPO (General Classifier of Enterprises and Organizations in Russia) # **00029618**
(Primary State Registration Number) **# 1027739610425**
(Identification Number of Tax Payer) # **7710124814**
(Taxpayer Classification Code) # **770101001**

03/03/2004 **# 10-03/230**

For # 425/1-2004 from 02.03.04

Dear Vladimir Aleksandrovich!

GozGorTechNadzor of Russia evaluated "Instructions for the layout, construc tion, reconstruction and maintenance of oil and gas pipeline with the usage of "Butler" technology", given by LTD "NGB-Energodiagnostika". GozGorTechNadzor validates the technology along with comments, suggestions following the evaluation.

Head of GozGorTechNadzor of Russia S.N. Mokousov

Pashkov N.E., tel: 265-77-86

EQUIPMENT CERTIFICATION
RUSSIAN FEDERATION

Федеральный горный и промышленный надзор России
(Госгортехнадзор России)

РАЗРЕШЕНИЕ

№ РРС 02-5414

На применение

Оборудование (техническое устройство, материал)
Оборудование для строительства трубопроводов диаметром до 426 мм согласно перечню в приложении к настоящему разрешению.

Код ОКП (ГН ВЭД) 48 3400 (8462 21 800 0)

Изготовитель (поставщик) Компания "Butler Tech International, LLC/Butler Tech Corporation" (Kingwood, Texas, 77325, USA).
Основание выдачи разрешения Экспертное заключение ООО "СЖС - Энергодиагностика" №7/407.2002.

Условия изготовления (применения)
Представление заказчикам технических паспортов (сертификатов) на оборудование; инструкций по эксплуатации, техническому обслуживанию и ремонту оборудования на русском языке.

Срок действия разрешения до 21.02.2005

Дата выдачи 21.02.2002

Статс-секретарь - первый заместитель
Начальника Госгортехнадзора России
Е.А. Иванов
(подпись, должность, Ф.И.О.)

012519

Process/Construction Certification
Russian Federation

Federal Service for Environmental Industrial and Nuclear Supervision
(GozGorTechNadzor of Russia)

Permission

 # RRS 02-5414

For Utilization

Requisite (technical equipment, work material)
Equipment for constructing oil and gas pipeline of 426 mm or less, according to the checklist attached to given Permission.

Code (General Classifier of Products in Russia)
- High pressure fuel injection pump **48 3400 (8462 21 800 0)**

Manufacturer (vendor) "Butler Tech International LLC, Butler Tech Corporation"
(Kingwood, TX 77325, USA)
Reason for issuing permission is Expert Conclusion of " – Energo-diagnostika" **# 7/407.2002.**

Preparation conditions (utilization)
Presentation of Technical Passports (Certificates) for the equipment to the consumer; instructions for the exploitation, technical service and maintenance of equipment in Russian language.

Permission is valid until 21/02/2005

State Secretary – Primary Substitute of
Head of GozGorTechNadzor of Russia.
Permission given on 21/02/2002 E.A. Ivanov
(signature, title, . . . (last, first and middle name))

012519

EQUIPMENT CERTIFICATION
RUSSIAN FEDERATION

ПРИЛОЖЕНИЕ

к разрешению № PPC 02-5414 от 21.02.02
(без разрешения недействительно)

ПЕРЕЧЕНЬ

оборудования компании "Butler Tech International, LLC/Butler Tech Corporation" (США), разрешенного к применению на территории Российской Федерации

1. Оборудование "Sure Lock" для подготовки труб и механической сборки трубопроводов, соответственно моделей 24, 26, 26Б, 48, 48Б, 812, 1016.

2. Агрегаты "Bulls Eye" для калибровки и формовки концов труб, соответственно моделей 115, 170, 170Б, 220, 220Б, 350, 450.

3. Гидравлические маслостанции с электрическим приводом или приводом от двигателей внутреннего сгорания.

Стате-секретарь - первый заместитель
Начальника Госгортехнадзора России

Е.А. Иванов

(подпись, должность, Ф.И.О.)

