JANA LABORATORIES INC.

Report

Project 07-4063

Examination and Testing of a Tapping Tee

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DCA17FP006 – Millersville – NTSB
NTSB-UGI-02317

Report No.: Project 07-4063 – Report

Client: UGI Utilities Inc.
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Date of Issue: July 10, 2008

Purpose of Test:

The purpose of this project was to examine and test the submitted mechanical tapping tee assembly. This report documents the examination and testing performed.

Test Item Identification and Description:

The following samples, as shown in Table 1, were provided for testing by the client.

Table 1: Sample Description

Jana Sample ID	Description
07-1090	Mechanical tapping-tee assembly for polyethylene (PE) gas pipe identified as "#39 Appleblossom TWP". The assembly consisted of a saddle-type tapping tee installed on a length of PE pipe. The details of the assembly and the identifying information recovered are provided later in this report.
07-1091	Two similar-appearing black plastic bolt fragments, head-end, with fracture surface at one end, in the threaded portion of the bolts. The bolts were received in one bag labeled "9-2-06 #39 LANC APPLE Blossom DR".
07-1092	This sample number was assigned to soil, which was adhered to Sample 07-1090 when received, after it was removed and collected at Jana Laboratories. No evaluation of this sample has been performed.

Recovery of identification markings on the various components of Sample 07-1090 was performed and is reported in the Results section.

Standard Test Methods References:

Dimensional measurements were made in general conformance with ASTM D2122-98 (2004) insofar as permitted by the condition of the submitted sample.

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Examination by X-ray photography, tensile testing of bolts and bolt fragments, and determination of filler and glass content of bolts and bolt fragments were performed by qualified subcontract laboratories. The test method details are given in the following section.

Dimensional measurements in accordance with ASTM D2122 are covered by Jana Laboratories Inc.'s ISO 17025 scope of accreditation (I.A.S. TL-256).

Test Details:

Prior to detailed examination and disassembly, the sample tapping tee was photographed under X-ray on September 6, 2007 by a subcontract laboratory at the direction of Jana Laboratories.

The detailed examination and disassembly of the sample tapping tee assembly was performed in the following sequence.

The samples were examined on September 11, 2007 at Jana Laboratories in the presence of personnel representing various interests. A roster of the individuals in attendance is provided in Appendix A of this report.

This session included disassembly and examination of the sample tapping tee in accordance with the Disassembly Protocol provided in Appendix B. The actual disassembly and recording of data and photographs included in this report were performed by D. Woods and P. Vibien of Jana Laboratories, Inc. Other individuals present took photographs, measurements and notes, which have not been provided to Jana Laboratories and have not been considered in preparing this report.

Further examination of the sample tapping tee was performed on February 28, 2008, by D. Woods and J. Choegan of Jana Laboratories, Inc.

The sample tapping tee was installed on a length of exemplar 2″ SDR 11 polyethylene gas pipe, using exemplar bolts, on February 29, 2008, by D. Woods of Jana Laboratories. The exemplar pipe was then tapped in accordance with the tapping tee manufacturer's instructions, except that after tapping the cutter was left in place (not withdrawn) until the work described in the next paragraph was completed.

The assembly was transported to a subcontract laboratory by J. Choegan of Jana Laboratories on March 11, 2008 where it was photographed under X-ray in the presence of J. Choegan. The sample / exemplar assembly was returned to Jana Laboratories by Mr. Choegan on March 12, 2008.

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The cutter was withdrawn from the assembly on May 13, 2008 at Jana Laboratories. The cutter condition and the locking sleeve position were documented.

The fracture surfaces of both portions of the two broken bolts were examined and photographed by optical microscopy on March 19, 2008 (Sample 07-1091 plus the mating threaded-end portions that were retained in the saddle of Sample 07-1090).

One unbroken bolt from Sample 07-1090 and the threaded-end portion of one bolt of Sample 07-1091 were tested by a qualified subcontract laboratory between April 28 and May 2, 2008. Tests performed were tensile strength testing and ash content. Tensile testing was performed in general accordance with ASTM D638-08, with changes to the specimen geometry, number of specimens, and the gripping mechanism as needed to allow testing of the available samples. The test speed was 0.2 inches per minute, based on crosshead speed. Testing was performed at 73 °F. Ash testing was performed to determine the total noncombustible ash ("filler") content, as well as to quantify the total noncombustible ash that is glass fiber ("glass"). Testing was performed in accordance with method GM9077P, which is a method in general accordance with ASTM D5630-06 optimized for separation of glass fiber from other filler materials.

The fracture surfaces created during the tensile testing were examined at Jana Laboratories on May 25, 2008, using optical microscopy.

Test Results:

Photographs of the samples as-received and results of the X-ray examination of Sample 07-1090 as-received are provided in Appendix C.

The results of the disassembly and examination of the tapping tee are provided in Appendix D. Identifying information recovered from the components of Sample 07-1090 is also included in Appendix D.

The installation of the saddle on exemplar pipe with exemplar bolts, the tapping of the exemplar pipe, the X-ray photography of the assembly and the removal and examination of the cutter are documented in Appendix E.

Examination of the as-received bolt fracture surfaces and the laboratory tensile test fracture surfaces by optical microscopy is documented in Appendix F.

Results of the Tensile Strength and Ash testing of the bolt and bolt fragment are provided in Appendix G.

