

Louisville Gas and Electric Company
2022 Annual Report
Case No. 2017-00119

In accordance with the Kentucky Public Service Commission's Order of March 16, 2018 in Case No. 2017-00119, Louisville Gas and Electric Company ("LG&E") is submitting the fifth and final annual report for the years 2018– 2022. The annual report provides the completion of the implementation of LG&E's Action Plan and the number of bolted-style coupling systems removed in 2022 from distribution lines having an operating pressure in excess of 60 psig along with observations of the removed couplings. LG&E has completed all requirements of the order.

LG&E developed the Action Plan in collaboration with Daniel Ersoy of the Gas Technology Institute ("GTI"). The Action Plan focused on the removal of couplers in the LG&E transmission and high-pressure (>60 psi) distribution systems, prohibited use of couplers going forward except in very limited circumstances and only in lower-pressure environments, and to improve the training and communication efforts to minimize the chances of coupler separations. The Action Plan items align with Section 3 of the GTI Report that was submitted in Case No. 2017-00119 as an attachment to Commission Staff's Second Request for Information.

LG&E had completed all action items in the Action Plan submitted in the 2018 annual report with the exception of one item which was completed in 2022.

GTI Report Section 3, Part F: Continuous Process Improvement and Leading Indicators

Action 1: Continuous process improvement and leading indicators, including incorporating findings into Distribution Integrity Management Program ("DIMP").

Action Taken: The Gas Distribution and Information Technology teams implemented a new risk analysis software to consider the suggested, among other, risk factors associated with the distribution system. This will allow a better ranking of infrastructure to be utilized by the DIMP team members to initiate improvements.

Status: Complete

In accordance with the Action Plan Section 3, Part E, a program was implemented for the opportunistic bolted style coupling removal or encapsulation in October 2017. In accordance with the Kentucky Public Service Commission's Order to LG&E on March 16, 2018 for Case No. 2017-00119, LG&E hereby notifies the Commission that the following five mechanical couplings were removed from service from LG&E's high-pressure (>60 psi) gas distribution system in 2022. The five couplings were physically removed from the ground while no couplings were retired in place by terminating the pipeline in an upstream and / or downstream location. None of the couplings were removed from service due to a failure in the coupling or leak.

Distribution Couplings removed from the ground:

- 1) 800 Cannons Lane – Two 12-inch bolted style mechanical couplings installed in 1987 were exposed on 06/29/2022 and removed from the ground on 08/09/2022 for inspection. The lab analysis is attached in Exhibit A and Exhibit B.
- 2) 554 Cannons Lane – A 12-inch and a 20-inch bolted style mechanical coupling installed in 1987 were exposed on 07/08/2022 and removed from the ground on 08/09/2022 for inspection. The lab analysis is attached as in Exhibit C and Exhibit D.
- 3) 26th Street and Bank Street – A 6-inch bolted style mechanical coupling installed in 1951 was exposed and removed from the ground 11/11/2022. The coupling was inspected. The lab analysis is attached as in Exhibit E.

LG&E plans to continue the opportunistic removal of bolt-style coupling systems and to manage the couplings under its distribution integrity management program.

IMR TEST LABS

A Curtiss-Wright Business Unit
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Louisville, KY 40218
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LG&E - Kentucky Utilities
6900 Enterprise Drive
Louisville, KY 40214

November 29, 2022

Attention: Sarah Nicholson

Exhibit A
Report No. 202202293

Metallurgical Evaluation of a 12" Coupling and Associated Hardware

Location: Grandview South - 800 Cannons Ln.
Designation: 2022-004

DESCRIPTION AND PURPOSE

A natural gas pipe section including a coupling was submitted for metallurgical evaluation. The section was a 12" pipe with a Dresser Style Insulating Coupling. Four joint harnesses were also affixed to the pipe section. Copies of the installation information for the coupling and harnesses were provided for this investigation. It was reported that the coupling had been installed in the field at the Grandview South at approximately 800 Cannons Lane on November 23, 1987. The pipe section was subsequently excavated after substantial service duration without failure. It was requested that the general dimensions, weld quality, corrosion condition and mechanical properties of the coupling components be determined as directed.

RESULTS

The submitted pipe section with the coupling is shown in Figures 1 through 4. Four lugs of the joint harnesses had been fillet welded to both pipe segments. Four rods and associated nuts had been affixed through the welded lugs to apply compression to the coupled joint. The coupling consisted of a steel coupling with an interior nonmetallic gasket / sleeve. Prior to receipt, the ends of the pipe segment were labelled as Ends A and B, as shown in Figures 1 and 2. The top and bottom of the coupling section were also marked. Lugs A1, A2, A3, and A4 were welded to Pipe A, and Lugs B1, B2, B3, and B4 were welded to Pipe B. The rod between Lugs A1 and B1 was identified as Rod 1. The remaining lugs were identified in a corresponding fashion.

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Figure 1. Photograph of the top of the submitted coupling sample.

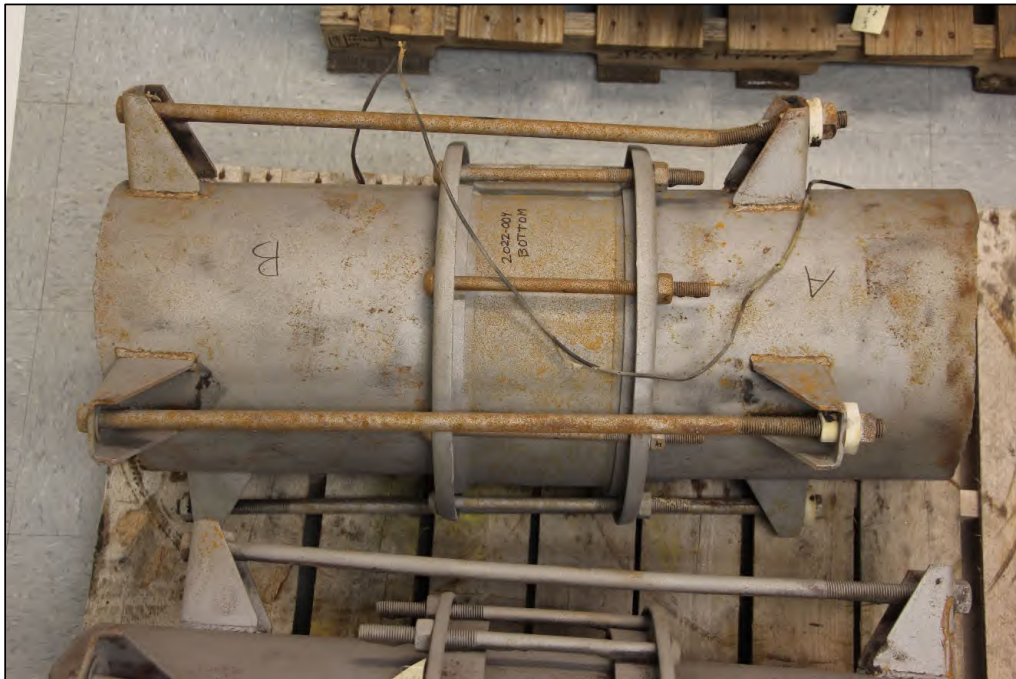


Figure 2. Photograph of the bottom of the submitted sample.

SECTION 1- DIMENSIONAL MEASUREMENT

The four sets of harness lugs were positioned around the pipe. The relative orientations of the harness lugs were measured by photographing the assembly from the ends and applying a protractor overlay for angle measurement. The obtained measurements are shown in Figures 3 and 4 with the data summarized in Table 1. The depth of insertion of the pipe segments into the coupling was also measured and the dimensions are provided in Table 2. No requirements were provided for these characteristics.

TABLE 1 – LUG SPACING DIMENSIONAL MEASUREMENTS

Compound	Angle	Deviation from 90°	Image
Rod A1 / Rod A2	88	- 2	Figure 3
Rod A2 / Rod A3	82	- 8	Figure 3
Rod A3 / Rod A4	87	- 3	Figure 3
Rod A4 / Rod A1	103	13	Figure 3
Rod B1 / Rod B2	85	- 5	Figure 4
Rod B2 / Rod B3	85	- 5	Figure 4
Rod B3 / Rod B4	92	2	Figure 4
Rod B4 / Rod B1	98	8	Figure 4

TABLE 2 – PIPE COUPLING DIMENSIONAL MEASUREMENTS

Component	Depth of Pipe into Coupling	Gap Between Pipes in Coupling
Pipe A	17 ¼"	1.635" (Original sample length – 36 3/8")
Pipe B	17 ½"	

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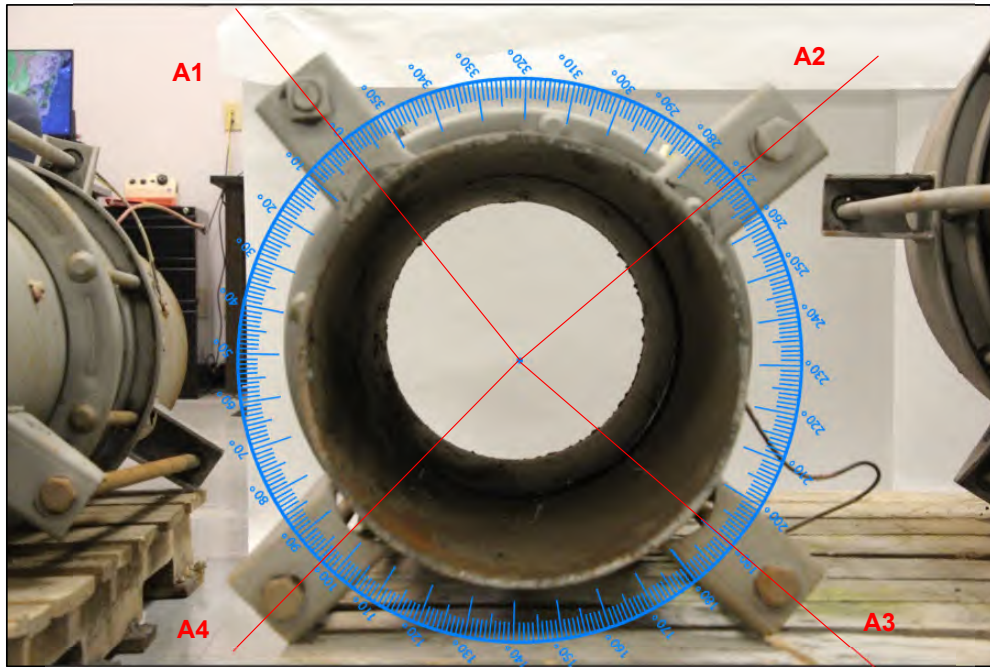


Figure 3. End facing image of the sample at End A with a superimposed protractor.

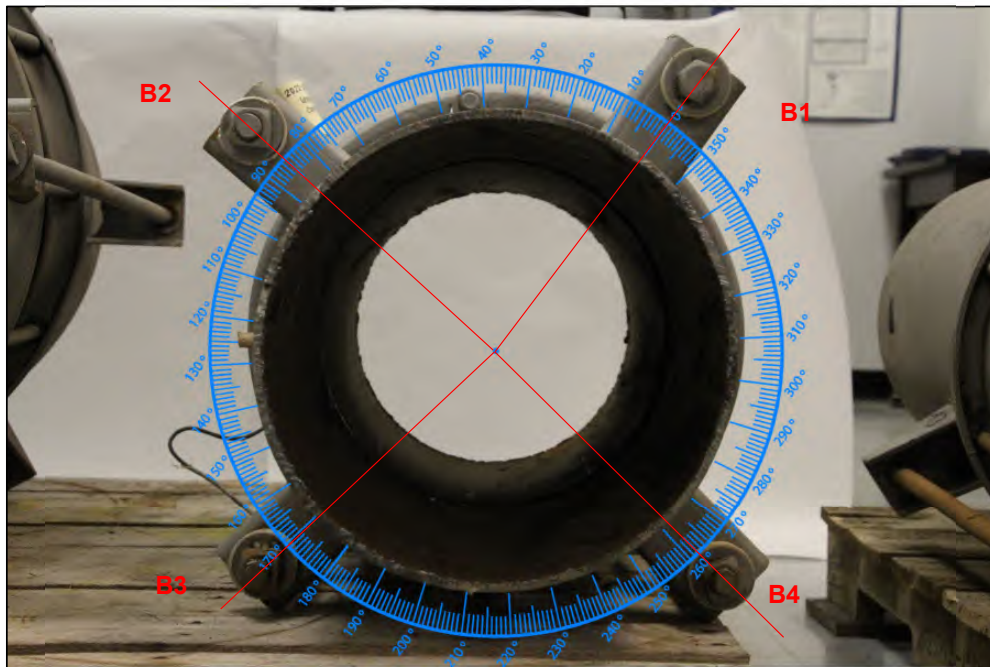


Figure 4. End facing image of the sample at End B with a superimposed protractor.

SECTION 2- VISUAL OBSERVATIONS

The lug attachment welds were regions of interest on the pipe coupling sample. Each lug contained four fillet weld locations; exterior top, exterior bottom, interior top, and interior bottom. Each weld that was present was inspected visually using a flashlight and magnifying lens. It was indicated that welding was performed in accordance with API 1104. General weld inspection was performed initially, followed by visual inspection by an outside NDE company. For comparison purposes, the welds were rated as substantial fusion, partial fusion, and minimal fusion. The summarized weld fusion and corrosion observations are provided in Table 3. Representative weld regions are shown in Figures 5 through 9. The welds contained localized discontinuities including undercut, arc strikes, porosity, and spatter. No cracking in the welds or base metal heat affected zones (HAZ) was visually identified. No gross corrosion was observed anywhere on the pipe or associated hardware.

The coupling and harness rods were also inspected for damage. The observations for the rods and bolts are provided in Table 4. No corrosion cracking was evident. The rods were not necked down or stretched.

The elastomeric components of the coupling consisted of a pipe separator, insulating sleeve, and two gaskets. Inspection revealed that they appeared to be intact and not degraded.

TABLE 3 – LUG WELD VISUAL EXAMINATION RESULTS

Component	Location	Weld	Observations
Lug A1	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Obscured – could not be inspected
		Bottom	Obscured – could not be inspected
Lug A2	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial
Lug A3	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial
Lug A4	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial
Lug B1	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial
Lug B2	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial
Lug B3	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial
Lug B4	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial

TABLE 4 – FASTENER VISUAL EXAMINATION RESULTS

Component	Observations
Rod 1	Straight
Rod 2	Straight
Rod 3	Straight, slight corrosion
Rod 4	Bent at Lug A4, slight corrosion
Bolt 1	Straight
Bolt 2	Straight
Bolt 3	Straight
Bolt 4	Straight, slight corrosion
Bolt 5	Straight, slight corrosion
Bolt 6	Straight, slight corrosion
Bolt 7	Straight
Bolt 8	Straight



Figure 5. Image of the Lug A1 exterior bottom weld which exhibited substantial fusion except for some undercut, spatter, and arc strikes.



Figure 6. Image of the Lug A2 exterior bottom weld which exhibited substantial fusion except for some undercut, spatter, and arc strikes.

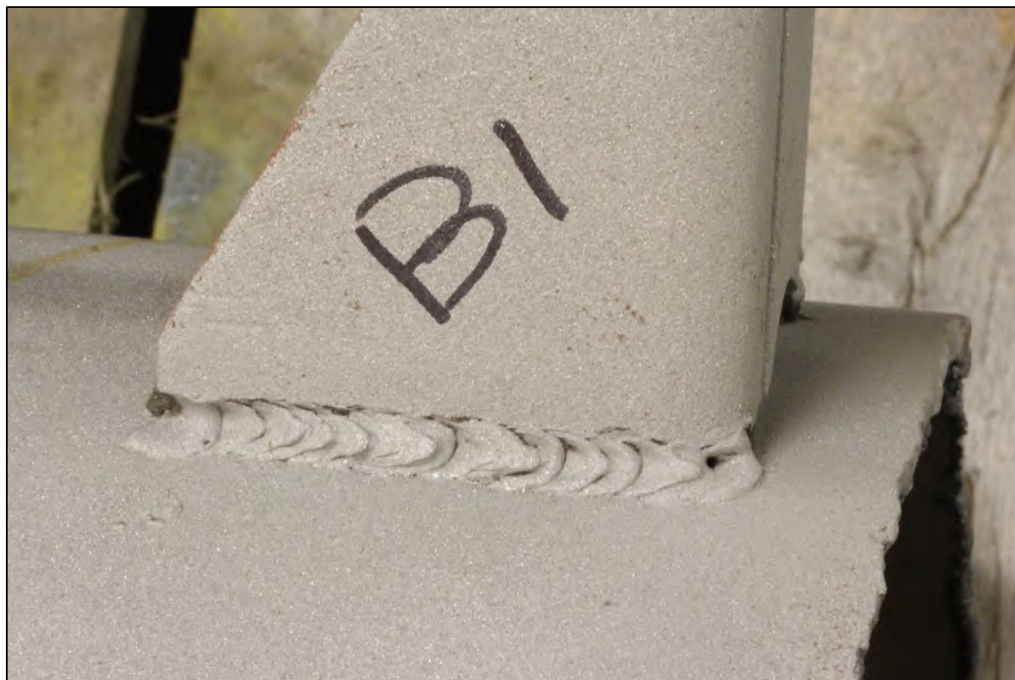


Figure 7. Image of the Lug B1 exterior bottom weld which exhibited substantial fusion except for some undercut and arc strikes.