001757

Equipment Certification
Russian Federation

Attachment
To the Permission # RRS 02-5414 from **21/02/2002**
(not valid without permission)

Checklist

" Butler Tech International, LLC/Butler Tech Corporation" (USA) Equipment has permission to be utilized on the territory of Russian Federation.

1. Equipment "Sure Lock" for preparation of pipes and mechanical assembly of the pipeline, according to models 24, 26, 26B, 48, 48B, 812, 1016.

2. Machine "Bulls Eye", for collaboration and formation of the pipe ends, according to models 115, 170, 170B, 220, 220B, 350, 450.

3. Hydraulic oil with electrical propulsion or propulsion from internal flaring (incineration).

State Secretary – Primary Substitute of
Head of GozGorTechNadzor of Russia.
E.A. Ivanov
(signature, title, . . . (last, first and middle name))

001757

10.0 Client Recommendations

LIMITED LIABILITY COMPANY

NEFTEKAMSK OILFIELD EQUIPMENT FACTORY

452684, Russian Federation, Republic of Bashkortostan, city of Neftekamsk, ul. Montazhnaya, 7.

Telephone **(34783) 5-24-20,** fax **(34783) 5-24-25** E-mail:nzno@bashneft.ru; www.nzno.ru
Settlement acc. 40702810200030000539 Branch Office of OAO "UralSib", the city of Ufa
INN 0264022247 BIK 048073770 KPP 025250001 Corr. acc. 30101810600000000770 OKVED 31.10.9
OKPO 15283208

Date 01 October 2009 No. 11/1989

Yr Ref _____ dated_____

To the Vice President of
"Butler Tech"
A. Yu. Sukhorukov

The "Butler Tech" company has implemented the technology and equipment for assembling of pipes into double pipe joints (two pipes joined togethed mechanically) in the (plant) OOO "NZNO" and in addition the assembly of pipe in field conditions by OAO "ANK "Bashneft" using the Sure Lock mechanical pipe joint technology beginning in 1995.

During the period of operation of equipment from 1995 to 01.09.2009 over 5700 km of pipeline was assembled using the Butler technology.

In the process of manufacturing of pipe sections, the mechanical joint is tested for endurance by pressure 25% higher than the operating pressure of pipes of this nominal size. The tests are performed at transitions from one nominal size to the other using certified equipment. Static and fluctuating tension testing and bending tests were performed. The joints have withstood (passed) the tests without losses of leak tightness up to the beginning of plastic deformation of the pipe metal.

This assembly technology ensures: an increased speed of pipeline construction of up to 1.5 to 4 km per day, a degree of pipe joint saftey measured at 150% of the yield point of the pipe, elimination of temperature exposure in the joint area, a reduction of construction costs, the joining of pipes with any anticorrosive coatings without destruction thereof, the feasibility of using light-gauge pipes, the elimination of x-ray testing, the elimination of the need to purchase consumables for welding work, environmental cleanliness and safety of construction, feasibility of construction in any weather conditions, the need for smaller numbers of personnel, an improvement of work conditions and the usability of the system in both plant and field conditions.

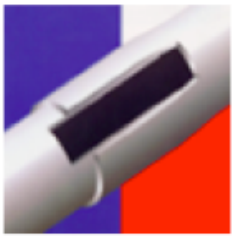
The pipelines have been installed and used in OAO "ANK "Bashneft" for about 15 years and during this time there were no failures due to th fault of Sure Lock mechanical pipe joint.

Sincerely yours, Chief
Engineer V. Z. Gaskarov

ОБЩЕСТВО С ОГРАНИЧЕННОЙ ОТВЕТСТВЕННОСТЬЮ

БАТЛЕР ТЭК ИНТЕРНЕШНЛ

107082, Москва, ул. Бол. Почтовая 26В, строение 2
ИНН/КПП 77016869696/77010100, тел/факс (495) 936 9669
e-mail : butlertechrus@mail.ru



October 15, 2015 **№ BTI – 088/10-15**

Herbert James Green
President
Butler Tech International, LLC (USA)

Butler Tech Sure Lock Mechanical Joint Technology in Russian Federation

Dear Mr. Green,

The purpose of this letter is to update you on the certification status regarding pipeline construction in the Russian Federation utilizing the Butler Tech Sure Lock Mechanical Pipe Joint and the related equipment and the adaption of a significant regulation revision that we have been working toward for the past twenty-years.