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Issued by: [redacted]

David Woods, B.Sc.
Senior Project Leader

Reviewed by: [redacted]

Tony Kosari, M.Sc.
CRT/Specialty Testing Team Leader

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Appendix A

September 11, 2007 Attendance

Table A1: Attendance List

Person	Company	Representing
Charles J. Longacre, P.E.	Forensic Engineering Sciences, Inc.	Liberty Mutual
Glenn C. Frederick, P.E.	Lawrence J. Dove Associates	Keystone Custom Homes
Thomas W. Butler, Ph.D.	SEA Limited	Abel Construction
Robert S. Biggard	Pennsylvania PUC	Pennsylvania PUC
James H. Plants	UGI Utilities, Inc	UGI Utilities, Inc
Patrick Vibien, P.Eng.	Jana Laboratories, Inc.	UGI Utilities, Inc
Mike Kenny	Jana Laboratories, Inc.	UGI Utilities, Inc
David Woods	Jana Laboratories, Inc.	UGI Utilities, Inc

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Appendix B

Disassembly Protocol

Protocol for Dissembling the Tapping Tee Assembly

Part I. Prior-Disassembling Actions

1.1 Record hand written description on pipe and tag
1.2 Record line print of pipe
1.3 Record marking on cap
1.4 Record marking on top saddle and tower
1.5 Record marking on bottom saddle
1.6 Record visible markings on front left bolt
1.7 Record visible markings on front right bolt
1.8 Record visible markings on back left bolt
1.9 Record visible markings on back right bolt
1.10 Using calipers measure the distance between bottom of the cap and the stop marking.
1.11 Using calipers measure height of the visible threads from the bottom thread to the underside of the cap. Count the number of visible thread(s)
1.12 Measure the gap between saddle and pipe at apex and 180° from the apex using feeler gauges at the 4 locations
1.13 Measure gap between saddle flange surfaces at each bolt at inside surface of inside edge of flanges
1.14 Use a circumferential wrap tape, measure the Outside Diameter (OD) of the pipe in two locations, (i.e., 4″ on either side of Tee saddle).
1.15 Using Vernier Calipers measure the OD of the pipe using calipers at one location 4″ from the Tee saddle: Measure on the Axis of the tower and at 90 degrees (this is an assessment of the out-of-roundness of the pipe)

Part II. Removing Cap and Examining the Tower and Parts

2.1 Remove cap and examine the inside of the cap; look for O-ring and take photos
2.2 Measure the height from top of the cutter to rim of the tower
2.3 Back-out the cutter
2.4 Examine cutter for markings
2.5 Photograph the cutter and the cutting end
2.6 Measure the height from the top of sleeve to tower rim
2.7 Take a photo down the tower

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Part III. Examining Bolts

3.1 Record observations of the gap between the saddles on left and right sides
3.2 Measure the protruding bolt at left back corner
3.3 Measure the protruding bolt at right back corner
3.4 Measure the protruding bolt at left front corner
3.5 Measure the protruding bolt at right front corner
3.6 Measure the torque to remove each bolt
3.7 Remove, label and package the bolts wherever is possible
3.8 Measure the depth of each bolt fragments from the flange upper surface of the bottom flange to the top of the fragment
3.9 Measure the length of the bottom bolt fragment in the assembly, using a micrometer, at each corner.
3.10 Measure the length of threads on the broken bolt heads and the number of threads
3.11 Photograph the broken bolts
3.12 Measure the length of the intact bolts
3.13 Photograph the bolts
3.14 Determine action items for instrumental analysis of the bolts

Part IV. Bottom and Top Saddles

4.1 Remove and photograph the bottom and top saddles
4.2 Collect any debris
4.3 Measure thickness of flange at each cap screw (bolt) as indictor of compression on top saddle

Part V. Examining Coupling between Main Pipe and Tapping Tee

5.1 Cut pipe to reduce length and reserve pieces. Section main pipe, attached to Tee, longitudinally
5.2 Photograph the sleeve from inside
5.3 Measure the protruding height of the sleeve at the valley
5.4 Measure the protruding height of the sleeve at the shortest locations
5.5 Measure the deflection of pipe wall near the opening
5.6 Back-out the sleeve
5.7 Photograph the sleeves and record any markings
5.8 Photograph the perforation on the sleeves
5.9 Separate top saddle from pipe
5.10 Photograph the joining areas
5.11 Measure the diameter of the opening on the pipe
5.12 Examine opening from thread grooves.

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Appendix C

Sample As-Received

Figure C1: Sample 07-1090, #39 Appleblossom

Figure C1 is an overview of the sample as received, showing bottom and top saddle parts, tower, cap, branch with Excess Flow Valve (EFV) and ½″ pigtail branch line.

Figure C2: Sample 07-1090, Top View

Figure C2 shows the overall sample alignment from the top view. Part of the threaded portion of both of the lower two bolts in this view was retained in the threaded hole in the lower saddle. The head portions of the broken bolts were received in a separate bag.

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Figure C3: Sample 07-1090 Side View

Figure C3 shows a side view of the tapping tee saddles, with the intact bolts on the right and the broken bolts on the left.

Figure C4: Sample 07-1090 Interior View of Tap

Figure C4 shows the tap viewed from the inside of the main pipe (arrow). No locking sleeve is visible.