Figure 8. Image of the Lug B2 exterior bottom weld which exhibited substantial fusion except for some undercut, spatter, and arc strikes. A portion of the interior weld was obscured.



Figure 9. Image of the Lug B4 exterior top weld which was fractured and exhibited substantial fusion except for some undercut, arc strikes, and spatter.

SECTION 3- TORQUE TESTING- FOR INFORMATION ONLY

Torque testing was performed on the nuts of the rods and bolts on the pipe coupling sample. A calibrated torque wrench was used to determine breakaway torque on each fastener. The breakaway torque measurements are summarized in Table 5. Rod fasteners did not have a specified torque requirement. The eight coupling bolts and four harness rods exhibited torque values ranging from 40 to 60 ft.-lbs. No requirements were utilized for comparison as the coupler model was not specified.

TABLE 5 – FASTENER TORQUE MEASUREMENT

Component	Breakaway Torque	Observations
Rod 1	40 ft.-lbs.	
Rod 2	55 ft.-lbs.	
Rod 3	30 ft.-lbs.	
Rod 4	40 ft.-lbs.	
Bolt 1	50 ft.-lbs.	
Bolt 2	55 ft.-lbs.	
Bolt 3	45 ft.-lbs.	
Bolt 4	60 ft.-lbs.	
Bolt 5	45 ft.-lbs.	
Bolt 6	55 ft.-lbs.	
Bolt 7	50 ft.-lbs.	
Bolt 8	55 ft.-lbs.	

SECTION 4- TENSILE TESTING, ASTM A370-19

Tensile testing was performed on round specimens that were removed from the four harness rods and the eight coupling bolts. The tensile mechanical properties of the fasteners were measured and the results are summarized in Table 6. No mechanical property requirements were provided for the fasteners.

TABLE 6 – FASTENER TENSION TEST RESULTS

Component	Ultimate Tensile Strength, ksi	0.2% Offset Yield Strength, ksi	Elongation, %	Reduction in Area, %
Rod 1	108	65.5	25	51
Rod 2	107	66.0	25	50
Rod 3	108	65.0	24	47
Rod 4	108	65.5	25	48
Bolt 1	78.0	49.9	37	73
Bolt 2	83.5	53.5	37	74
Bolt 3	79.0	54.5	37	75
Bolt 4	77.5	49.9	38	75
Bolt 5	82.0	61.0	38	75
Bolt 6	80.5	58.5	36	77
Bolt 7	79.0	59.0	39	76
Bolt 8	80.0	59.5	38	76

Specimen Dimensions; Diameter 0.350" with gage length of 1.40"
Percent elongation was measured using elongation-after-fracture measurements

SECTION 5- ROCKWELL HARDNESS, ASTM E18-20

Small sections of the eight lugs were excised for hardness testing. Rockwell hardness testing was performed on sectioned segments of the lugs after the removal of surface roughness by sanding. The obtained results are provided in Table 7 and are suggestive of a moderate strength level. No requirements were provided for comparison.

TABLE 7 – LUG HARDNESS TEST RESULTS – ROCKWELL B – HRBW

Results	Average of Five Measurements
Lug A1	78
Lug A2	81
Lug A3	76
Lug A4	77
Lug B1	52
Lug B2	76
Lug B3	78
Lug B4	53

SECTION 6- NONDESTRUCTIVE EXAMINATION

The two separated ends of the disassembled coupling were sent to a third party NDE laboratory for inspection. Visual and liquid dye penetrant inspections were performed on the lug attachment welds. Inspection was performed in accordance with the acceptance criteria of API 1104 "Welding of Pipelines and Related Facilities". The inspection results are provided as Appendices A and B. Two representative welds are shown in Figures 10 and 11 with the dye penetrant test media remaining.



Figure 10. Image of the Lug A4 exterior top weld after dye penetrant media had been used during inspection.

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Figure 11. Image of the Lug B2 exterior top weld after dye penetrant media had been used during inspection.



Respectfully submitted

Brett A. Miller, P.E. FASM
Technical Director


Concurrence

Brian Kelly
Failure Analyst

All procedures were performed in accordance with the IMR Quality Manual, current revision, and related procedures; and the PWA MCL Manual F-23 and related procedures. The information contained in this test report represents only the material tested and may not be reproduced, except in full, without the written approval of IMR Test Labs ("IMR"). IMR maintains a quality system in compliance with the ISO/IEC 17025 and is accredited by A2LA, certificates #1140.03 and #1140.04. IMR will perform all testing in good faith using the proper procedures, trained personnel, and equipment to accomplish the testing required. Conformance will be based on results without measurement uncertainty applied, unless otherwise requested by the customer. IMR's liability to the customer or any third party is limited at all times to the amount charged for the services provided. All test samples will be retained for a minimum of 3 months and may be destroyed thereafter, unless otherwise specified by the customer. The recording of false, fictitious, or fraudulent statements or entries on this document may be punished as a felony under federal statutes. IMR Test Labs is a GEAE S-400 approved lab (Supplier Code T9334).

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APPENDIX B – LIQUID DYE PENETRANT INSPECTION RECORD

		Liquid Penetrant Examination Report	
4100 Bishop Lane Louisville, KY 40218 P: (502) 966-5558; F: (502) 966-5401		www.mistrasgroup.com	
Client: <u>IMR</u>	Date: <u>11-19-2022</u>	Page: <u>1</u> of <u>1</u>	
Address: <u>4510 ROBARDS LN</u> <u>LOUISVILLE, KY 40218</u>	Job Number: _____	Purchase Order: <u>7697FA</u>	
Contact: <u>BRETT MILLER</u>	Reference Number: <u>202202293</u>	Part No/Description: <u>STEEL GAS COUPLINGS</u>	
Location: <u>MGI SHOP</u>	LIFTING LUGS		

Code/Specification AMSE SEC.V ARTICLE 6	Procedure 100-PT-001 REV 22	Acceptance Criteria API 1104
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Type and Method

Fluorescent: Water Wash [Method A] Red Visible Dye: Water Wash [Method A]
 [Type I] Solvent Removable [Method C] [Type II] Solvent Removable [Method C]
 Post Emulsified: Hydrophilic [D] Lipophilic [B] Post Emulsified [Method B]

Sensitivity Level: ½ 1 2 3 4 N/A Other: _____

	Manufacturer	Type	Batch Number(s)	Application Method	Process Time (minutes)	
					Pre-clean Dry Time:	
Cleaner:	MAGNAFLUX	SKC-S	20L01K	DAMP CLOTH	5 MIN	10 MIN
Penetrant:	MAGNAFLUX	SKL-SP2	18L04K	BRUSH	N/A	N/A
Developer:	MAGNAFLUX	SKD-S2	21J046	SPRAY	10 MIN	N/A
Emulsifier:	N/A	N/A	N/A		N/A	N/A

Developer Form: a. Dry Powder b. Water Soluble c. Water Suspended d. Nonaqueous Wet e. Specific Application

Penetrant Removal Method & Dry Time SKC-S DAMP CLOTH @ 5MIN	Black Light (Model and S/N) N/A	White Light Source L.E.D. FLASHLIGHT
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Original Repair

Material & Thickness: C/S Test Temperature: 67 F

Surface Condition:
 As Welded As Ground As Cast Rough Machined Final Machined Meets Code Requirements

Test Results: Quantity Inspected: 8 Quantity Accepted: Quantity Rejected: 8

RED DYE PENETRANT INSPECTION PERFORMED ON THE FOLLOWING:
 DESCRIPTION: (202202293) COUPLINGS- LUG WELDS
 WELD I.D.: A1(REJECTED)--UNDERCUT
 WELD I.D.: A2(REJECTED)--UNDERCUT,POROSITY
 WELD I.D.: A3(REJECTED)--UNDERCUT,LACK OF FUSION
 WELD I.D.: A4(REJECTED)--UNDERCUT,POROSITY

 WELD I.D.: B1(REJECTED)--UNDERCUT,LACK OF FUSION
 WELD I.D.: B2(REJECTED)--UNDERCUT,POROSITY
 WELD I.D.: B3(REJECTED)--UNDERCUT,POROSITY,LACK OF FUSION
 WELD I.D.: B4(REJECTED)--UNDERCUT,UNDER FILL, POROSITY

The content of this document may be defense article/service related as described and controlled by International Traffic in Arms Regulations (ITAR)(22 CFR 120-130). Distribute only to entities meeting ITAR requirements. Discard by shredding. At no time during testing did these parts or material come into contact with mercury.

Technician Name, Level & Date: CHRIS DADDONA LVL II 11-19-2022 Customer (if applicable): _____ Reviewed By (if applicable): _____

Certification of Inspection, Liquid Penetrant [Basic Report Form] 100-PTFORM-Q02 | Rev 1

Bolt-Style Coupling (pressures > 3 psig)

This form will be completed when LG&E or LG&E contractors expose a bolt-style coupling in a system where the pressure is > 3 psig (medium and high-pressure distribution and transmission) and the coupling will be backfilled. The purpose of the form is to provide Operations, Engineering and Gas Regulatory personnel with information about the bolt style coupling installation.

Part A- Discovery of Coupling

Precautions:

1. Stop excavation upon discovering the bolt-style coupling in the excavation
2. Set-up a perimeter around the excavation to keep the public away from the excavation

General Information:

1. Contact Employee for the bolt style coupling found: **James McGough** [REDACTED]
2. Date of exposure: **06/29/2022**
3. Location: **Grandview Valve Nest (Approximate Address: 800 Cannons Ln. Louisville, KY 40207)**
4. Size of coupling (based on pipe size if not exposed enough to determine): **12"**
5. Type of soil: Sandy Clay Gravel Topsoil Other (take picture and describe)
6. Soil Density test: Type A Type B Type C
7. Status: Removed Abandoned in place Backfilled- left in service
8. Discovery Method: Leak on Coupler Other Maintenance Excavation Facility Replacement
 Facility Retirement Other:
9. Pressure Class: Medium Pressure (MP) High Pressure (HP) Transmission

Pictures:

1. Take at least two pictures of the coupling. The pictures should be from different angles (additional pictures can be taken).
2. Email pictures to supervisor. Ensure pictures are attached to this form:

Sketch: Provide a sketch showing the coupling orientation (vertical/horizontal), nearby branches, pipe, valves and fittings, other utilities or structures, etc.

Leak Survey:

1. Use an instrument designed to detect natural gas to check for the presence of natural gas after backfilling the excavation. Include readings in the above sketch in relation to the coupling. If the contact employee is not leak survey qualified, they should contact:
 - a. Their supervisor to call Gas Regulatory to complete the survey after the excavation is backfilled. Call [REDACTED]
 - b. If Gas Regulatory is not available contact Gas Dispatch to have the survey assigned to a Gas Trouble Technician.

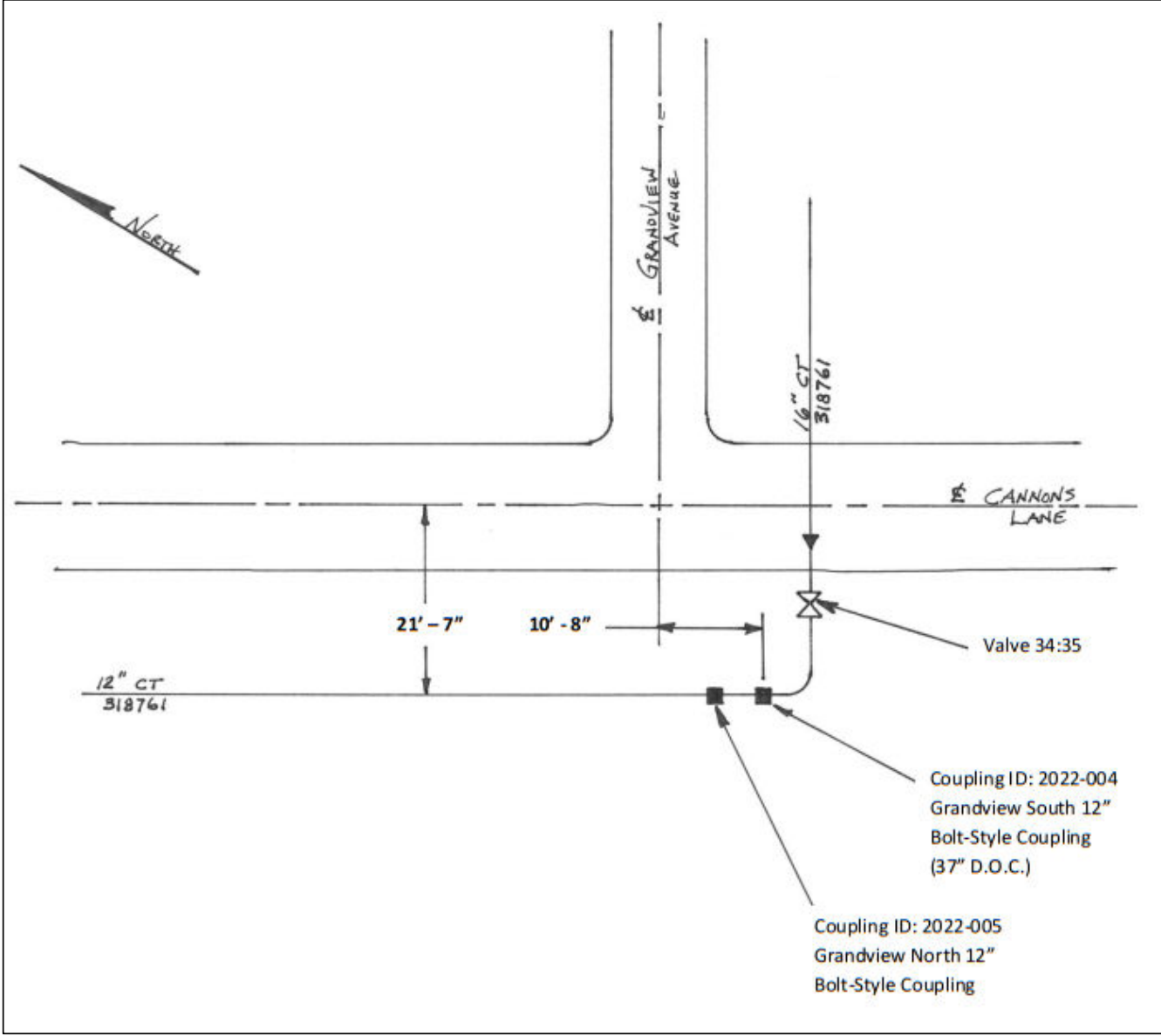
Leak Survey completed at time of backfill (circle one) yes no not applicable

Include completed form in the main report and email a scanned copy of the completed form (back and front) to the DIMP group at [REDACTED]

Field Pictures



Sketch



Safety Briefing

Date: October 3, 2022

Employee Name	Employee ID
Sarah Nicholson	██████
Ethan Hinkson	██████

Hazards Identified	
<input checked="" type="checkbox"/>	Sharp edges on cut pipe ends. Wear gloves when handling.
<input checked="" type="checkbox"/>	Pinch points on couplings. Wear gloves when handling.
<input checked="" type="checkbox"/>	Some couplings samples are heavy. Use a partner to assist with moving. Use proper lifting techniques. Wear hard toes shoes.
<input checked="" type="checkbox"/>	Debris may on samples. Wear eye protection.
<input checked="" type="checkbox"/>	Tripping hazards on floor. Keep area clean and free of tripping hazards

PPE Required	
<input checked="" type="checkbox"/>	Hard toed shoes
<input checked="" type="checkbox"/>	Safety glasses
<input checked="" type="checkbox"/>	Gloves (leather preferred)

Part B- Coupling Information

General Information		Tracking #: 2022-004	
PO Number 1121185	Expense Org 004610	Project 158276	Task COUPLER
Address/Location Grandview South @ 800 Cannons Ln. Louisville, KY 40207			
Size 12"	Material STL	Coating CT	MAOP 200 PSIG
Main/Service Number 318761	Soil Type (from Part A) Clay (Type B)	Manufacturer Dresser	Model Style 38
Pipe Connection:	Steel to Steel	Steel to Plastic	Plastic to Plastic

Historical Information	
Installation Date 11/23/1987	Document Source Quest
Installation Company Southern Pipeline	Document Source Quest
Foreman Campbell	Document Source Quest
Welder Paul Howard & Don Gousha	Document Source Quest

GIS Information	
Sys Id (of Coupler) 73388283	
Screen Capture	

Pictures (Label the following parts before taking pictures.)