As you are aware, Butler Tech Sure Lock mechanical pipe joint pipeline construction equipment has been utilized by Russian oil companies in growing numbers since the initial introduction of the technology in 1994.

The utilization of the equipment has been formally approved by the Russian State Technical Supervision authority since the first permit for Butler Tech equipment was issued in 1996. During that period and continuing to the present no mechanical joint failures have been recorded resulting from the application of the technology under the established procedures.

In 2004 the Russian State Technical Supervision authority approved the Butler Tech construction manuals and procedures resulting in a significant increase of the volume of constructed pipelines utilizing the Sure Lock Mechanical Pipe joint.

In 2015 based on the volume of pipelines constructed utilizing the Sure Lock technology, the ongoing successful test results, multiple positive technical expertise studies conducted, and more than 20 years of unbreakable service of the constructed Sure Lock pipelines, Russian State Technical Supervision (Rostechnadzor) applied a major change in title 718 of the «Rules and safety regulations in oil and gas industry», the most significant authority document for pipelines constructed in Russian oil and gas fields, by withdrawing the exclusive requirment for joining steel pipes for oil and gas field applications by welding only.

Applying this change into this primary pipeline construction document of the Russian Federation validates the total acceptance of the Sure Lock Mechanical Pipe joint for construction pipelines as a normal construction practice.

Kind regards,

General Director
Butler Tech International (Russia) **Yuri A. Sukhorukov**

LUKOIL
OIL COMPANY

LIMITED LIABILITY COMPANY
LUKOIL - West Siberia

No. 07-09-113 Date 26.10.09.

Yr ref. 153-09-09 dated 21.09.09.

To the Vice President of Butler Tech company

A. Yu. Sukhorukov

On performance of equipment

Dear Aleksandr Yuryevich!

During the period from 2001 in order to increase the rates of construction and lower the costs when carrying out pipelines construction and installation work, OOO "LUKOIL - West Siberia" has purchased four installations, manufactured in USA by "BUTLER TECH", for mechanical joining of pipes using Sure Lock technology.

The assembly equipment has proven itself to be simple in use and reliable in operation in climate of West Siberia; it is used in various weather conditions: rain, snow, from -35°C to +30°C. During the time of operation, neither assembly (power and joining units) nor shaping installations had any emergency failures. Only scheduled maintenance with the use of consumables is carried out.

Since 1 November 2001 more than 1550 km of pipes have been constructed using these installations. During the time of operation of pipelines there were no failures of joints caused by design or process. With implementation of construction method using BUTLER TECH technology welded joint corrosion problem has been eliminated.

First Deputy General Director - Chief Engineer — P. V. Oboronkov

V. Ya. Vedernikov
6-10-25
R. M. Pichuzhkin
6-10-88
A. N. Korkishko
6-10-60

Russia, Tyumen oblast., 628486, city of Kogalym, ul. Pribaltiyskaya, 20
Tel.: (34667) 2-98-00
Tel./fax: (34667) 2-98-00, 6-14-36, 6-14-37
Teletype 314357
SIBIR RU

ОБЩЕСТВО С ОГРАНИЧЕННОЙ ОТВЕТСТВЕННОСТЬЮ
БАТЛЕР ТЭК ИНТЕРНЕШНЛ
107082, Москва, ул. Бол. Почтовая 26В, строение 2
ИНН/КПП 77016869696/77010100, тел/факс (495) 936 9669
e-mail : butlertechrus@mail.ru

August 25, 2015

Mr. Herbert James Green
President
BUTLER TECH INTERNATIONAL, LLC (USA)
butlertechusa@gmail.com

Dear Mr. Green,

The following information on pipeline construction in Russian Federation utilizing Butler Tech equipment is provided herein:

Butler Tech pipeline construction equipment is utilized by oil companies in Russian Federation since 1994 at that period none of the mechanical joint failures were recorded.