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Figure C5: X-ray of Sample 07-1090, Side View

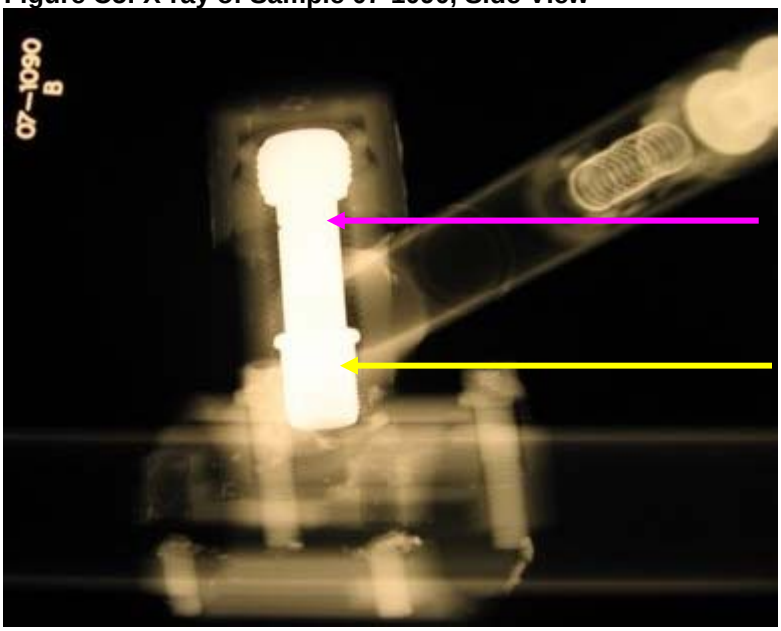

Figure C5 is an X-ray photograph of the tapping tee, showing the cutter (pink arrow) and the locking sleeve (yellow arrow). The locking sleeve does not appear to be engaged with the pipe wall.

Appendix D

Sample 07-1090 Disassembly and Examination

Numbering is in accordance with the Protocol, Appendix B descriptions. Descriptions in parentheses are explanatory and do not appear on the samples explicitly.

1.1 Hand written description on pipe and tag
#39 Appleblossom TAP
07-4063
STN 07-1090

1.2 Print line of pipe
ROTA SONIC INSPECTED PE2406 CDA T04 – 1 00896 FOR GAS
ASTM D2513 2" IPS SDR 11.0 UPONOR ALDYL ROTA SONIC INSPECTED PE240

1.3 Marking on cap
Permalock US Patent #4,730,636 P.C. HH CAV.3 P.E. (cavity mark 12)

1.4 Marking on top saddle and tower
(On saddle)
Perfection P.E. HH
2306 2406 Mold 9 (by indicator)
2" IPS

(On tower)
PERMALOCK Mechanical Tapping Tee
Perfection Corporation MADISON OHIO
ASTM D2513 PE2406 CE ½ CTS x (illegible) WALL
⅝ OD 55713 M244080 PMTT.MD.-090 FVC 40
US PATENT #'S 4,730,636 4,809,735 5,425,395
I38370502LO6

(On EFV)
UMAC Excess Flow Valve Series 400
IS325C5000R Design Pressure 70 psi

(On pigtail)
6 coil no. 0258

(On EFV/fitting fusion)
BEY02

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1.5 Marking on bottom saddle
2 IPS P.E. P.C. H#H Cav.1 Mold 10

1.6 Visible markings on front left bolt
3

1.7 Visible markings on front right bolt
3

1.8 Visible markings on back left bolt
3

1.9 Visible markings on back right bolt
3

1.10 Using calipers measure the distance between bottom of the cap and the stop marking
No gap. Measurement is 0 inches

1.11 Using calipers measure the height of the visible threads from the bottom thread to the underside of the cap. Count the number of visible thread(s)
No threads visible

1.12 Measure the gap between saddle and pipe at apex and 180° from the apex using feeler gauges at the 4 locations
Top left = 0.062 inches
Top right = 0.048 inches
Bottom left = 0.004 inches
Bottom right = <0.002 inches

1.13 Measure gap between saddle flange surfaces at each bolt at inside surface of inside edge of flanges
No gaps between saddle flange surfaces at front left and front right. Front center gap measured 0.025 inches.
Gap at rear aligned with bolt holes: 0.450 inches Right, 0.456 inches Center, 0.483 inches Left.
Gap at rear at edge of flange: 0.330 inched Left, 0.33 inches Right.

1.14 Use a circumferential wrap tape, measure the OD of the pipe in two locations, i.e. 4″ on either side of Tee saddle
OD left side = 2.388 inches
OD right side = 2.388 inches

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1.15 Using Vernier Calipers measure the OD of the pipe using calipers at one location 4" from the Tee saddle: Measure on the Axis of the tower and at 90 degrees (this is an assessment of the ovality of the pipe)

Vertical Diameter, right side =	*2.378*
Horizontal Diameter, right side =	*2.395*
Ovality, unrounded, right side =	*0.7%*
Vertical Diameter, left side =	*2.387*
Horizontal Diameter, left side =	*2.392*
Ovality, unrounded, left side =	*0.2%*

2.1 Remove cap and examine the inside of the cap; look for O-ring and take photos

Cap removed. O-ring present and intact and lubricated. Cap clean.