Figure 1 – Coupler Top View



Figure 2 – Pipe Side A (Top)



Figure 3 – Pipe Side B (Top)



Figure 4 – Coupler Bottom View



Figure 5 – Lug A1



Figure 6 – Lug A2



Figure 7 – Lug A3



Figure 8 – Lug A4



Figure 9 – Lug B1



Figure 10 – Lug B2



Figure 11 – Lug B3



Figure 12 – Lug B4

Part C- Visual Inspection of Coupling

Visual Inspection Performed by: Ethan Hinkson & Sarah Nicholson

Date: 10/3/2022

Table 1- Component Quantities

Number of Bolts on Coupler Body	8
Number of Reinforcement Rods	4
Number of Lugs	8

Table 2- Corrosion

	Pipe A	Pipe B	Coupler Body	Bolts	Rods	Lugs	Nuts
General External Corrosion?	Yes	No	No	No	No	No	No
Localized External Corrosion?	No	No	No	No	No	No	No
Pits Present?	No	No	No	No	No	No	No
Internal Corrosion?	No	No					

* If Pits are present take maximum depth measurements and put in the Additional Comments section.

Table 3- Coupler Body

Bolt	Washer Present	Nut present?
1	No	Yes
2	No	Yes
3	No	Yes
4	No	Yes
5	No	Yes
6	No	Yes
7	No	Yes
8	No	Yes

Table 4- Reinforcement Rods

Rod	Length (in.)	Diameter (in.)	Washer present at head of bolt?	Washer present at end of bolt?	Nut Present? Type?	Type of rod?
1	30 ¾"	¾"	Yes	Yes	Square	Standard
2	30 ¾"	¾"	Yes	Yes	Square	Standard
3	30 ¾"	¾"	Yes	Yes	Square	Standard
4	30 ¾"	¾"	Yes	Yes	Square	Standard

Type of Lug

(Please indicate the shape of the lug by circling one below. If the lug shape is different than any preset shape below, sketch the shape.)

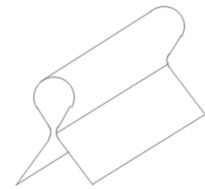
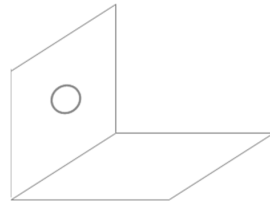
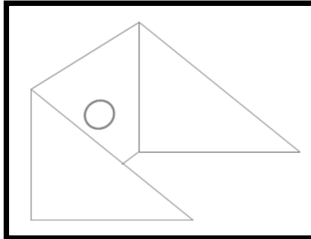


Table 5- Lugs (Measurements)

Pipe Side	Lug Number	Thickness (in.)	Circumference (in)	
			Distance to next lug, clockwise	Distance to next lug, counter-clockwise
A	1	0.23"	6 ¼"	6 ½"
A	2	0.23"	8"	6 ¼"
A	3	0.24"	7"	8"
A	4	0.23"	6 ½"	7"
B	1	0.23"	6 ¾"	7"
B	2	0.23"	7 ¼"	6 ¾"
B	3	0.22"	7 ½"	7 ¼"
B	4	0.23"	7"	7 ½"

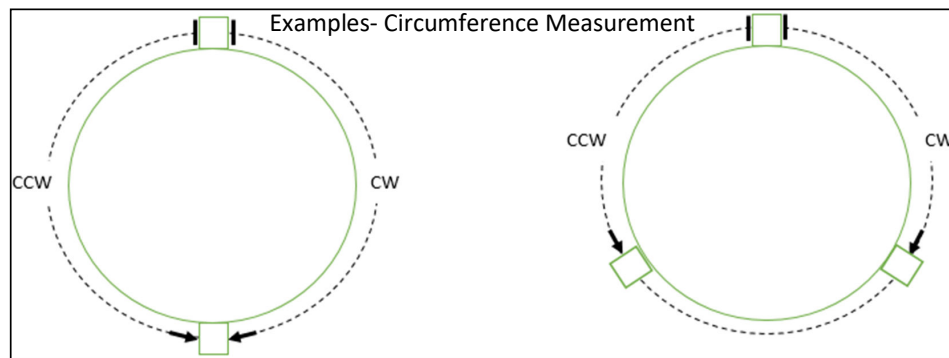


Table 6- Lugs (Observations)

Lug	Lug	Assembly sets aligned?	Deformed?	Deflected? (angle of)
A1	B1	Yes	No	No
A2	B2	Yes	No	No
A3	B3	Yes	No	No
A4	B4	Yes	No	No

Table 7- Lugs (Weld Quality)

Pipe Side	Lug Number	Any failed welds causing detachment?	Welded on all sides of exterior? If no, describe	Are welds on exterior continuous? If no, describe
A	1	No	Yes	Yes
A	2	No	Yes	Yes
A	3	No	Yes	Yes
A	4	No	Yes	Yes
B	1	No	Yes	Yes
B	2	No	Yes	Yes
B	3	No	Yes	Yes
B	4	No	Yes	Yes

Pipe Side	Lug Number	Welded on all sides of interior? If no, describe	Are welds on interior continuous? If no, describe
A	1	N/A (Obscured)	N/A (Obscured)
A	2	Yes	Yes
A	3	Yes	N/A (Obscured)
A	4	Yes	N/A (Obscured)
B	1	Yes	N/A (Obscured)
B	2	Yes	Yes
B	3	Yes	Yes
B	4	Yes	Yes

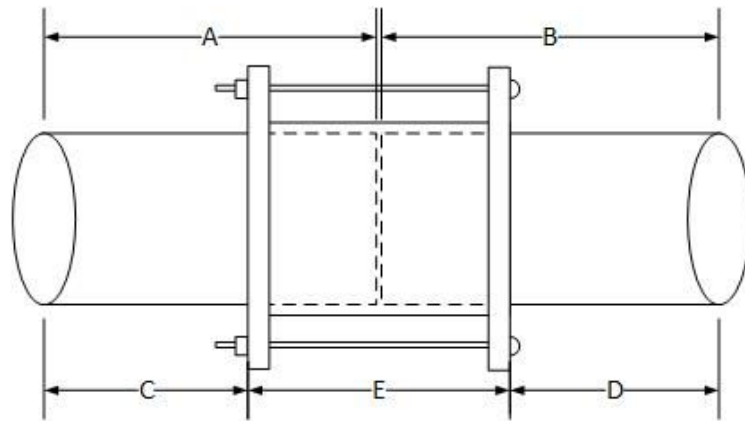


Table 8- Stab Depth

	A	B	C	D	Stab Depth (A-C) or (B-D)
Pipe Side A	16 ¼"		14 ¼"		2"
Pipe Side B		18"		13 ½"	4 ½"
	Sum of stab depths (should be closely equal to measurement E)				6 ½"
	Coupler Length (E)				8 ½"
	Difference				2"

Additional Comments - General Observations, Pit Depths, etc.



Figure 13 – General Corrosion on Pipe Side A

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LG&E - Kentucky Utilities
6900 Enterprise Drive
Louisville, KY 40214

November 29, 2022

Attention: Sarah Nicholson

Exhibit B
Report No. 202202294

Metallurgical Evaluation of a 12" Coupling and Associated Hardware

Location: Grandview North @ 800 Cannons Ln.
Designation: 2002-005

DESCRIPTION AND PURPOSE

A natural gas pipe section including a coupling was submitted for metallurgical evaluation. The section was a 12" pipe with a Dresser Style Insulating Coupling. Four joint harnesses were also affixed to the pipe section. Copies of the installation information for the coupling and harnesses were provided for this investigation. It was reported that the coupling had been installed in the field at Grandview North, at approximately 800 Cannons Lane on November 23, 1987. The pipe section was subsequently excavated after substantial service duration without failure. It was requested that the general dimensions, weld quality, corrosion condition and mechanical properties of the coupling components be determined as directed.

RESULTS

The submitted pipe section with the coupling is shown in Figures 1 through 4. Four lugs of the joint harnesses had been fillet welded to both pipe segments. Four rods and associated nuts had been affixed through the welded lugs to apply compression to the coupled joint. The coupling consisted of a steel coupling with an interior nonmetallic gasket / sleeve. Prior to receipt, the ends of the pipe segment were labelled as Ends A and B, as shown in Figures 1 and 2. The top and bottom of the coupling section were also marked. Lugs A1, A2, A3, and A4 were welded to Pipe A, and Lugs B1, B2, B3, and B4 were welded to Pipe B. The rod between Lugs A1 and B1 was identified as Rod 1. The remaining lugs were identified in a corresponding fashion.

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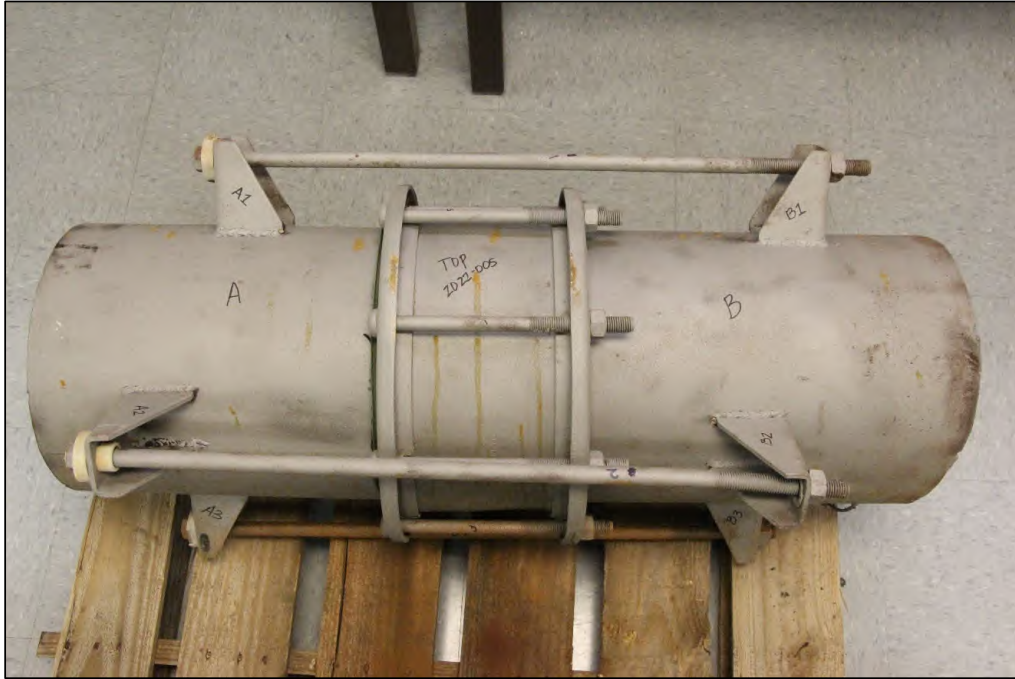


Figure 1. Photograph of the top of the submitted coupling sample.



Figure 2. Photograph of the bottom of the submitted sample.

SECTION 1- DIMENSIONAL MEASUREMENT

The four sets of harness lugs were positioned around the pipe. The relative orientations of the harness lugs were measured by photographing the assembly from the ends and applying a protractor overlay for angle measurement. The obtained measurements are shown in Figures 3 and 4 with the data summarized in Table 1. The depth of insertion of the pipe segments into the coupling was also measured and the dimensions are provided in Table 2. No requirements were provided for these characteristics.

TABLE 1 – LUG SPACING DIMENSIONAL MEASUREMENTS, DEGREES

Compound	Angle	Deviation from 90°	Image
Rod A1 / Rod A2	95	5	Figure 3
Rod A2 / Rod A3	101	11	Figure 3
Rod A3 / Rod A4	82	- 8	Figure 3
Rod A4 / Rod A1	82	- 8	Figure 3
Rod B1 / Rod B2	103	13	Figure 4
Rod B2 / Rod B3	86	- 4	Figure 4
Rod B3 / Rod B4	90	0	Figure 4
Rod B4 / Rod B1	81	- 9	Figure 4

TABLE 2 – PIPE COUPLING DIMENSIONAL MEASUREMENTS

Component	Depth of Pipe into Coupling	Gap Between Pipes in Coupling
Pipe A	18.375"	1.875" (Original sample length – 40.0")
Pipe B	19.750"	

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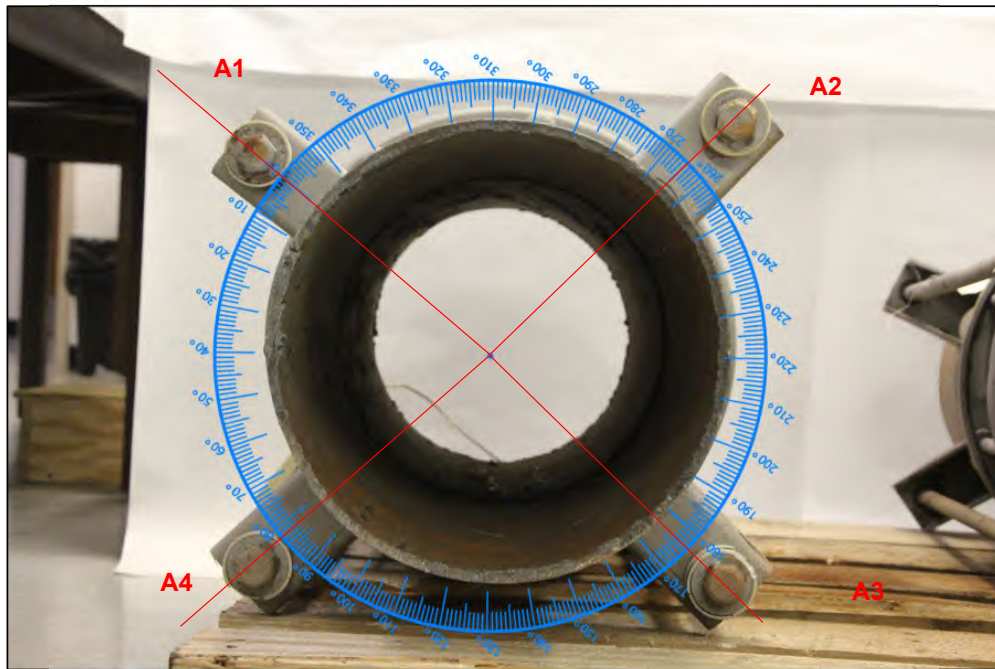


Figure 3. End facing image of the sample at End A with a superimposed protractor.

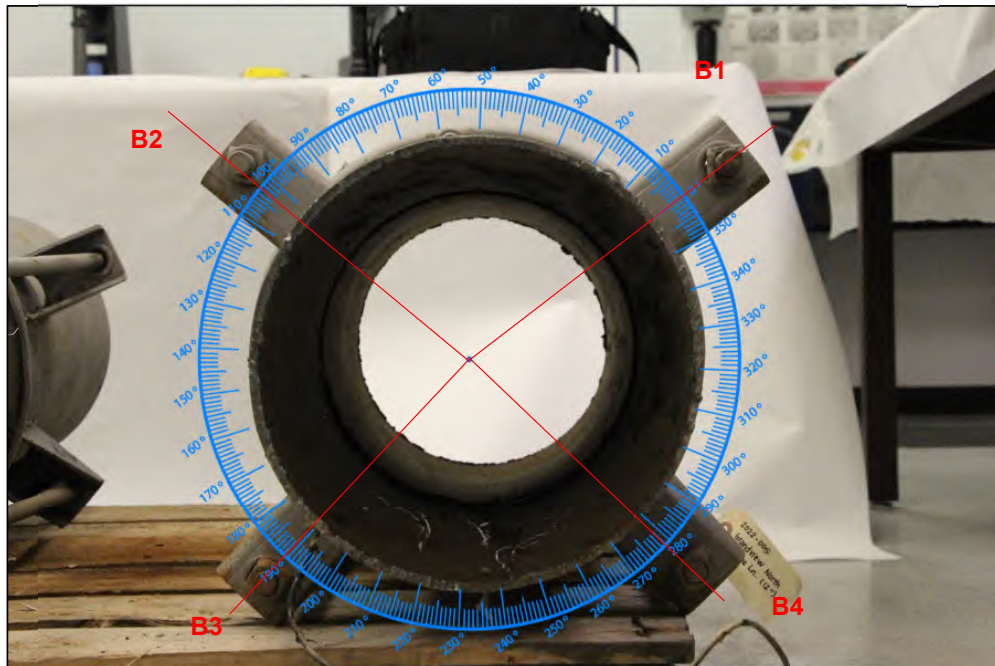


Figure 4. End facing image of the sample at End B with a superimposed protractor.