The utilization of the supplied equipment and related procedures are approved by Russian State Technical Supervision (Rostechnadzor) since the first Rostechnadzor Permit for Butler Tech equipment was issued in 1996 (copy of which is enclosed to this letter).

Per early 2010 our company survey indicates the following Russian oil and gas companies have been utilizing full range of Butler Tech equipment for industrial pipeline construction:

Open Joint Stock Company BASHNEFT – divisions:
Bashneft Yanaul
Bashneft Ufa
Bashneft Ishimbay
Bashneft Belkamneft

Total amount of constructed and utilized pipelines	**5700 KM (3560 miles)**
Medias transported	salt water, oil and gas crude
Sizes and types of pipelines	oil production and water injection diameters from 76 to 325 mm with internal two layer FBE plastic and external three layer coatings, pressures up to 200 ATM
Enviormental conditions	winter ambient temperatures down to – 35 C (- 31 F) summer ambient temperatures up to + 30 C (86 F)

N E F T S E R V I C E H O L D I N G

LIMITED LIABILITY COMPANY

“PIPELINE TRANSPORT SERVICE”
(OOO “Servis TT”)

ul. Gaydara, 14a, Perm, 614077 Tel.: (342) 246-37-00, fax: (342) 290-11-83, e-mail: servicett@stt.pnsh.ru, www.stt.pnsh.ru

OGRN 1035901002378, INN/KPP 5906055030/590601001

24.09.2009 No. И-01/1481

Yr Ref

To the Vice-President of Butler Tech International LLC

Yu. A. Sukhorukov

(095)358 66 33

Testimonial on quality of Sure Lock mechanical pipe joints

Dear Yury Aleksandrovich!

In reply to your ref no. 152-09-09 dated 21.09.2009 on provision of information on the quality of Sure Lock mechanical pipe joints we advise as follows:

During the whole period of use of Butler installation at the disposal of OOO “Pipeline Transport Service” the enterprise has installed 96 km of pipelines of various diameter on the territory of Komi Republic and Perm Region. During construction of all pipelines, plant prepared pipe products with inside and outside anti-corrosive coating were used.

To date, OOO “Servis TT” has received no claims from customer operational services, no notices of accidents at pipelines constructed using this pipeline construction technology. There were no requests for warranty repair or replacement.

Appendix: Total length of constructed pipelines - 1 page.

Sincerely yours,

Deputy Director
For Development K. A. Kuznetsov

The quality management system of the organization has been certified to meet the requirements of ISO **9001:2000**

Limited Liability Company

“Management Company “Tatneft-TruboprovodServis”

423450, Republic of Tatarstan,
city of Almetyevsk, ulitsa R. Fakhretdina, 98

Tel./fax:(8553) 37-42-10, settlement account No 40702810362360101601
OSB “Bank Tatarstan” No. 8610 of Volgo-Vyatsky SB RF, city of Kazan, Almetyevo branch No. 4683/060
OGRN 1061644057980, corr. acc. 30101810600000000603 with RKTs NB RT
BIC 49205603, INN 1644037308, KPP 164401001

23.09.2009 No. 2790/01-02-89

Yr ref. 152-09-09 dated 21.09.09

To the Vice President of
BUTLER TECH INTERNATIONAL, LLC
A. Yu. Sukhorukov

Dear Aleksandr Yuryevich!

Mechanical pipe joining equipment using Butler technology was purchased in 1998. Since 1999 to date, a total of 1303.6 km of pipelines have been constructed at OAO “Tatneft” oil extraction facilities using Sure Lock mechanical pipe joints, including 89 mm diameter x 4mm wall thickness – 1100.7 km, 114 mm diameter x 4.5 wall thickness – 202.87 km. The pipelines carry oil-gas-water mixture with water content of 70-95**%.** Operating pressure up to 4.0 MPa. No cases of depressurization of constructed pipelines were detected during 10 years of operation. Likewise, no equipment failures were registered during the period of operation.

Director
OOO “UK “Tatneft TruboprovodServis” Khamitov R. A.