Figure D1: Cap As-Removed

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Figure D2: O-ring and Cutter Position in Tower with Cap Removed

2.2 Measure the height from top of the cutter to rim of the tower
0.014 inches

2.3 Back-out the cutter
Torque to back-out cutter measured 12 in-lbf break-away and 5 in-lbf continuous. Cutter backed out smoothly with no cross-threading.

2.4 Examine cutter for markings
No marks visible

2.5 Photograph the cutter and the cutting end

Figure D4: Cutter After Removal

Figure D5: Cutting End of Cutter with Tap Slug

2.6 Measure the height from the top of sleeve to tower rim
Three measurements taken: 2.947, 2.943, 2.942 inches, Average = 2.944 inches

2.7 Take a photo down the tower

Figure D6: View Down Tower with Cutter Removed; Locking Sleeve at Bottom

Observation: the locking sleeve was loose at the bottom of the tower.

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3.1 Record observations of the gap between the saddles on left and right sides
See 1.12 and 1.13

3.2 Measure the protruding bolt at left back corner
0.212 inches

3.3 Measure the protruding bolt at right back corner
0.198 inches

3.4 Measure the protruding bolt at left front corner
0.229 inches

3.5 Measure the protruding bolt at right front corner
0.233 inches

3.6 Measure the torque to remove each intact bolt
Front left = 11 in-lbf breakaway; 3-5 in-lbf continuous
Front right = 12 in-lbf to breakaway; 5 in-lbf continuous

3.7 Remove, label and package the intact bolts
The intact bolts (front right and front left) were removed per 3.6. They were labeled and packaged for later examination and testing. Both bolts were straight when removed, and were free of visible macroscopic fractures. The shank diameter of each bolt was measured to be 0.493 inches.

3.8. Measure the height of each bolt fragment from the flange upper surface of the bottom flange to the top of the fragment
Back left = 0.258 inches
Back right = 0.265 inches

3.9 Measure the length of the bottom bolt fragment in the assembly, using a micrometer, at each corner
Back left = 1.243 inches
Back right = 1.246 inches

3.10 Measure the length of threads on the broken bolt heads and the number of threads
No threads remaining on head end of broken bolts. Both bolts broke at the first thread.

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3.11 Photograph the broken bolts

Figure D7: Broken Bolts, Sample 07-1091

Figure D8: Broken Bolts, Sample 07-1091, Fracture Surfaces

3.11 Measure the length of the intact bolts
Front left = 2.501 inches
Front right = 2.504 inches

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3.12 Photograph the bolts

Figure D9: Front Right Intact Bolt

Figure D10: Front Left Intact Bolt

3.13 Determine action items for instrumental analysis of the bolts
These action items were determined:

Examine fracture surfaces by optical microscopy. Perform additional analysis of fracture surfaces by SEM/EDS or FTIR as appropriate to identify any contamination

Determine glass and other incombustible filler content of representative bolts and fragments by ash testing

Insofar as practical, determine the tensile breaking strength of intact and fractured bolts.

4.1 Remove the bottom and top saddles and photograph the flanges

Figure D11: Top Saddle Flanges at Bolt Holes

4.2 Collect any debris
Completed and retained as Sample 07-1092

4.3 Measure thickness of flange at each cap screw (bolt) as indictor of compression on top saddle
Front right = 1.010 inches
Front left = 1.013 inches
Back right = 1.017 inches
Back left = 1.020 inches

5.1 Cut pipe to reduce length. Preserve pieces. Section main pipe, attached to tee, longitudinally
Completed

5.2 Photograph the sleeve from inside
Not applicable; sleeve was not engaged with pipe

5.3 Measure the protruding height of the sleeve at the valley
Not applicable; sleeve was not engaged with pipe

5.4 Measure the protruding height of the sleeve at the shortest locations
Not applicable; sleeve was not engaged with pipe

5.5 Measure the deflection of pipe wall near the opening
Complex with some deflection of wall and raising of a lip at the hole edge. See Figure D12.

Figure D12: Contour of Pipe at Tap

In figure D12, the visible marked intervals at the lower edge of the scale are centimeters with millimeter graduations.

5.6 Back-out the sleeve
Not applicable as the locking sleeve was free and not engaged with the pipe

5.7 Photograph the sleeve and record any markings

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Figure D13: Locking Sleeve

No marking were visible on the locking sleeve

5.8 Photograph the ratchet surface on the sleeve

Figure D14: Locking Sleeve Ratchet Surface

5.9 Separate top saddle from pipe
Not applicable, as the saddle was not engaged with the pipe due to the non-engagement of the locking sleeve.

5.10 Photograph the joining areas

Figure D15: Joining Surface of Upper Saddle

Figure D16: Joining Surface of Pipe

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Figure D17: Joining Surface of the Lower Saddle

5.11 Measure the diameter of the tap hole in the pipe
The tap hole was irregular with two general diameters as shown below, corresponding to a step at the approximate mid-wall of the pipe. A photograph is provided as Figure D18.

The measurement directions A and B are perpendicular to each other but otherwise are arbitrarily chosen.

A: maximum diameter = 0.812 inches
A: minimum diameter = 0. 752 inches
B: maximum diameter = 0.791 inches
B: minimum diameter = 0. 730 inches

5.12 Examine thread grooves in opening
Figure D18 is a photograph of the tap hole showing irregular dimensions and no well-formed thread grooves. The appearance suggests that the locking sleeve may have partially engaged the pipe wall by approximately 1½ threads.