SECTION 2- VISUAL OBSERVATIONS

The lug attachment welds were regions of interest on the pipe coupling sample. Each lug contained four fillet weld locations; exterior top, exterior bottom, interior top, and interior bottom. Each weld that was present was inspected visually using a flashlight and magnifying lens. It was indicated that welding was performed in accordance with API 1104. General weld inspection was performed initially, followed by visual inspection by an outside NDE company. For comparison purposes, the welds were rated as substantial fusion, partial fusion, and minimal fusion. The summarized weld fusion and corrosion observations are provided in Table 3. Representative weld regions are shown in Figures 5 through 9. The welds contained localized discontinuities including undercut, arc strikes, porosity, and spatter. No cracking in the welds or base metal heat affected zones (HAZ) was visually identified. No gross corrosion was observed anywhere on the pipe or associated hardware.

The coupling and harness rods were also inspected for damage. The observations for the rods and bolts are provided in Table 4. No corrosion cracking was evident. The rods were not necked down or stretched.

The elastomeric components of the coupling consisted of a pipe separator, insulating sleeve, and two gaskets. Inspection revealed that they appeared to be intact and not degraded.

TABLE 3 – LUG WELD VISUAL EXAMINATION RESULTS

Component	Location	Weld	Observations
Lug A1	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial
Lug A2	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Minimal
		Bottom	Minimal
Lug A3	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Obscured by deposits
Lug A4	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Obscured by deposits
		Bottom	Substantial
Lug B1	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial
Lug B2	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial
Lug B3	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial
Lug B4	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial

TABLE 4 – FASTENER VISUAL EXAMINATION RESULTS

Component	Observations
Rod 1	Bent – Slight Rust
Rod 2	Bent – Slight Rust
Rod 3	Straight – Slight Rust
Rod 4	Straight – Slight Rust
Bolt 1	Straight - Superficial Rust
Bolt 2	Straight - Superficial Rust
Bolt 3	Straight - Superficial Rust
Bolt 4	Straight - Superficial Rust
Bolt 5	Straight - Superficial Rust
Bolt 6	Straight - Superficial Rust
Bolt 7	Straight - Superficial Rust
Bolt 8	Straight - Superficial Rust

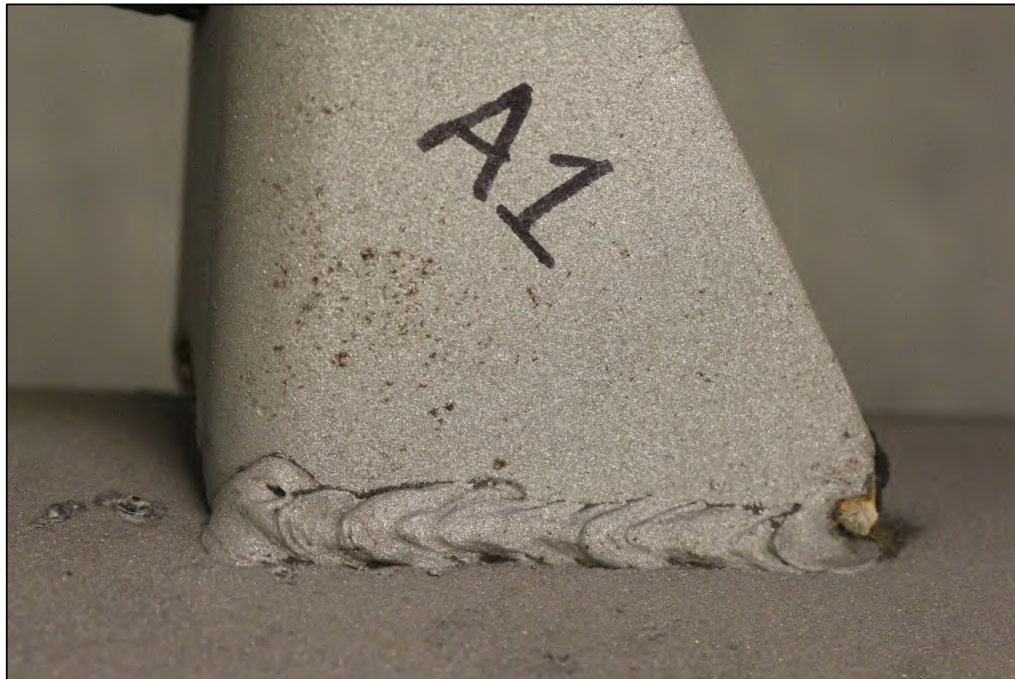


Figure 5. Image of the Lug A1 exterior weld which exhibited substantial fusion except for some undercut, arc strikes, and overlap.



Figure 6. Image of the Lug A3 exterior and interior welds which exhibited overlap, undercut, spatter, and arc strikes.



Figure 7. Image of the Lug A4 exterior and interior welds which exhibited general fusions along with undercut, spatter, and overlap.



Figure 8. Image of the Lug B2 exterior weld which exhibited substantial fusion except for some undercut, and overlap.



Figure 9. Image of the Lug B4 exterior weld which exhibited substantial fusion except for undercut and arc strikes.

SECTION 3- TORQUE TESTING- FOR INFORMATION ONLY

Torque testing was performed on the nuts of the rods and bolts on the pipe coupling sample. A calibrated torque wrench was used to determine breakaway torque on each fastener. The breakaway torque measurements are summarized in Table 5. Rod fasteners did not have a specified torque requirement. The eight coupling bolts and four harness rods exhibited torque values ranging from 20 to 80 ft.-lbs. Rods 1 and 2 rotated when torque was applied to the nuts. No requirements were utilized for comparison as the coupler model was not specified.

TABLE 5 – FASTENER TORQUE MEASUREMENT

Component	Breakaway Torque	Observations
Rod 1	80 ft.-lbs.	Loose rod
Rod 2	40 ft.-lbs.	Loose rod
Rod 3	20 ft.-lbs.	
Rod 4	60 ft.-lbs.	
Bolt 1	20 ft.-lbs.	
Bolt 2	25 ft.-lbs.	
Bolt 3	40 ft.-lbs.	
Bolt 4	45 ft.-lbs.	
Bolt 5	50 ft.-lbs.	
Bolt 6	35 ft.-lbs.	
Bolt 7	50 ft.-lbs.	
Bolt 12	40 ft.-lbs.	

SECTION 4- TENSILE TESTING, ASTM A370-19

Tensile testing was performed on round specimens that were removed from the four harness rods and the eight coupling bolts. The tensile mechanical properties of the fasteners were measured and the results are summarized in Table 6. No mechanical property requirements were provided for the fasteners.

TABLE 6 – FASTENER TENSION TEST RESULTS

Component	Ultimate Tensile Strength, ksi	0.2% Offset Yield Strength, ksi	Elongation, %^③	Reduction in Area, %
Rod 1 ①	106	65.0	25	50
Rod 2 ①	108	65.0	25	48
Rod 3 ①	108	64.5	25	49
Rod 4 ①	107	65.5	25	49
Bolt 1 ① ②	95.5	85.5	5	55
Bolt 2 ① ②	102	91.5	5	54
Bolt 3 ①	103	95.5	16	54
Bolt 4 ①	98.0	90.0	19	58
Bolt 5 ① ④	111	101	15	56
Bolt 6 ①	101	94.5	17	54
Bolt 7 ①	96.5	90.5	19	59
Bolt 8	103	98.5	3	57

① Specimen Dimensions; Diameter 0.350" with gage length of 1.40"

② Specimen fractured outside of the marked gage

③ Percent elongation was measured using elongation-after-fracture measurements

④ Specimen fractured outside of middle half of marked gage

SECTION 5- ROCKWELL HARDNESS, ASTM E18-20

Small sections of the eight lugs were excised for hardness testing. Rockwell hardness testing was performed on sectioned segments of the lugs after the removal of surface roughness by sanding. The obtained results are provided in Table 7 and are suggestive of a moderate strength level. No requirements were provided for comparison.

TABLE 7 – LUG HARDNESS TEST RESULTS – ROCKWELL B – HRBW

Results	Average of Five Readings
Lug A1	80
Lug A2	54
Lug A3	53
Lug A4	53
Lug B1	75
Lug B2	77
Lug B3	76
Lug B4	53

① Reported hardness is an average of four individual readings

SECTION 6- NONDESTRUCTIVE EXAMINATION

The two separated ends of the disassembled coupling were sent to a third party NDE laboratory for inspection. Visual and liquid dye penetrant inspections were performed on the lug attachment welds. Inspection was performed in accordance with the acceptance criteria of API 1104 “Welding of Pipelines and Related Facilities”. The inspection results are provided as Appendices A and B. Two representative welds are shown in Figures 10 and 11 with the dye penetrant test media remaining.



Figure 10. Image of the Lug A1 exterior weld after dye penetrant media had been used during inspection.



Figure 11. Image of the Lug B1 exterior top weld after dye penetrant media had been used during inspection.

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Respectfully submitted

A handwritten signature in black ink that reads "Brett A. Miller".

Brett A. Miller, P.E. FASM
Technical Director

Concurrence


A handwritten signature in black ink that reads "Brian Kelly".

Brian Kelly
Failure Analyst

All procedures were performed in accordance with the IMR Quality Manual, current revision, and related procedures; and the PWA MCL Manual F-23 and related procedures. The information contained in this test report represents only the material tested and may not be reproduced, except in full, without the written approval of IMR Test Labs ("IMR"). IMR maintains a quality system in compliance with the ISO/IEC 17025 and is accredited by A2LA, certificates #1140.03 and #1140.04. IMR will perform all testing in good faith using the proper procedures, trained personnel, and equipment to accomplish the testing required. Conformance will be based on results without measurement uncertainty applied, unless otherwise requested by the customer. IMR's liability to the customer or any third party is limited at all times to the amount charged for the services provided. All test samples will be retained for a minimum of 3 months and may be destroyed thereafter, unless otherwise specified by the customer. The recording of false, fictitious, or fraudulent statements or entries on this document may be punished as a felony under federal statutes. IMR Test Labs is a GEAE S-400 approved lab (Supplier Code T9334).

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APPENDIX B – LIQUID DYE PENETRANT INSPECTION RECORD

		Liquid Penetrant Examination Report			
4100 Bishop Lane Louisville, KY 40218 P: (502) 966-5558; F: (502) 966-5401		www.mistrasgroup.com			
Client: IMR	Date: 11-19-2022	Page: 1 of 1			
Address: 4510 ROBARDS LN LOUISVILLE, KY 40218	Job Number:				
Contact: BRETT MILLER	Purchase Order: 7697FA				
Location: MGI SHOP	Reference Number: 202202294				
	Part No/Description: STEEL GAS COUPLINGS LIFTING LUGS				
Code/Specification AMSE SEC.V ARTICLE 6	Procedure 100-PT-001 REV 22	Acceptance Criteria API 1104			
Type and Method <input type="checkbox"/> Fluorescent: <input type="checkbox"/> Water Wash [Method A] <input checked="" type="checkbox"/> Red Visible Dye: <input type="checkbox"/> Water Wash [Method A] [Type I] <input type="checkbox"/> Solvent Removable [Method C] [Type II] <input type="checkbox"/> Solvent Removable [Method C] <input type="checkbox"/> Post Emulsified: <input type="checkbox"/> Hydrophilic [D] <input type="checkbox"/> Lipophilic [B] <input type="checkbox"/> Post Emulsified [Method B] Sensitivity Level: <input type="checkbox"/> ½ <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> N/A <input type="checkbox"/> Other:					
	Manufacturer	Type	Batch Number(s)	Application Method	Process Time (minutes)
Cleaner:	MAGNAFLUX	SKC-S	20L01K	DAMP CLOTH	Pre-clean Dry Time: 5MIN Penetrant Dwell Time: 10 MIN
Penetrant:	MAGNAFLUX	SKL-SP2	18L04K	BRUSH	Emulsifier Time: N/A
Developer:	MAGNAFLUX	SKD-S2	21J046	SPRAY	Developer Time: 10 MIN
Emulsifier:	N/A	N/A	N/A		Post Clean Method: N/A
Developer Form: <input type="checkbox"/> a. Dry Powder <input type="checkbox"/> b. Water Soluble <input type="checkbox"/> c. Water Suspended <input type="checkbox"/> d. Nonaqueous Wet <input type="checkbox"/> e. Specific Application					
Penetrant Removal Method & Dry Time SKC-S DAMP CLOTH @ 5MIN		Black Light (Model and S/N) N/A		White Light Source L.E.D. FLASHLIGHT	
<input checked="" type="checkbox"/> Original <input type="checkbox"/> Repair	Material & Thickness C/S			Test Temperature 67 F	
Surface Condition <input checked="" type="checkbox"/> As Welded <input type="checkbox"/> As Ground <input type="checkbox"/> As Cast <input type="checkbox"/> Rough Machined <input type="checkbox"/> Final Machined <input checked="" type="checkbox"/> Meets Code Requirements					
Test Results		Quantity Inspected: 8	Quantity Accepted:	Quantity Rejected: 8	
RED DYE PENETRANT INSPECTION PERFORMED ON THE FOLLOWING: DESCRIPTION: (202202294) COUPLINGS- LUG WELDS WELD I.D.: A1(REJECTED)--UNDERCUT, UNDER FILL, POROSITY WELD I.D.: A2(REJECTED)--UNDERCUT WELD I.D.: A3(REJECTED)--UNDERCUT WELD I.D.: A4(REJECTED)--UNDERCUT,LACK OF FUSION WELD I.D.: B1(REJECTED)--UNDERCUT,LACK OF FUSION WELD I.D.: B2(REJECTED)--UNDERCUT,LACK OF FUSION WELD I.D.: B3(REJECTED)--UNDERCUT WELD I.D.: B4(REJECTED)--UNDERCUT,UNDER FILL, POROSITY					
<small>The content of this document may be defense article/service related as described and controlled by International Traffic in Arms Regulations (ITAR)[22 CFR 120-130]. Distribute only to entities meeting ITAR requirements. Discard by shredding. At no time during testing did these parts or material come into contact with mercury.</small>					
Technician Name, Level & Date CHRIS DADDONA LVL.II 11-19-2022		Customer (if applicable):		Reviewed By (if applicable):	
Certification of Inspection, Liquid Penetrant [Basic Report Form]				100-PTFORM-002 Rev 1	

Bolt-Style Coupling (pressures > 3 psig)

This form will be completed when LG&E or LG&E contractors expose a bolt-style coupling in a system where the pressure is > 3 psig (medium and high-pressure distribution and transmission) and the coupling will be backfilled. The purpose of the form is to provide Operations, Engineering and Gas Regulatory personnel with information about the bolt style coupling installation.

Part A- Discovery of Coupling

Precautions:

1. Stop excavation upon discovering the bolt-style coupling in the excavation
2. Set-up a perimeter around the excavation to keep the public away from the excavation

General Information:

1. Contact Employee for the bolt style coupling found: **James McGough** [REDACTED]
2. Date of exposure: **06/29/2022**
3. Location: **Grandview Valve Nest (Approximate Address: 800 Cannons Ln. Louisville, KY 40207)**
4. Size of coupling (based on pipe size if not exposed enough to determine): **12"**
5. Type of soil: Sandy Clay Gravel Topsoil Other (take picture and describe)
6. Soil Density test: Type A Type B Type C
7. Status: Removed Abandoned in place Backfilled- left in service
8. Discovery Method: Leak on Coupler Other Maintenance Excavation Facility Replacement
 Facility Retirement Other:
9. Pressure Class: Medium Pressure (MP) High Pressure (HP) Transmission

Pictures:

1. Take at least two pictures of the coupling. The pictures should be from different angles (additional pictures can be taken).
2. Email pictures to supervisor. Ensure pictures are attached to this form:

Sketch: Provide a sketch showing the coupling orientation (vertical/horizontal), nearby branches, pipe, valves and fittings, other utilities or structures, etc.

Leak Survey:

1. Use an instrument designed to detect natural gas to check for the presence of natural gas after backfilling the excavation. Include readings in the above sketch in relation to the coupling. If the contact employee is not leak survey qualified, they should contact:
 - a. Their supervisor to call Gas Regulatory to complete the survey after the excavation is backfilled. Call [REDACTED]
 - b. If Gas Regulatory is not available contact Gas Dispatch to have the survey assigned to a Gas Trouble Technician.