ЛУКОЙЛ
НЕФТЯНАЯ КОМПАНИЯ

ЛУКОЙЛ-Коми
ОБЩЕСТВО С ОГРАНИЧЕННОЙ ОТВЕТСТВЕННОСТЬЮ

№ 04 / 10313 Дата 23.04.08г

на №_____от_____

И.о. Директора
ООО «Сервис ТТ»
господину Упилкову А.В.

копия:
Генеральному директору
ООО «Нефтьсервисхолдинг»
господину Шитову А.А.

Отзыв о проделанной работе

Уважаемый Алексей Викторович!

В период с января по апрель 2008 года ООО «Сервис ТТ» выполняло работы по строительству напорного нефтепровода Ду 325 мм ДНС «Баяндыская» - ДНС-8 «Уса», протяженностью 39 км методом «Батлер». Несмотря на сложности, возникавшие в процессе строительства (погодные условия, проблемы с поставкой трубной продукции под технологию «Батлер») работы выполнены в соответствии с условиями контракта и хорошим качеством, что способствует выполнению программы по добыче нефти ТПП «ЛУКОЙЛ-Усинскнефтегаз» ООО «ЛУКОЙЛ-Коми».

Выражаем благодарность коллективу ООО «Сервис ТТ» и руководству ООО «Нефтьсервисхолдинг» за реализацию проекта и надеемся на дальнейшее плодотворное взаимовыгодное сотрудничество.

Генеральный директор А.Р. Хабибуллин

Короваев
5-5144

Россия
169710, Республика Коми,
Тел.:(82144) 5-53-60
Факс:(82144) 41-3-38
E-mail: postman@lukoil-komi.ru

Вх. № 0871

LUKOIL OIL COMPANY
with Limited Responsibility

LUKOIL-COMM

Community

04/10313 Date 04/23/2008

TO: Mr. Upilkov A.V.
Director of "Service TT" LTD

CC: Mr. Shitov A.A.
Director of "Neftserviceholidng" LTD

Recommendation letter or **Review of Performed Job** or **Testimony of Performed Job**

Dear Aleksey Viktorovich,

During the period of January through April 2008 "Service TT" LTD was laying pipeline in the diameter of 325 mm DNS "Bayadinskaya" – DNS 8 "Usa", stretching 39 km, with Butler Technology. While using "Butler" technology to lay the pipes, even though we have ran into some weather related problems, the job was completed successfully with good quality, according to the agreements in the contract which leads to completion of oil extraction for "Lukeoil-Usinksneftegas" TPP and "Lukeoil-Kommi" LTD project.

We are expressing our gratitude to LTD "Service TT"" and the management of "Neftserviceholding" LTD for implementation of the project, and hope for mutually fruitful collaboration in the future.

General Director A.R. Habibulin

C-E Vetco Services, Inc.
A Subsidiary of
Combustion Engineering, Inc
1600 Brittmoore Road
Houston, Texas 77043

Tel 713/461 6112
Cable Combeng
Telex 775-583

VETCO SERVICES

March 3, 1982

Mr. Major Butler
President
Butler Taper Joint, Inc.
2012 Karbach Street
Houston, Texas 77092

Ref: Information to Mr. Raviola,
Pres. Casing S.A.
(Jobs performed Nov-Dec 1981.)

Dear Mr. Butler:

This letter is to inform you that we have used the Butler Taper Joint system "Sure-Lock" to connect pipe in the jobs performed in Seminole and Denver City, Texas, we are totally satisfied with the performance of this system.

At the Seminole, Texas job we connected 18,980 feet of 3" and 4" diameter pipe schedule 40 ERW supplied by a U.S. Mill. The pipe was internally coated with Epoxy Coating #226. The pipe was lowered into the ditch, partially covered leaving the connections exposed and then tested to 2,160 PSI.

At Denver City, Texas, a total of 365,000 feet was connected without any problems. The pipe was 4" diameter, seamless, schedule 40 DRL manufactured by Mannesmann and internally coated with a phenolic coating #242. Hydrostatic testing was performed applying 2,000 PSI.