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Figure D18: Tap Hole Appearance

The tap hole was out of alignment with the fitting by approximately 0.4 inches. That is, the fitting had apparently rotated on the pipe between the time the tap was made and the time the sample was examined.

Figure D19: Rotation of Fitting Relative to Tap Hole

Figure D19 shows the distance that the tapping tee apparently rotated relative to the pipe between the time the pipe was tapped and the time the sample was examined. The yellow line is the approximate centerline of the tapping tee saddle as-received. The distance between the tapping tee centerline and the hole centerline (pink line) is approximately 0.4 inches.

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Appendix D - Continued

Sample 07-1090 Disassembly and Examination

Additional Measurements Made February 28, 2008 at Jana Laboratories

The effective diameter of the mated top and bottom saddles was measured in three places at each end of the saddle assembly. These locations are shown in Figure D20.

Figure D20: Saddle Diameter Measurement Locations

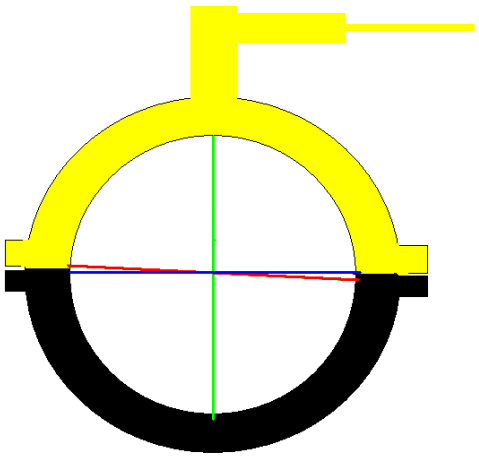

Figure D20 shows the three diameters that were measured with the saddles mated. Green is the diameter perpendicular to the flanges, while red and blue are the diameters measured the closest to parallel to the flanges without measuring at the gap between the flanges. These measurements were made at both ends of the saddle assembly with the saddles mated but not tightly clamped. They were repeated at one end with the saddles tightly clamped together.

Mated but not clamped, Right end:

Perpendicular to flanges = 2.278 inches
Parallel 1 = 2.337 inches
Parallel 2 = 2.309 inches

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Mated but not clamped, Left end:

Perpendicular to flanges = 2.309 inches
Parallel 1 = 2.320 inches
Parallel 2 = 2.312 inches

Clamped, Left end:

Perpendicular to flanges = 2.313 inches
Parallel 1 = 2.314 inches
Parallel 2 = 2.317 inches

The bolt bearing surfaces of the top saddle flanges were parallel to the flanges insofar as this could be verified with calipers. The bolt bores in the top saddle flanges and the threaded holes in the bottom saddle flanges were perpendicular to the flanges insofar as could be determined by close visual inspection.

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Appendix E

Tapping of Exemplar Pipe

On February 29, 2008 the tapping tee of Sample 07-1090, excluding the bolts, was installed on a length of 2″ SDR 11 PE gas pipe randomly chosen from stock on hand at Jana Laboratories. The bolts used were exemplar bolts of the same dimensions and appearance as the original bolts of Sample 07-1090. The installation was performed in accordance with the tapping tee manufacturer's instructions. The bolts were hand-tightened using a 4-inch long Allen wrench until the flanges just touched. Approximately 10 seconds after completing installation of the last bolt and removing the Allen wrench, the last bolt fractured in tension. It was replaced.

The fit and alignment of the fitting to the exemplar pipe appeared to be adequate.

An exemplar measuring tube was used to determine the tapping depth. The height of the measuring tube above the fitting at the conclusion of the tapping operation was 0.06 inches.

At the end of the tapping operation the cutter end could be seen protruding into the pipe when viewed down the inside of the pipe.

The assembly was X-rayed on March 11, 2008. The X-ray photographs taken indicated that the cutter had fully penetrated the pipe and that the locking sleeve appeared to engage the pipe to a depth of approximately three threads.

The assembly was then further examined at Jana Laboratories. The cutter was backed-out and removed and the position of the locking sleeve was inspected by looking down the inside of the tower and also from the inside of the exemplar pipe.

The following photographs document this installation and examination.

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Figure E1: Overall Alignment