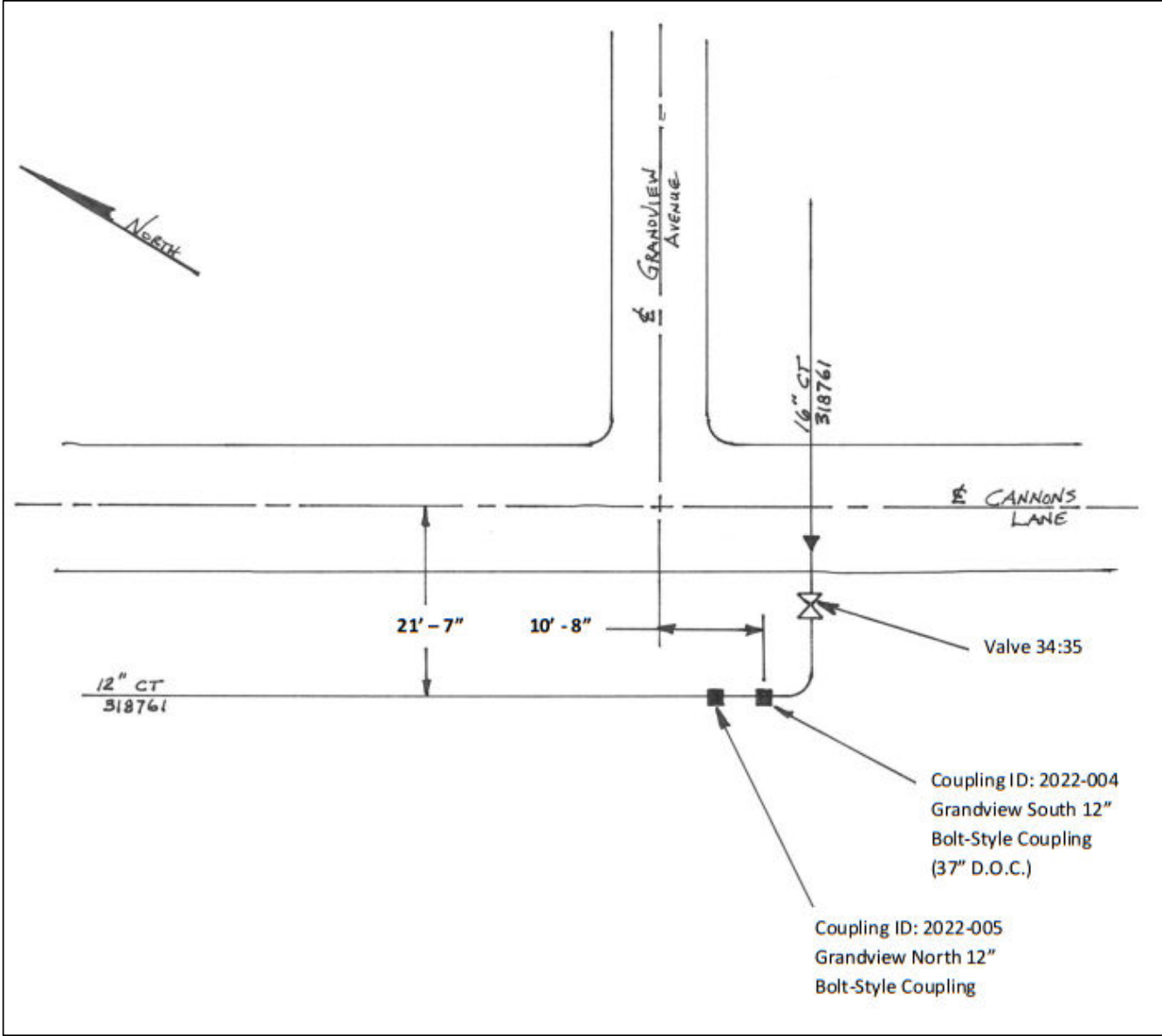
Leak Survey completed at time of backfill (circle one) yes no not applicable

Include completed form in the main report and email a scanned copy of the completed form (back and front) to the DIMP group at [REDACTED]

Field Pictures



Sketch



Safety Briefing

Date: October 3, 2022

Employee Name	Employee ID
Sarah Nicholson	██████
Ethan Hinkson	██████

Hazards Identified	
<input checked="" type="checkbox"/>	Sharp edges on cut pipe ends. Wear gloves when handling.
<input checked="" type="checkbox"/>	Pinch points on couplings. Wear gloves when handling.
<input checked="" type="checkbox"/>	Some couplings samples are heavy. Use a partner to assist with moving. Use proper lifting techniques. Wear hard toes shoes.
<input checked="" type="checkbox"/>	Debris may on samples. Wear eye protection.
<input checked="" type="checkbox"/>	Tripping hazards on floor. Keep area clean and free of tripping hazards

PPE Required	
<input checked="" type="checkbox"/>	Hard toed shoes
<input checked="" type="checkbox"/>	Safety glasses
<input checked="" type="checkbox"/>	Gloves (leather preferred)

Part B- Coupling Information

General Information		Tracking #: 2022-005	
PO Number 1121185	Expense Org 004610	Project 158276	Task COUPLER
Address/Location Grandview North @ 800 Cannons Ln. Louisville, KY 40207			
Size 12"	Material STL	Coating CT	MAOP 200 PSIG
Main/Service Number 318761	Soil Type (from Part A) Clay (Type B)	Manufacturer Dresser	Model Style 39
Pipe Connection:	Steel to Steel	Steel to Plastic	Plastic to Plastic

Historical Information	
Installation Date 11/23/1987	Document Source Quest
Installation Company Southern Pipeline	Document Source Quest
Foreman Campbell	Document Source Quest
Welder Paul Howard & Don Gousha	Document Source Quest

GIS Information	
Sys Id (of Coupler)	10939702
Screen Capture	

Pictures (Label the following parts before taking pictures.)



Figure 1 – Coupler Top View



Figure 2 – Pipe Side A (Top)



Figure 3 – Pipe Side B (Top)



Figure 4 – Coupler Bottom View



Figure 5 – Lug A1



Figure 6 – Lug A2



Figure 7 – Lug A3



Figure 8 – Lug A4



Figure 9 – Lug B1



Figure 10 – Lug B2



Figure 11 – Lug B3



Figure 12 – Lug B4

Part C- Visual Inspection of Coupling

Visual Inspection Performed by: Ethan Hinkson & Sarah Nicholson

Date: 10/3/2022

Table 1- Component Quantities

Number of Bolts on Coupler Body	8
Number of Reinforcement Rods	4
Number of Lugs	8

Table 2- Corrosion

	Pipe A	Pipe B	Coupler Body	Bolts	Rods	Lugs	Nuts
General External Corrosion?	No	No	No	No	Yes	No	No
Localized External Corrosion?	No	No	No	No	No	No	No
Pits Present?	No	No	No	No	Yes	No	No
Internal Corrosion?	No	No					

* If Pits are present take maximum depth measurements and put in the Additional Comments section.

Table 3- Coupler Body

Bolt	Washer Present	Nut present?
1	No	Yes
2	No	Yes
3	No	Yes
4	No	Yes
5	No	Yes
6	No	Yes
7	No	Yes
8	No	Yes

Table 4- Reinforcement Rods

Rod	Length (in.)	Diameter (in.)	Washer present at head of bolt?	Washer present at end of bolt?	Nut Present? Type?	Type of rod?
1	30 ¾"	¾"	Yes	Yes	Square	Standard
2	30 ¾"	¾"	Yes	Yes	Square	Standard
3	30 ¾"	¾"	Yes	Yes	Square	Standard
4	30 ¾"	¾"	Yes	Yes	Square	Standard

Type of Lug

(Please indicate the shape of the lug by circling one below. If the lug shape is different than any preset shape below, sketch the shape.)

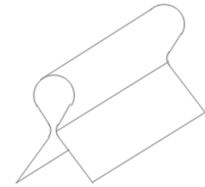
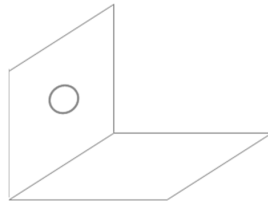
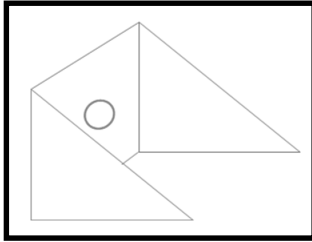


Table 5- Lugs (Measurements)

Pipe Side	Lug Number	Thickness (in.)	Circumference (in)	
			Distance to next lug, clockwise	Distance to next lug, counter-clockwise
A	1	0.23"	8"	6"
A	2	0.23"	7"	8"
A	3	0.23"	7"	7"
A	4	0.24"	6"	7"
B	1	0.23"	6"	8 ¼"
B	2	0.23"	8 ¼"	6"
B	3	0.22"	6 ¼"	7 ¼"
B	4	0.23"	7"	6"

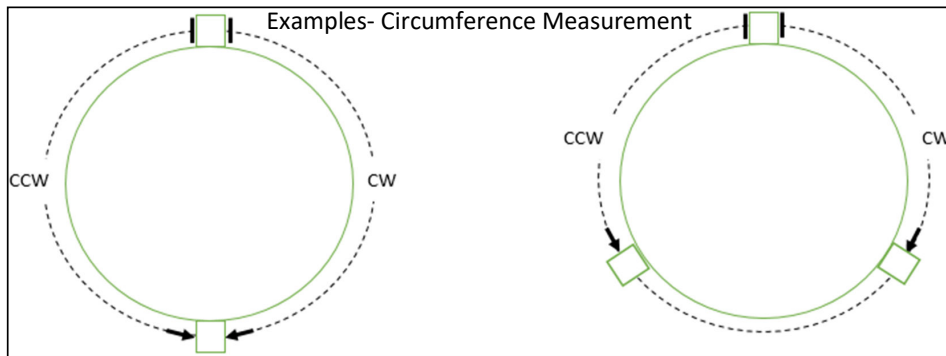


Table 6- Lugs (Observations)

Lug	Lug	Assembly sets aligned?	Deformed?	Deflected? (angle of)
A1	B1	Yes	No	No
A2	B2	Yes	No	No
A3	B3	Yes	No	No
A4	B4	Yes	No	No

Table 7- Lugs (Weld Quality)

Pipe Side	Lug Number	Any failed welds causing detachment?	Welded on all sides of exterior? If no, describe	Are welds on exterior continuous? If no, describe
A	1	No	Yes	Yes
A	2	No	Yes	Yes
A	3	No	Yes	Yes
A	4	No	Yes	Yes
B	1	No	Yes	Yes
B	2	No	Yes	Yes
B	3	No	Yes	Yes
B	4	No	Yes	Yes

Pipe Side	Lug Number	Welded on all sides of interior? If no, describe	Are welds on interior continuous? If no, describe
A	1	Yes	Yes
A	2	Yes	Yes
A	3	Yes	Yes
A	4	No	No
B	1	Yes	Yes
B	2	Yes	Yes
B	3	Yes	Yes
B	4	Yes	Yes

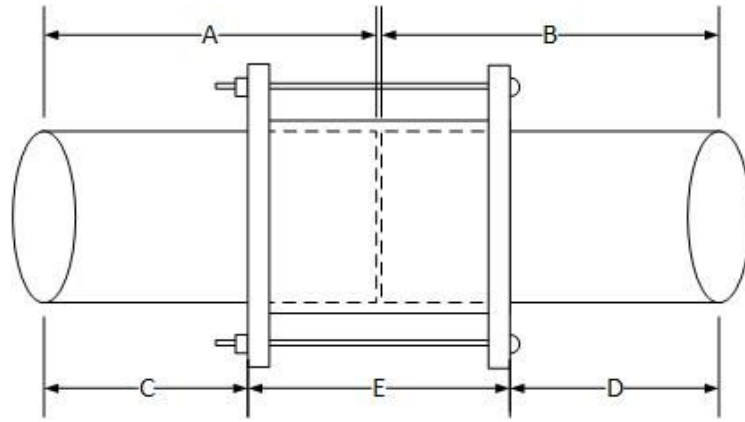


Table 8- Stab Depth

	A	B	C	D	Stab Depth (A-C) or (B-D)
Pipe Side A	18 ½"		14 ¾"		3 ¾"
Pipe Side B		19"		16 ½"	2 ½"
	Sum of stab depths (should be closely equal to measurement E)				6 ¼"
	Coupler Length (E)				8 ½"
	Difference				2 ¼"

Additional Comments - General Observations, Pit Depths, etc.

IMR TEST LABS

A Curtiss-Wright Business Unit
www.imrlouisville.com

4510 Robards Lane
Louisville, KY 40218
T: 1.502.810.9007 | F: 1.502.810.0380

LG&E - Kentucky Utilities
6900 Enterprise Drive
Louisville, KY 40214

November 29, 2022

Attention: Sarah Nicholson

Exhibit C
Report No. 202202295

Metallurgical Evaluation of a 12" Coupling and Associated Hardware

Location: Bardstown to Cannons Lane
Designation: 2022-006

DESCRIPTION AND PURPOSE

A natural gas pipe section including a coupling was submitted for metallurgical evaluation. The section was a 12" pipe with a Dresser Style Insulating Coupling. Four joint harnesses were also affixed to the pipe section. Copies of the installation information for the coupling and harnesses were provided for this investigation. It was reported that the coupling had been installed in the field at Bardstown to Cannons Lane, approximately at 554 Cannons Lane. It had been originally installed on September 9, 1987. The pipe section was subsequently excavated after substantial service duration without failure. It was requested that the general dimensions, weld quality, corrosion condition and mechanical properties of the coupling components be determined as directed.

RESULTS

The submitted pipe section with the coupling is shown in Figures 1 through 4. Four lugs of the joint harnesses had been fillet welded to both pipe segments. Four rods and associated nuts had been affixed through the welded lugs to apply compression to the coupled joint. The coupling consisted of a steel coupling with an interior nonmetallic gasket / sleeve. Prior to receipt, the ends of the pipe segment were labelled as Ends A and B, as shown in Figures 1 and 2. The top and bottom of the coupling section were also marked. Lugs A1, A2, A3, and A4 were welded to Pipe A, and Lugs B1, B2, B3, and B4 were welded to Pipe B. The rod between Lugs A1 and B1 was identified as Rod 1. The remaining lugs were identified in a corresponding fashion. It was also noted that the coupling was slightly tilted from the pipe axis, as shown in Figure 1.

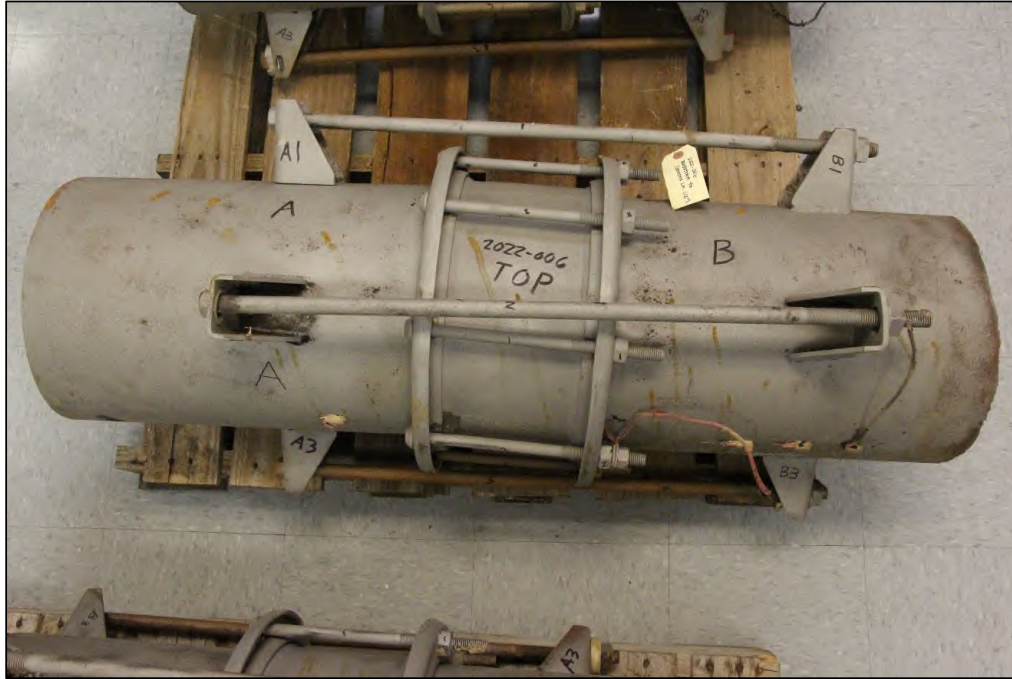


Figure 1. Photograph of the top of the submitted coupling sample.



Figure 2. Photograph of the bottom of the submitted sample.

SECTION 1- DIMENSIONAL MEASUREMENT

The four sets of harness lugs were positioned around the pipe. The relative orientations of the harness lugs were measured by photographing the assembly from the ends and applying a protractor overlay for approximate angle measurement. The angle measurements are depicted in Figures 3 and 4 with the data summarized in Table 1. The depth of insertion of the pipe segments into the coupling was also measured and the dimensions are provided in Table 2. No requirements were provided for these characteristics.