All testing was done by Pipeline Engineers, and the pipelines were approved for service without observations. The job averaged 280 joints per 8 hours work shift.

The testing exceed the API (American Petroleum Institute) norms and the recommendations for pipeline service and comply with the requirements exceeding the test criteria of the U.S. Department of Transportation, Pipeline Safety Office (DOT) Sections 192.273 Sub Part F of the Safety Standards applicable to the industry in the United States.

In summary, we can report that the performance and integrity of the system is excellent. The time saved in the field installation made possible the completion of the jobs in record time.

Very truly yours,

Paul Steffenhagen

Paul Steffenhagen
Technical Services

PS:vs

VETCO SERVICES, INC.

9545 KATY, SUITE 480 HOUSTON, TEXAS 77024 TEL.: 461-6112 TELEX: 775756

June 29, 1977

Mr. Major Butler
14707 Early Hollow
Cyprus, Texas 77429

Subject: Internal Coating in Butler Taper Joint

Four sections of 4½" O.D. x 2' pipe with Taper Joint ends were internally blasted. One set was internally coated with Hydracoat to a thickness of 12 mils. The other set was coated with Tempcoat to a thickness of 8 mils. Both sets were joined using a Butler hydraulic connecting unit.

The two coupled joints were then inspected for holidays in the coating, with particular attention given to coating continuity in the joint area. Both joints were found to be 100% holiday free.

From both a theoretical and actual study of the joint, a continuous, holiday free lining system can be accomplished with good reliability.

E.D. McCrory, Jr. P.E.
Director
Coatings R&D

EDM:jkr

IN CONSIDERATION OF THE MECHANICAL JOINT CONNECTION FOR PIPELINES

It was in 1971 when Panhandle Eastern Pipe Line Company first employed the use of the mechanical joint method in laying gas field gathering lines. Prior to that time the Company had layed thousands of miles of small diameter pipe to more than 5000 gas wells in our gas fields of Kansas, Oklahoma and Texas. Typically, all such pipelines were constructed following the traditional down-the-ditch method where the 40 foot long joints were butt welded by qualified pipeline welders.

Panhandle Eastern and Amoco entered into an agreement the latter part of 1970 to develop a large "tight sands" gas field in the Denver-Julesberg Basin of Colorado. Over 1100 wells were to be drilled and an extensive pipeline network required to gather and transport the gas. Profitability of the venture might be close, so holding the costs of the pipeline would be important.

A trial run of the Mechanical Joint System was held by Major Butler on some of our well lines in southwest Kansas the early part of 1971. The results were so promising that the Company decided to utilize it for our well lines in the forthcoming Colorado project. We proceeded with the plan and found that the mechanical joint method offered even more savings than earlier identified.

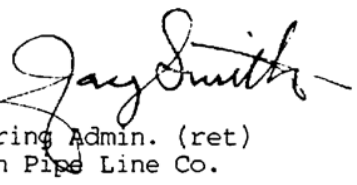
1. Contractors significantly reduced their lay price from the traditional weld method because their labor cost was lower. Most of the high cost of having qualified welders was eliminated. They learned they could lay the pipe down the ditch at a faster rate, with less skilled workers, and the operation was not as sensitive to weather elements.

2. Since the butt joint did not require welding, our design engineers found that the wall thickness of the pipe could be reduced by 15 to 30 percent and still meet regulatory requirements. This lowered the material costs of the pipe proportionately. We found further saving by having our pipe supplier (TexTube) apply the joint end treatment at the mill rather than conducting that operation in the field.

3. Elimination of welded butt joints also eliminated costs of radiography of the weld which further reduced field costs.

Twenty years have passed since Panhandle Eastern first laid gathering lines with mechanical joints. Over 1200 miles of pipelines in the Denver-Julesberg field are still in operation. Failure of the joints has never been a problem. We have used the mechanical joint method in numerous pipelines since then and expect to use it in the future. It is a sound and sensible engineering practice.

Very truly yours,



JAY R. SMITH
Manager, Engineering Admin. (ret)
Panhandle Eastern Pipe Line Co.

December 1992