Figure E2: Alignment, "Front" Side

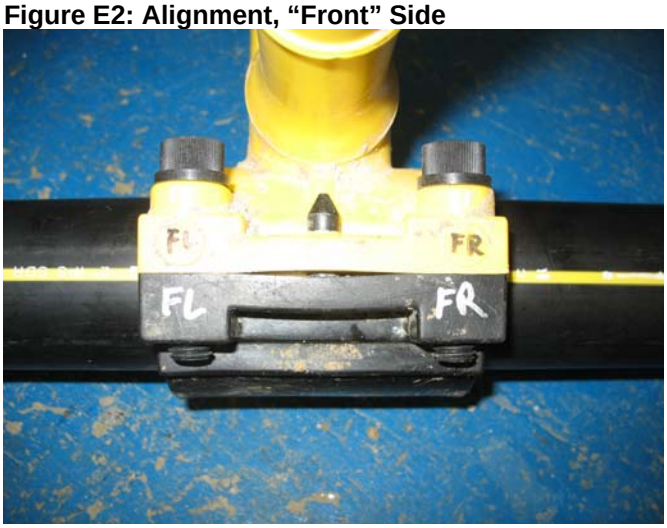

Figure E3: Alignment, "Back" Side

Figure E4: Measuring Tube Height at End of Tapping

Figure E5: Cutter Inside Pipe

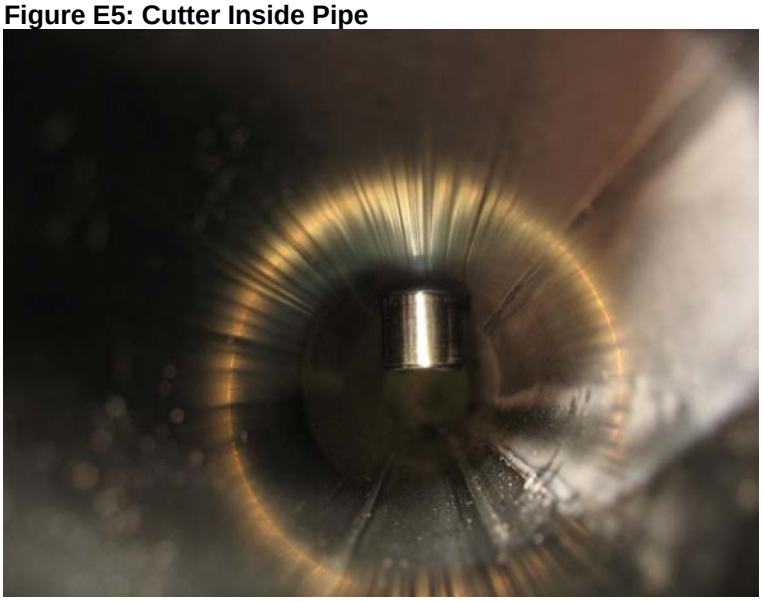

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Figure E6: X-ray of Installed Tapping Tee