TABLE 1 – LUG SPACING DIMENSIONAL MEASUREMENTS

Compound	Angle	Deviation from 90°	Image
Rod A1 / Rod A2	80	- 10	Figure 3
Rod A2 / Rod A3	108	18	Figure 3
Rod A3 / Rod A4	106	16	Figure 3
Rod A4 / Rod A1	66	- 24	Figure 3
Rod B1 / Rod B2	72	- 18	Figure 4
Rod B2 / Rod B3	120	30	Figure 4
Rod B3 / Rod B4	109	19	Figure 4
Rod B4 / Rod B1	59	- 31	Figure 4

TABLE 2 – PIPE COUPLING DIMENSIONAL MEASUREMENTS

Component	Depth of Pipe into Coupling	Gap Between Pipes in Coupling
Pipe A	22.5"	0.625" (Original sample length – 44.5")
Pipe B	21.375"	

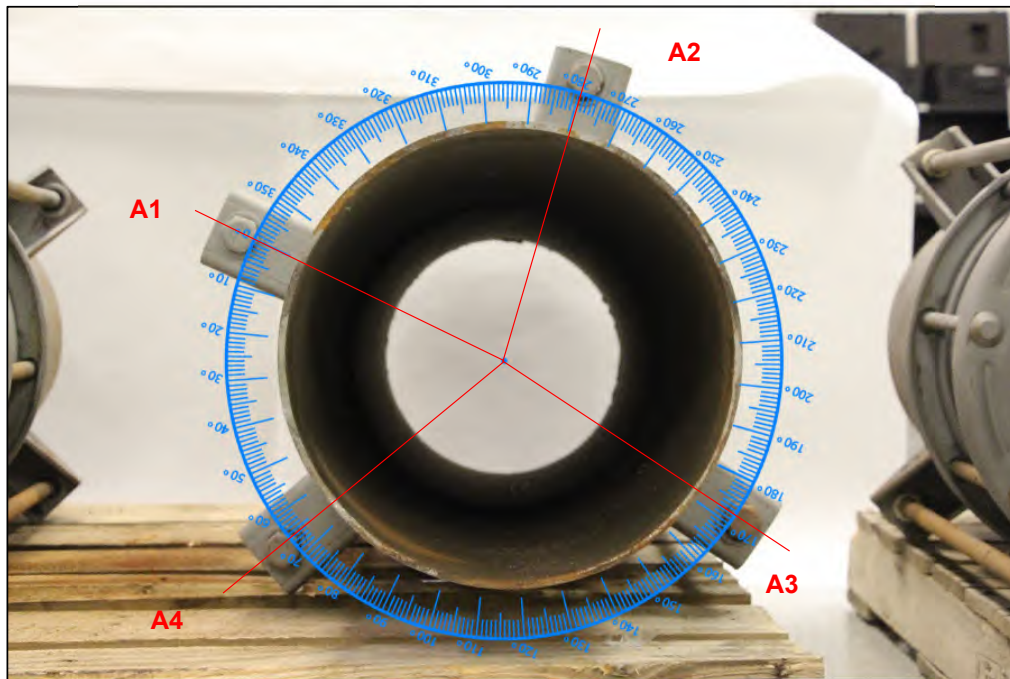


Figure 3. End facing image of the sample at End A with a superimposed protractor.

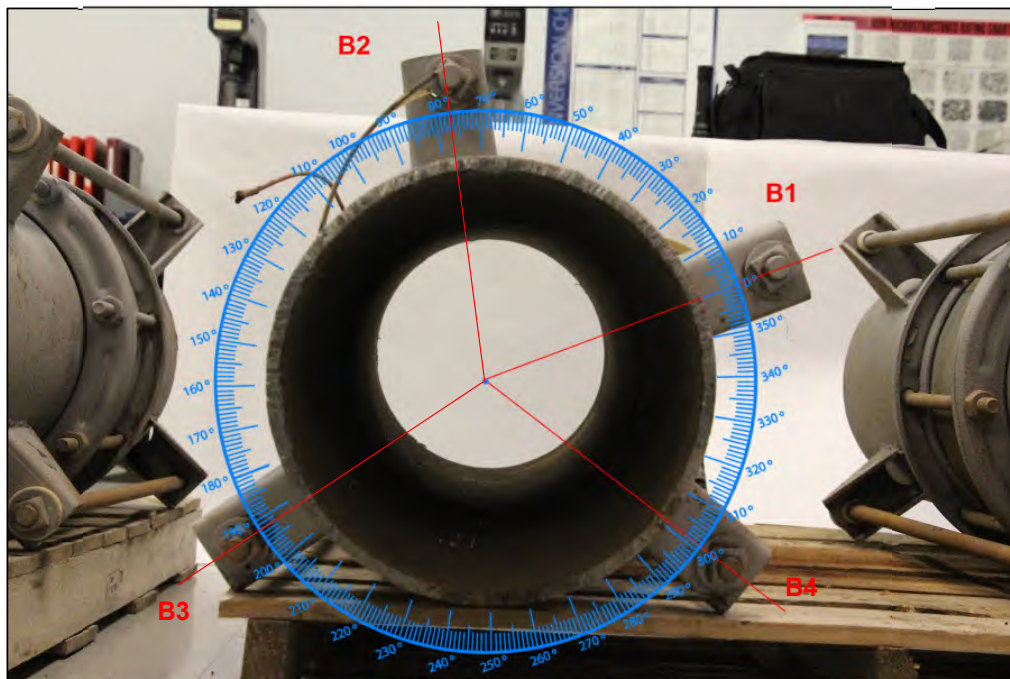


Figure 4. End facing image of the sample at End A with a superimposed protractor.

SECTION 2- VISUAL OBSERVATIONS

The lug attachment welds were regions of interest on the pipe coupling sample. Each lug contained four fillet weld locations; exterior top, exterior bottom, interior top, and interior bottom. Each weld that was present was inspected visually using a flashlight and magnifying lens. It was indicated that welding was performed in accordance with API 1104. General weld inspection was performed initially, followed by visual inspection by an outside NDE company. For comparison purposes, the welds were rated as substantial fusion, partial fusion, and minimal fusion. Locations that had not been welded were identified as None. The summarized weld fusion and corrosion observations are provided in Table 3. Representative weld regions are shown in Figures 5 through 10. The welds contained localized discontinuities including undercut, arc strikes, porosity, and spatter. No cracking in the welds or base metal heat affected zones (HAZ) was visually identified. No gross corrosion was observed anywhere on the pipe or associated hardware. It was noted that several areas contained fillet weld evidence outside of the primary welds. It was not known if these welds were intentionally fractured in order to re-position the lugs.

The coupling and harness rods were also inspected for damage. The observations for the rods and bolts are provided in Table 4. No corrosion cracking was evident. The rods were not necked down or stretched.

The elastomeric components of the coupling consisted of a pipe separator, insulating sleeve, and two gaskets. Inspection revealed that they appeared to be intact and not degraded.

TABLE 3 – LUG WELD VISUAL EXAMINATION RESULTS

Component	Location	Weld	Observations
Lug A1	Exterior	Top	None
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial
Lug A2	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Obscured
		Bottom	Substantial
Lug A3	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Minimal
Lug A4	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial
Lug B1	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	None
		Bottom	Minimal
Lug B2	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Obscured
		Bottom	Substantial
Lug B3	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Obscured
		Bottom	Substantial
Lug B4	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Minimal
		Bottom	Minimal

TABLE 4 – FASTENER VISUAL EXAMINATION RESULTS

Component	Observations
Rod 1	Straight – slight corrosion
Rod 2	Straight – slight corrosion
Rod 3	Straight – slight corrosion
Rod 4	Straight – slight corrosion
Bolt 1	Straight – slight corrosion
Bolt 2	Straight – slight corrosion
Bolt 3	Straight – slight corrosion
Bolt 4	Straight – slight corrosion
Bolt 5	Straight – slight corrosion
Bolt 6	Straight – slight corrosion
Bolt 7	Straight – slight corrosion
Bolt 8	Straight – slight corrosion



Figure 5. Image of the Lug A1 exterior bottom weld which exhibited substantial fusion except for some undercut, overlap, spatter, and arc strikes.



Figure 6. Image of the Lug A1 exterior top weld which was not welded.



Figure 7. Image of the Lug A2 exterior top weld which exhibited substantial fusion along with undercutting.



Figure 8. Image of the Lug B2 welds which exhibited substantial fusion along with undercut and overlap.

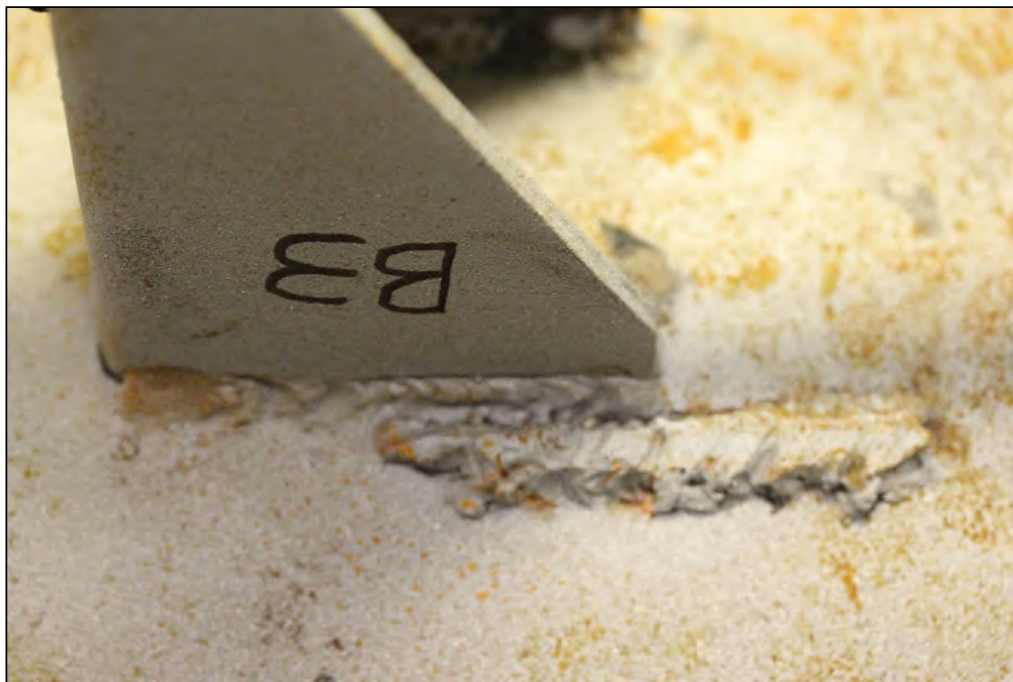


Figure 9. Image of the Lug B3 weld showing the remainder of a weld adjacent to the primary weld.



Figure 10. Image of the Lug B3 welds which exhibited substantial fusion except for some undercut, overlap, arc strikes, and spatter. The interior weld to the left was obscured.

SECTION 3- TORQUE TESTING- FOR INFORMATION ONLY

Torque testing was performed on the nuts of the rods and bolts on the pipe coupling sample. A calibrated torque wrench was used to determine breakaway torque on each fastener. The breakaway torque measurements are summarized in Table 5. Rod fasteners did not have a specified torque requirement. The eight coupling bolts and four harness rods exhibited torque values ranging from 5 to 100 ft.-lbs. Rod 2 rotated when torque was applied to the nut. No requirements were utilized for comparison as the coupler model was not specified.

TABLE 5 – FASTENER TORQUE MEASUREMENT

Component	Breakaway Torque	Observations
Rod 1	20 ft.-lbs.	
Rod 2	5 ft.-lbs.	Rod rotated freely - loose nut
Rod 3	35 ft.-lbs.	
Rod 4	90 ft.-lbs.	
Bolt 1	80 ft.-lbs.	
Bolt 2	100 ft.-lbs.	Two nuts were present
Bolt 3	80 ft.-lbs.	
Bolt 4	70 ft.-lbs.	
Bolt 5	70 ft.-lbs.	
Bolt 6	85 ft.-lbs.	
Bolt 7	60 ft.-lbs.	
Bolt 8	35 ft.-lbs.	

SECTION 4- TENSILE TESTING, ASTM A370-19

Tensile testing was performed on round specimens that were removed from the four harness rods and the eight coupling bolts. The tensile mechanical properties of the fasteners were measured and the results are summarized in Table 6. No mechanical property requirements were provided for the fasteners.

TABLE 6 – FASTENER TENSION TEST RESULTS

Component	Ultimate Tensile Strength, ksi	0.2% Offset Yield Strength, ksi	Elongation, %^③	Reduction in Area, %
Rod 1 ①	107	65.5	26	51
Rod 2 ①	115	63.5	23	44
Rod 3 ① ④	122	69.5	20	49
Rod 4 ①	112	61.5	24	49
Bolt 1 ①	78.0	51.0	38	77
Bolt 2 ①	80.0	53.5	37	75
Bolt 3 ①	80.0	58.0	38	76
Bolt 4 ①	79.0	56.0	39	77
Bolt 5 ①	82.5	56.5	37	74
Bolt 6 ①	79.5	56.5	39	77
Bolt 7 ①	78.5	55.0	38	77
Bolt 8 ① ②	79.5	58.0	37	77

① Specimen Dimensions; Diameter 0.350" with gage length of 1.40"

② Specimen fractured outside of the marked gage

③ Percent elongation was measured using elongation-after-fracture measurements

④ Specimen fractured outside of middle half of marked gage

SECTION 5- ROCKWELL HARDNESS TESTING, ASTM E18-20

Small sections of the eight lugs were excised for hardness testing. Rockwell hardness testing was performed on sectioned segments of the lugs after the removal of surface roughness by sanding. The obtained results are provided in Table 7 and are suggestive of a moderate strength level. No requirements were provided for comparison.

TABLE 7 – LUG HARDNESS TEST RESULTS – ROCKWELL B – HRBW

Results	Average of Four Measurements
Lug A1	54
Lug A2	79
Lug A3	77
Lug A4	53
Lug B1	70
Lug B2	49
Lug B3	61
Lug B4	62

SECTION 6- NONDESTRUCTIVE EXAMINATION

The two separated ends of the disassembled coupling were sent to a third party NDE laboratory for inspection. Visual and liquid dye penetrant inspections were performed on the lug attachment welds. Inspection was performed in accordance with the acceptance criteria of API 1104 “Welding of Pipelines and Related Facilities”. The inspection results are provided as Appendix A. Two representative welds are shown in Figures 11 and 12 with the dye penetrant test media remaining.

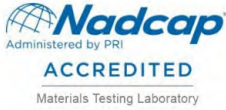


Figure 11. Image of the Lug A2 exterior top weld after dye penetrant media had been used during inspection.



Figure 12. Image of the Lug B1 exterior top weld after dye penetrant media had been used during inspection.

IMR Metallurgical Services • 4510 Robards Lane • Louisville, KY 40218



Respectfully submitted

Brett A. Miller, P.E. FASM
Technical Director

Concurrence

Brian Kelly
Failure Analyst

All procedures were performed in accordance with the IMR Quality Manual, current revision, and related procedures; and the PWA MCL Manual F-23 and related procedures. The information contained in this test report represents only the material tested and may not be reproduced, except in full, without the written approval of IMR Test Labs ("IMR"). IMR maintains a quality system in compliance with the ISO/IEC 17025 and is accredited by A2LA, certificates #1140.03 and #1140.04. IMR will perform all testing in good faith using the proper procedures, trained personnel, and equipment to accomplish the testing required. Conformance will be based on results without measurement uncertainty applied, unless otherwise requested by the customer. IMR's liability to the customer or any third party is limited at all times to the amount charged for the services provided. All test samples will be retained for a minimum of 3 months and may be destroyed thereafter, unless otherwise specified by the customer. The recording of false, fictitious, or fraudulent statements or entries on this document may be punished as a felony under federal statutes. IMR Test Labs is a GEAE S-400 approved lab (Supplier Code T9334).