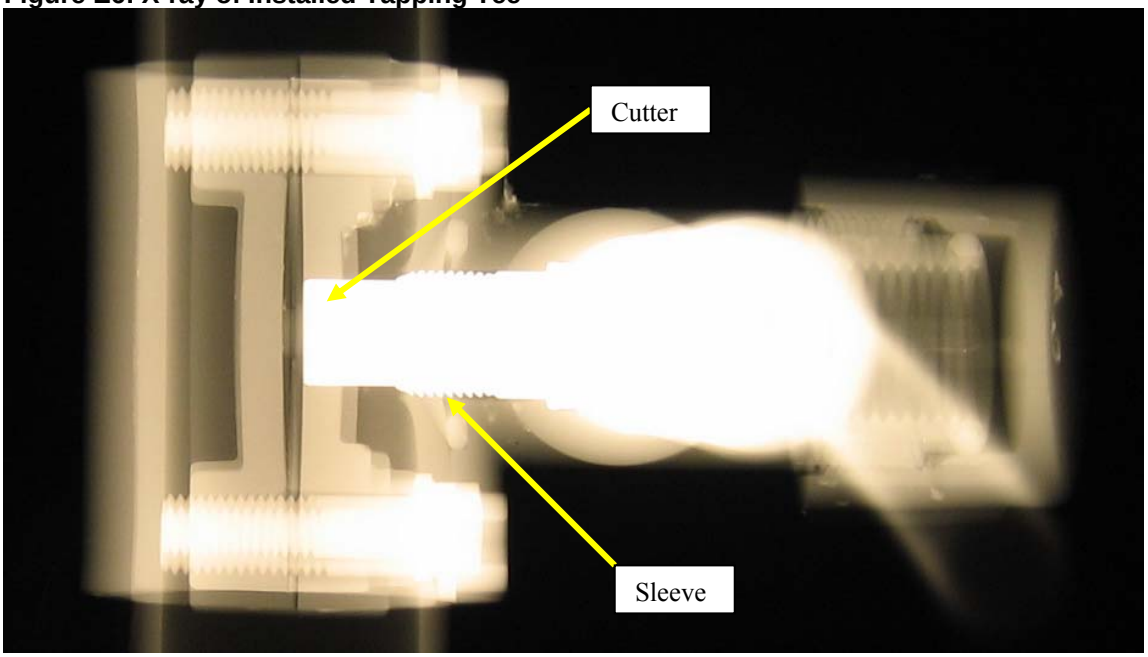

Figure E7: X-ray Close-up of Sleeve Engagement with Pipe Wall

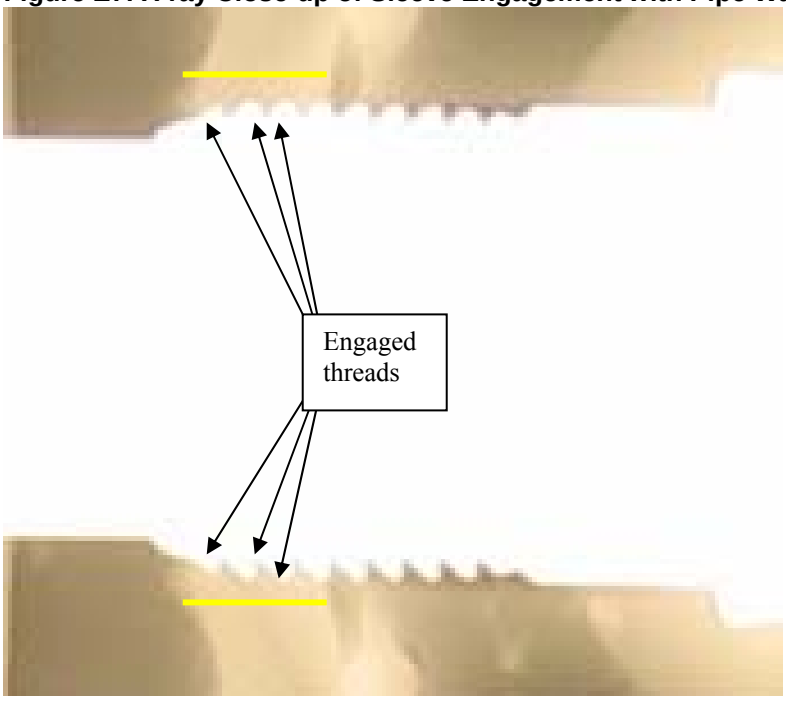

Figure E7 shows the X-ray cross section of the engagement of the sleeve threads with the pipe wall. Although four threads contact the pipe wall, only three threads are actually engaged.

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Appendix F

Bolt Fractography

Figure F1: Sample 07-1090 Back Left (threaded end) Fracture Surface As-Received

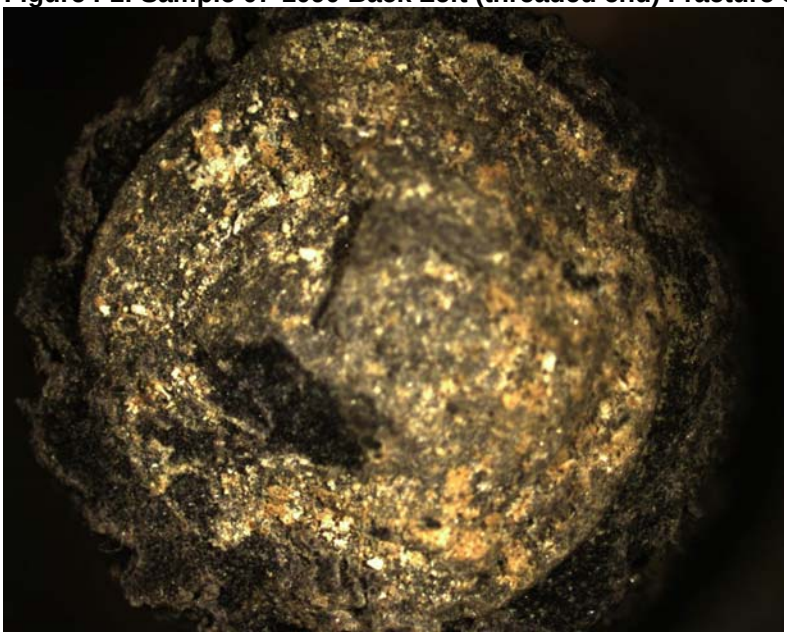

Figure F2: Sample 07-1090 Back Right (threaded end) Fracture Surface As-Received

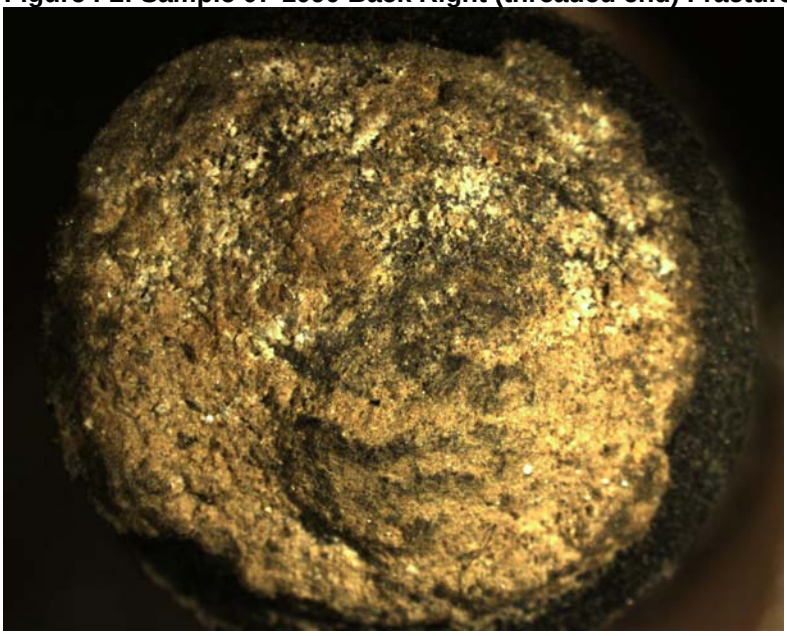

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Figure F3: Sample 07-1091-B (head end) Fracture Surface As-Received

Figure F4: Sample 07-1091 A (head end) Fracture Surface As-Received

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Figure F7: Sample 07-1090 Back Right New Fracture Surface After Tensile Testing