APPENDIX A – LIQUID DYE PENETRANT INSPECTION RECORD

		Liquid Penetrant Examination Report	
4100 Bishop Lane Louisville, KY 40218 P: (502) 966-5558; F: (502) 966-5401		www.mistrasgroup.com	
Client: IMR	Date: 11-19-2022	Page: 1 of 1	
Address: 4510 ROBARDS LN LOUISVILLE, KY 40218	Job Number:		
Contact: BRETT MILLER	Purchase Order: 7697FA		
Location: MGI SHOP	Reference Number: 202202295		
	Part No/Description: STEEL GAS COUPLINGS LIFTING LUGS		

Code/Specification AMSE SEC.V ARTICLE 6	Procedure 100-PT-001 REV 22	Acceptance Criteria API 1104
--	--------------------------------	---------------------------------

Type and Method			
<input type="checkbox"/> Fluorescent [Type I]	<input type="checkbox"/> Water Wash [Method A]	<input checked="" type="checkbox"/> Red Visible Dye [Type II]	<input type="checkbox"/> Water Wash [Method A]
<input type="checkbox"/> Solvent Removable [Method C]	<input type="checkbox"/> Post Emulsified: <input type="checkbox"/> Hydrophilic [D] <input type="checkbox"/> Lipophilic [B]	<input type="checkbox"/> Solvent Removable [Method C]	<input type="checkbox"/> Post Emulsified [Method B]
Sensitivity Level: <input type="checkbox"/> 1/2 <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> N/A		<input type="checkbox"/> Other:	

	Manufacturer	Type	Batch Number(s)	Application Method	Process Time (minutes)	
					Pre-clean Dry Time:	
Cleaner:	MAGNAFLUX	SKC-S	20L01K	DAMP CLOTH	5MIN	Penetrant Dwell Time: 10 MIN
Penetrant:	MAGNAFLUX	SKL-SP2	18L04K	BRUSH	N/A	Emulsifier Time: N/A
Developer:	MAGNAFLUX	SKD-S2	21J046	SPRAY	10 MIN	Developer Time: 10 MIN
Emulsifier:	N/A	N/A	N/A		N/A	Post Clean Method: N/A

Developer Form: a. Dry Powder b. Water Soluble c. Water Suspended d. Nonaqueous Wet e. Specific Application

Penetrant Removal Method & Dry Time SKC-S DAMP CLOTH @ 5MIN	Black Light (Model and S/N) N/A	White Light Source L.E.D. FLASHLIGHT
--	------------------------------------	---

<input checked="" type="checkbox"/> Original <input type="checkbox"/> Repair	Material & Thickness C/S	Test Temperature 67 F
--	-----------------------------	--------------------------

Surface Condition
 As Welded As Ground As Cast Rough Machined Final Machined Meets Code Requirements

Test Results	Quantity Inspected: 8	Quantity Accepted:	Quantity Rejected: 8
---------------------	-----------------------	--------------------	----------------------

RED DYE PENETRANT INSPECTION PERFORMED ON THE FOLLOWING:
 DESCRIPTION: (202202295) COUPLINGS- LUG WELDS
 WELD I.D.: A1(REJECTED)--UNDERCUT, POROSITY, MISSING WELD
 WELD I.D.: A2(REJECTED)--UNDERCUT, LACK OF FUSION, POROSITY
 WELD I.D.: A3(REJECTED)--UNDERCUT,LACK OF FUSION
 WELD I.D.: A4(REJECTED)--UNDERCUT,LACK OF FUSION,POROSITY

 WELD I.D.: B1(REJECTED)--UNDERCUT,POROSITY
 WELD I.D.: B2(REJECTED)--UNDERCUT,UNDERFILL,LACK OF FUSION
 WELD I.D.: B3(REJECTED)--UNDERCUT,LACK OF FUSION, POROSITY
 WELD I.D.: B4(REJECTED)--UNDERCUT,LACK OF FUSION

The content of this document may be defense article/service related as described and controlled by International Traffic in Arms Regulations (ITAR)(22 CFR 120-130). Distribute only to entities meeting ITAR requirements. Discard by shredding. At no time during testing did these parts or material come into contact with mercury.

Technician Name, Level & Date CHRIS DADDONA LVL.II 11-19-2022	Customer (if applicable):	Reviewed By (if applicable):
--	---------------------------	------------------------------

Certification of Inspection, Liquid Penetrant [Basic Report Form] 100-PTFORM-002 | Rev 1

Bolt-Style Coupling (pressures > 3 psig)

This form will be completed when LG&E or LG&E contractors expose a bolt-style coupling in a system where the pressure is > 3 psig (medium and high-pressure distribution and transmission) and the coupling will be backfilled. The purpose of the form is to provide Operations, Engineering and Gas Regulatory personnel with information about the bolt style coupling installation.

Part A- Discovery of Coupling

Precautions:

1. Stop excavation upon discovering the bolt-style coupling in the excavation
2. Set-up a perimeter around the excavation to keep the public away from the excavation

General Information:

1. Contact Employee for the bolt style coupling found: James McGough [REDACTED]
2. Date of exposure: 07/08/2022
3. Location: Bardstown to Cannons Line (Approximate Address: 554 Cannons Ln. Louisville, KY 40207)
4. Size of coupling (based on pipe size if not exposed enough to determine): 12"
5. Type of soil: Sandy Clay Gravel Topsoil Other (take picture and describe)
6. Soil Density test: Type A Type B Type C
7. Status: Removed Abandoned in place Backfilled- left in service
8. Discovery Method: Leak on Coupler Other Maintenance Excavation Facility Replacement
 Facility Retirement Other:
9. Pressure Class: Medium Pressure (MP) High Pressure (HP) Transmission

Pictures:

1. Take at least two pictures of the coupling. The pictures should be from different angles (additional pictures can be taken).
2. Email pictures to supervisor. Ensure pictures are attached to this form:

Sketch: Provide a sketch showing the coupling orientation (vertical/horizontal), nearby branches, pipe, valves and fittings, other utilities or structures, etc.

Leak Survey:

1. Use an instrument designed to detect natural gas to check for the presence of natural gas after backfilling the excavation. Include readings in the above sketch in relation to the coupling. If the contact employee is not leak survey qualified, they should contact:
 - a. Their supervisor to call Gas Regulatory to complete the survey after the excavation is backfilled. Call [REDACTED]
 - b. If Gas Regulatory is not available contact Gas Dispatch to have the survey assigned to a Gas Trouble Technician.

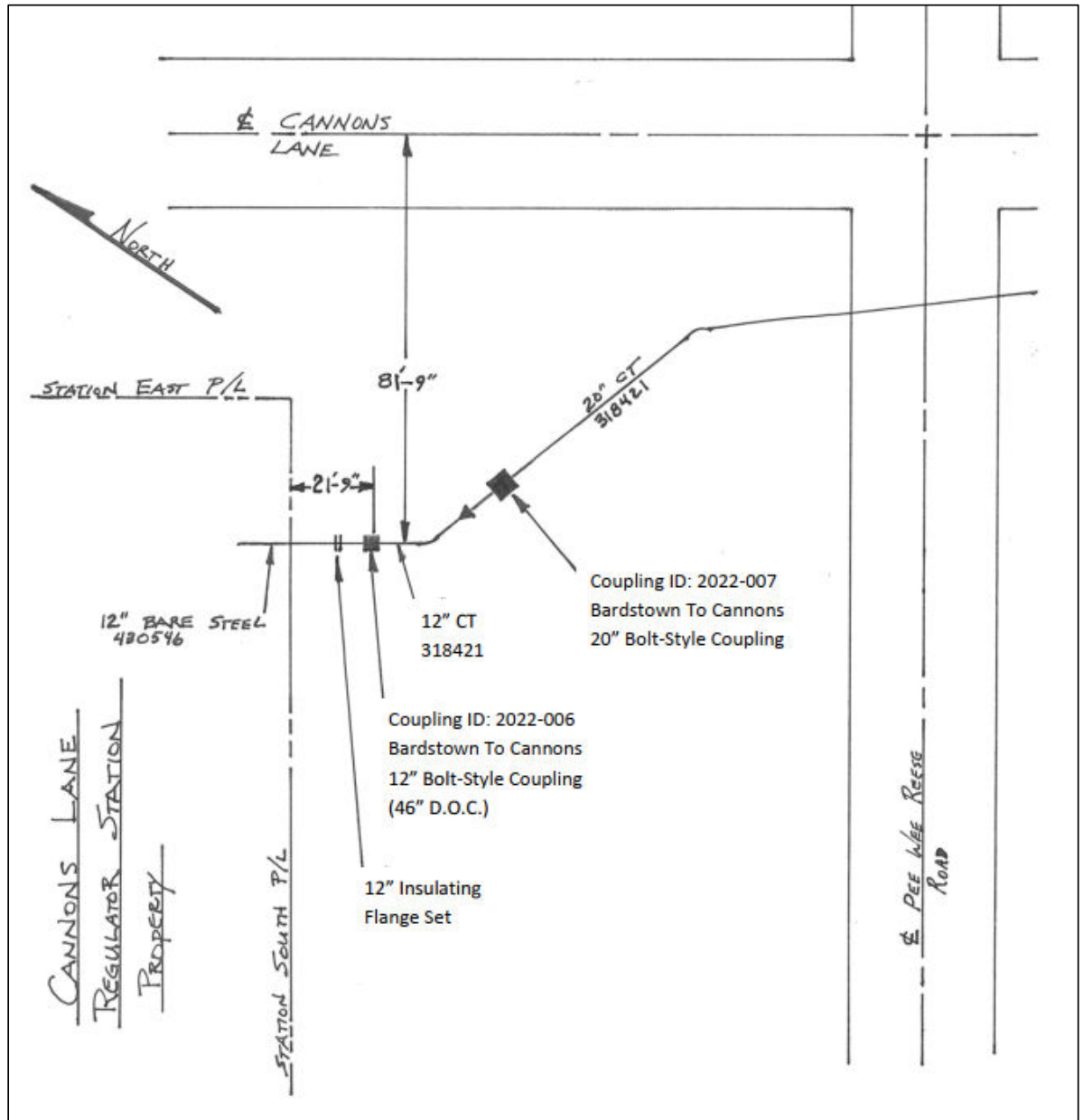
Leak Survey completed at time of backfill (circle one) yes no not applicable

Include completed form in the main report and email a scanned copy of the completed form (back and front) to the DIMP group at [REDACTED]

Field Pictures



Sketch



Safety Briefing

Date: October 3, 2022

Employee Name	Employee ID
Sarah Nicholson	██████
Ethan Hinkson	██████

Hazards Identified	
<input checked="" type="checkbox"/>	Sharp edges on cut pipe ends. Wear gloves when handling.
<input checked="" type="checkbox"/>	Pinch points on couplings. Wear gloves when handling.
<input checked="" type="checkbox"/>	Some couplings samples are heavy. Use a partner to assist with moving. Use proper lifting techniques. Wear hard toes shoes.
<input checked="" type="checkbox"/>	Debris may on samples. Wear eye protection.
<input checked="" type="checkbox"/>	Tripping hazards on floor. Keep area clean and free of tripping hazards

PPE Required	
<input checked="" type="checkbox"/>	Hard toed shoes
<input checked="" type="checkbox"/>	Safety glasses
<input checked="" type="checkbox"/>	Gloves (leather preferred)

Part B- Coupling Information

General Information		Tracking #: 2022-006	
PO Number 1121185	Expense Org 004610	Project 158276	Task COUPLER
Address/Location Bardstown to Cannons Line @ 554 Cannons Ln. Louisville, KY 40207			
Size 12"	Material STL	Coating CT	MAOP 200 PSIG
Main/Service Number 318421	Soil Type (from Part A) Clay (Type B)	Manufacturer Dresser	Model Style 39
Pipe Connection:	Steel to Steel	Steel to Plastic	Plastic to Plastic

Historical Information	
Installation Date 09/09/1987	Document Source Quest
Installation Company Southern Pipeline	Document Source Quest
Foreman Campbell	Document Source Quest
Welder Paul Howard & Don Gousha	Document Source Quest

GIS Information
Sys Id (of Coupler) 11594705
Screen Capture

Pictures (Label the following parts before taking pictures.)



Figure 1 – Coupler Top View



Figure 2 – Pipe Side A



Figure 3 – Pipe Side B



Figure 4 – Coupler Bottom View



Figure 5 – Lug A1



Figure 6 – Lug A2



Figure 7 – Lug A3



Figure 8 – Lug A4



Figure 9 – Lug B1



Figure 10 – Lug B2



Figure 11 – Lug B3



Figure 12 – Lug B4

Part C- Visual Inspection of Coupling

Visual Inspection Performed by: Ethan Hinkson & Sarah Nicholson

Date: 10/3/2022

Table 1- Component Quantities

Number of Bolts on Coupler Body	8
Number of Reinforcement Rods	4
Number of Lugs	8

Table 2- Corrosion

	Pipe A	Pipe B	Coupler Body	Bolts	Rods	Lugs	Nuts
General External Corrosion?	Yes	Yes	No	No	No	No	No
Localized External Corrosion?	No	No	No	No	No	No	No
Pits Present?	No	No	No	No	No	No	No
Internal Corrosion?	No	No					

* If Pits are present take maximum depth measurements and put in the Additional Comments section.

Table 3- Coupler Body

Bolt	Washer Present	Nut present?
1	No	Yes
2	No	Yes
3	No	Yes
4	No	Yes
5	No	Yes
6	No	Yes
7	No	Yes
8	No	Yes

Table 4- Reinforcement Rods

Rod	Length (in.)	Diameter (in.)	Washer present at head of bolt?	Washer present at end of bolt?	Nut Present? Type?	Type of rod?
1	30 ½"	¾"	Yes	Yes	Square	Standard
2	30 ½"	¾"	Yes	Yes	Square	Standard
3	30 ¾"	¾"	Yes	Yes	Square	Standard
4	30 ¾"	¾"	Yes	Yes	Square	Standard

Type of Lug

(Please indicate the shape of the lug by circling one below. If the lug shape is different than any preset shape below, sketch the shape.)

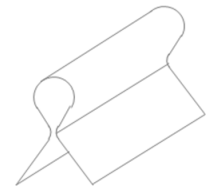
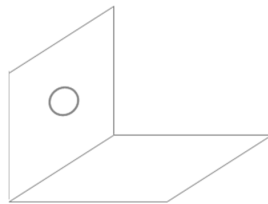
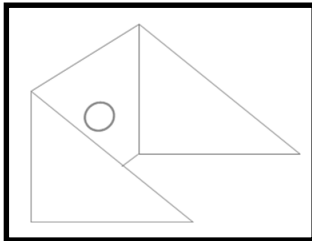


Table 5- Lugs (Measurements)

Pipe Side	Lug Number	Thickness (in.)	Circumference (in)	
			Distance to next lug, clockwise	Distance to next lug, counter-clockwise
A	1	0.23"	6 ½"	4"
A	2	0.23"	9"	6 ½"
A	3	0.23"	8 ½"	9"
A	4	0.23"	4"	8 ½"
B	1	0.23"	3 ½"	8 ¾"
B	2	0.23"	5 ¾"	3 ½"
B	3	0.22"	9 ¾"	5 ¾"
B	4	0.23"	8 ¾"	3 ½"

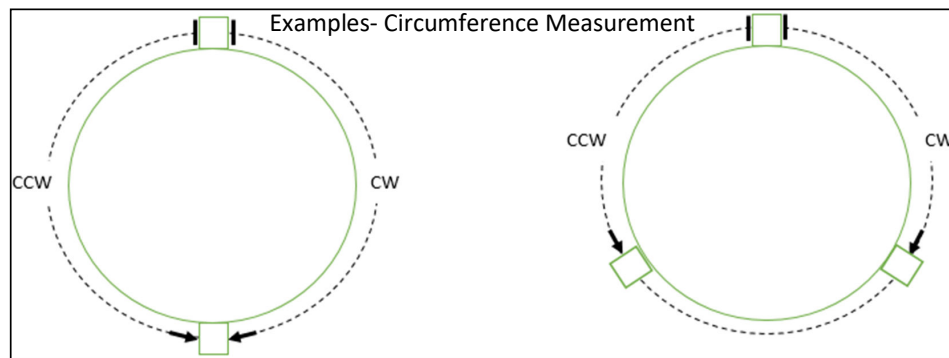


Table 6- Lugs (Observations)

Lug	Lug	Assembly sets aligned?	Deformed?	Deflected? (angle of)
A1	B1	Yes	No	No
A2	B2	Yes	No	No
A3	B3	Yes	No	No
A4	B4	Yes	No	No

Table 7- Lugs (Weld Quality)

Pipe Side	Lug Number	Any failed welds causing detachment?	Welded on all sides of exterior? If no, describe	Are welds on exterior continuous? If no, describe
A	1	No	No (1 ext. weld)	Yes
A	2	No	Yes	Yes
A	3	No	Yes	Yes
A	4	No	Yes	Yes
B	1	No	Yes	Yes
B	2	No	Yes	Yes
B	3	No	Yes	Yes
B	4	No	Yes	Yes

Pipe Side	Lug Number	Welded on all sides of interior? If no, describe	Are welds on interior continuous? If no, describe
A	1	Yes	Yes
A	2	Yes	N/A (Obscured)
A	3	Yes	Yes
A	4	No (1 int. weld)	No
B	1	No (1 int. weld)	Yes
B	2	N/A (Obscured)	N/A (Obscured)
B	3	N/A (Obscured)	N/A (Obscured)
B	4	Yes	Yes

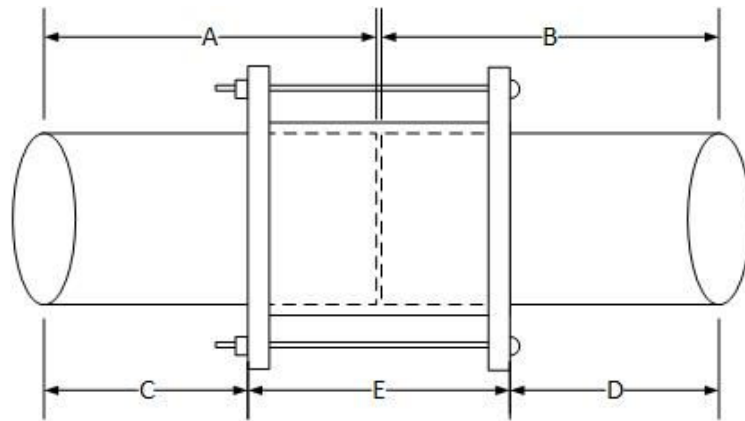


Table 8- Stab Depth

	A	B	C	D	Stab Depth (A-C) or (B-D)
Pipe Side A	22 ½"		18 ½"		4"
Pipe Side B		21 ½"		17"	4 ½"
	Sum of stab depths (should be closely equal to measurement E)				8 ½"
	Coupler Length (E)				8 ½"
	Difference				0

Additional Comments - General Observations, Pit Depths, etc.