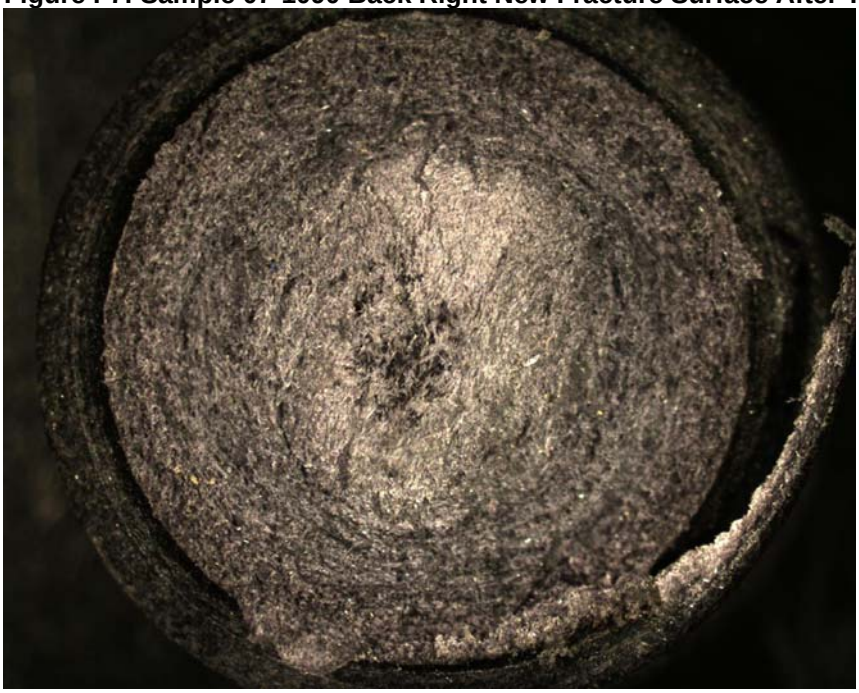
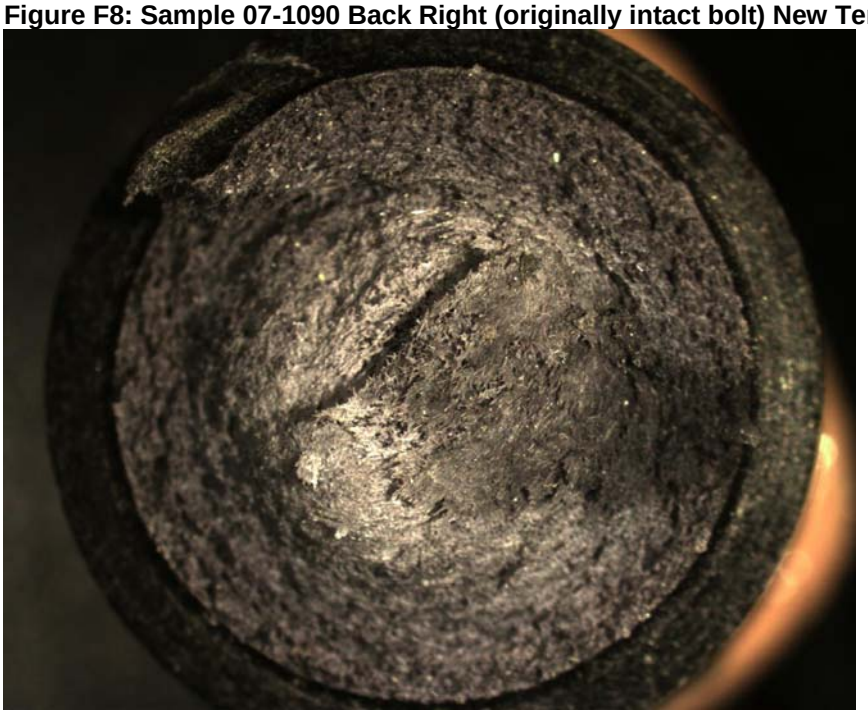


Figure F8: Sample 07-1090 Back Right (originally intact bolt) New Tensile Fracture Surface



Appendix G

Bolt Tensile and Ash Testing

Bolt Tensile Break Load determined in accordance with ASTM D638-08 (Modified)

The intact bolt 07-1090 FR was tested with a threaded female fixture at one end and a through-hole fixture at the other end, with a crosshead speed of 0.2 inches per minute and a gage length of 1.5 inches.

The fractured bolt portion was tested with threaded female fixtures at both end, with a crosshead speed of 0.2 inches per minute and a gage length of 0.4 inches. The results obtained with this short specimen configuration may be low due to side loading.

Filler Content / Glass Content determined in accordance with GM9077P:

Initial Sample Mass Measured
Exposed 16 h @400°C in Muffle Furnace
Ash Mass Measured and Reported as Filler Content (% by wt.)
Ash Washed in 5 % (by Volume) HCl Solution
Filtered Through 60 Mesh Screen and Filter Paper
Rinsed With Water
Dried 2 hours @ 120°C
Filtrate Mass Measured ad Reported as Glass Content (% by wt.)
Measurements Conducted @ 23ºC and 50 % RH)

Table G1: Tensile and Ash Test Results

Sample	Tensile Break Load (lbf)	Incombustible Filler Content (% by wt)	Glass Fiber Content (% by wt)
07-1090 FR	917	42.3	37.2
07-1090 BR	547*	Not Applicable	Not Applicable
07-1091 BR	Not Applicable	42.1	36.5

***** Result obtained on short bolt fragment may be low due to non-uniform loading

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