LG&E - Kentucky Utilities
6900 Enterprise Drive
Louisville, KY 40214

November 29, 2022

Attention: Sarah Nicholson

Exhibit D

Report No. 202202296

Metallurgical Evaluation of a 20" Coupling and Associated Hardware

Location: Bardstown to Cannons Lane
Designation: 2022-007

DESCRIPTION AND PURPOSE

A natural gas pipe section including a coupling was submitted for metallurgical evaluation. The section was a 20" pipe with a Dresser Style Insulating Coupling. Six joint harnesses were also affixed to the pipe section. Copies of the installation information for the coupling and harnesses were provided for this investigation. It was reported that the coupling had been installed in the field at Bardstown to Cannons Lane, approximately at 554 Cannons Lane. It was installed on September 9, 1987. The pipe section was subsequently excavated after substantial service duration without failure. It was requested that the general dimensions, weld quality, corrosion condition and mechanical properties of the coupling components be determined as directed.

RESULTS

The submitted pipe section with the coupling is shown in Figures 1 through 4. Six lugs of the joint harnesses had been fillet welded to both pipe segments. Six rods and associated nuts had been affixed through the welded lugs to apply compression to the coupled joint. The coupling consisted of a steel coupling with an interior nonmetallic gasket / sleeve. Prior to receipt, the ends of the pipe segment were labelled as Ends A and B, as shown in Figures 1 and 2. The top and bottom of the coupling section were also marked. Lugs A1, A2, A3, A4, A5, and A6 were welded to Pipe A, and Lugs B1, B2, B3, B4, B5 and B6 were welded to Pipe B. The rod between Lugs A1 and B1 was identified as Rod 1. The remaining lugs were identified in a corresponding fashion.

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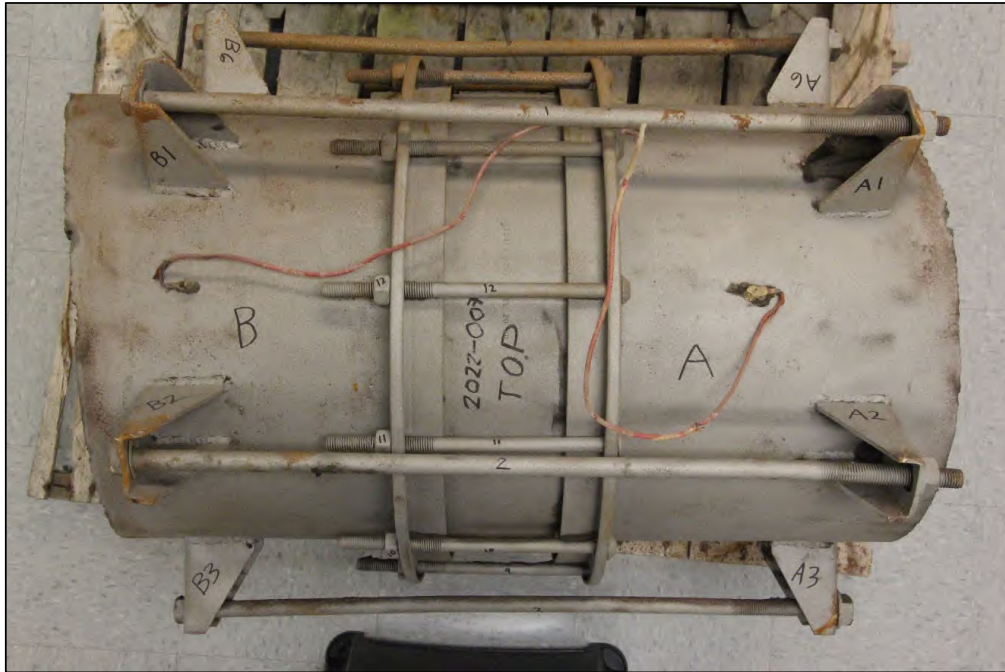


Figure 1. Photograph of the top of the submitted coupling sample.



Figure 2. Photograph of the bottom of the submitted sample.

SECTION 1- DIMENSIONAL MEASUREMENT

The six sets of harness lugs were positioned around the pipe. The relative orientations of the harness lugs were measured by photographing the assembly from the ends and applying a protractor overlay for angle measurement. The obtained measurements are shown in Figures 3 and 4 with the data summarized in Table 1. The depth of insertion of the pipe segments into the coupling was also measured and the dimensions are provided in Table 2. No requirements were provided for these characteristics.

TABLE 1 – LUG SPACING DIMENSIONAL MEASUREMENTS

Compound	Angle	Deviation from 60°	Image
Rod A1 / Rod A2	60	0	Figure 3
Rod A2 / Rod A3	61	1	Figure 3
Rod A3 / Rod A4	57	- 3	Figure 3
Rod A4 / Rod A5	69	9	Figure 3
Rod A5 / Rod A6	56	- 4	Figure 3
Rod A6 / Rod A1	57	- 3	Figure 3
Rod B1 / Rod B2	61	1	Figure 4
Rod B2 / Rod B3	60	0	Figure 4
Rod B3 / Rod B4	55	- 5	Figure 4
Rod B4 / Rod B5	65	5	Figure 4
Rod B5 / Rod B6	62	2	Figure 4
Rod B6 / Rod B1	57	- 3	Figure 4

TABLE 2 – PIPE COUPLING DIMENSIONAL MEASUREMENTS

Component	Depth of Pipe into Coupling	Gap Between Pipes in Coupling
Pipe A	15.75"	2.05" (Original sample length – 34.625")
Pipe B	16.825"	

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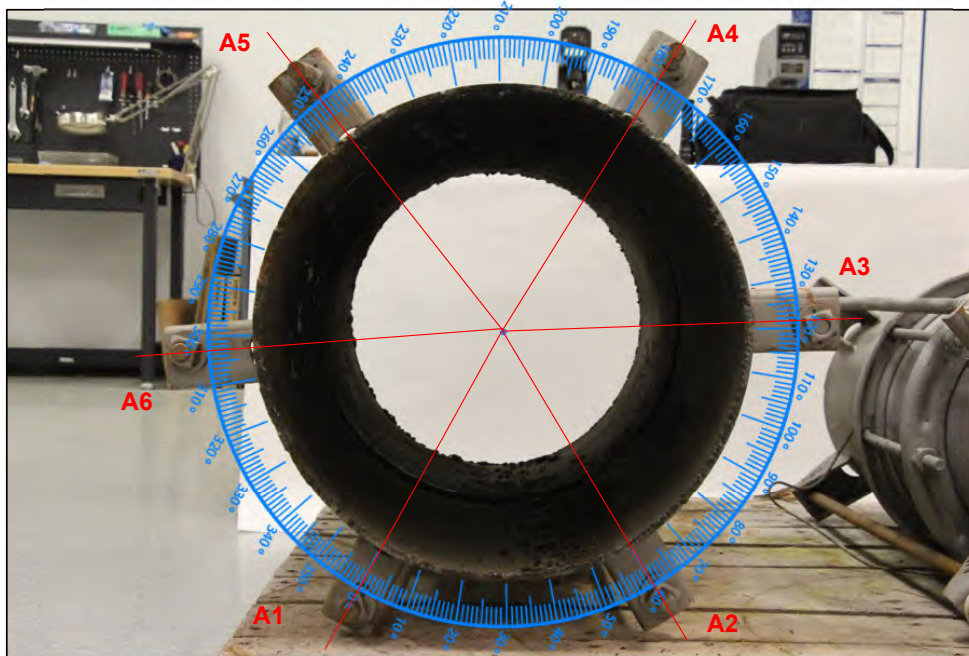


Figure 3. End facing image of the sample at End A with a superimposed protractor.

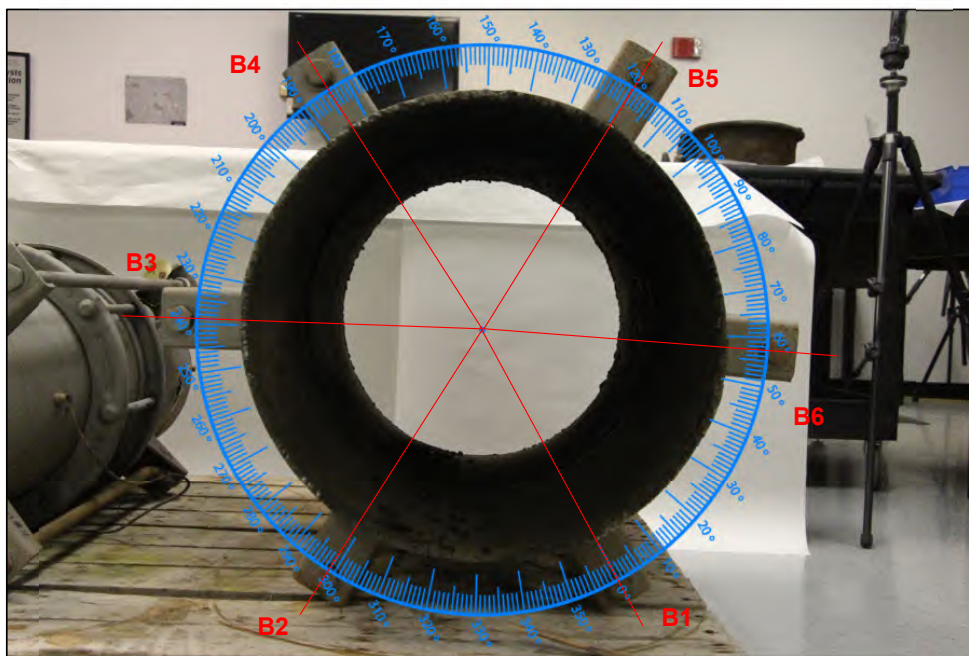


Figure 4. End facing image of the sample at End B with a superimposed protractor.

SECTION 2- VISUAL OBSERVATIONS

The lug attachment welds were regions of interest on the pipe coupling sample. Each lug contained four fillet weld locations; exterior top, exterior bottom, interior top, and interior bottom. Each weld that was present was inspected visually using a flashlight and magnifying lens. It was indicated that welding was performed in accordance with API 1104. General weld inspection was performed initially, followed by visual inspection by an outside NDE company. For comparison purposes, the welds were rated as substantial fusion, partial fusion, and minimal fusion. The summarized weld fusion and corrosion observations are provided in Table 3. Representative weld regions are shown in Figures 5 through 10. The welds contained localized discontinuities including undercut, arc strikes, porosity, and spatter. No cracking in the welds or base metal heat affected zones (HAZ) was visually identified. No gross corrosion was observed anywhere on the pipe or associated hardware.

The coupling and harness rods were also inspected for damage. The observations for the rods and bolts are provided in Table 4. No corrosion cracking was evident. The rods were not necked down or stretched.

The elastomeric components of the coupling consisted of a pipe separator, insulating sleeve, and two gaskets. Inspection revealed that they appeared to be intact and not degraded.

TABLE 3 – LUG WELD VISUAL EXAMINATION RESULTS

Component	Location	Weld	Observations
Lug A1	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Obscured
Lug A2	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial
Lug A3	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial
Lug A4	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial
Lug A5	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Minimal
		Bottom	Minimal
Lug A6	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Obscured
Lug B1	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial

TABLE 3 – LUG WELD VISUAL EXAMINATION RESULTS – CONTINUED

Component	Location	Weld	Observations
Lug B2	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial
Lug B3	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial
Lug B4	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial
Lug B5	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial
Lug B6	Exterior	Top	Substantial
		Bottom	Substantial
	Interior	Top	Substantial
		Bottom	Substantial

TABLE 4 – FASTENER VISUAL EXAMINATION RESULTS

Component	Observations
Rod 1	Bent – slightly rusted
Rod 2	Bent – slightly rusted
Rod 3	Bent – slightly rusted
Rod 4	Bent – slightly rusted
Rod 5	Bent – slightly rusted
Rod 6	Bent – slightly rusted
Bolt 1	Straight – slightly rusted
Bolt 2	Straight – slightly rusted
Bolt 3	Straight – slightly rusted
Bolt 4	Straight – slightly rusted
Bolt 5	Bent – slightly rusted
Bolt 6	Straight – slightly rusted
Bolt 7	Straight – slightly rusted
Bolt 8	Straight – slightly rusted
Bolt 9	Straight – slightly rusted
Bolt 10	Straight – slightly rusted
Bolt 11	Straight – slightly rusted
Bolt 12	Straight – slightly rusted

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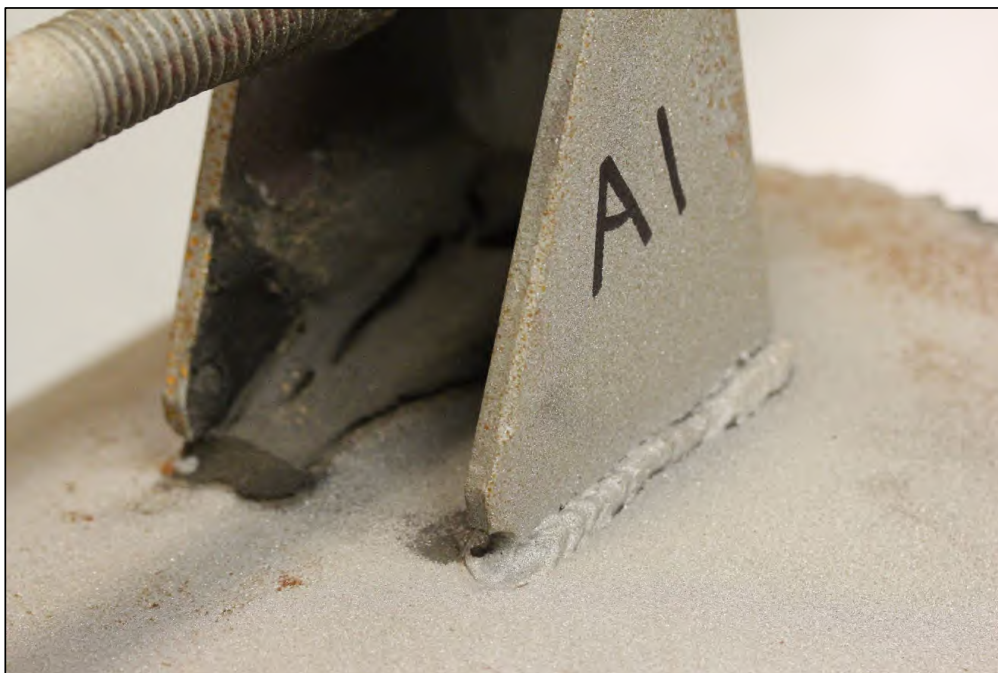


Figure 5. Image of the Lug A1 welds showing undercut. The interior weld shown was obscured by deposits.



Figure 6. Image of the Lug A4 exterior bottom weld which exhibited substantial fusion except for some overlap and undercut.



Figure 7. Image of the Lug A6 exterior bottom weld which exhibited substantial fusion except for some undercut regions.



Figure 8. Image of the Lug B1 welds showing good fusion with some undercut and overlap.



Figure 9. Image of the Lug B3 weld which exhibited substantial fusion except for some undercut and spatter.



Figure 10. Image of the Lug B5 exterior bottom weld which exhibited substantial fusion except for some undercut and overlap.

SECTION 3- TORQUE TESTING- FOR INFORMATION ONLY

Torque testing was performed on the nuts of the rods and bolts on the pipe coupling sample. A calibrated torque wrench was used to determine breakaway torque on each fastener. The breakaway torque measurements are summarized in Table 5. Rod fasteners did not have a specified torque requirement. The twelve coupling bolts and six harness rods exhibited torque values ranging from 30 to 120 ft.-lbs. No requirements were utilized for comparison as the coupler model was not specified.

TABLE 5 – FASTENER TORQUE MEASUREMENT

Component	Breakaway Torque	Observations
Rod 1	120 ft.-lbs.	
Rod 2	120 ft.-lbs.	
Rod 3	40 ft.-lbs.	
Rod 4	60 ft.-lbs.	
Rod 5	80 ft.-lbs.	
Rod 6	80 ft.-lbs.	
Bolt 1	80 ft.-lbs.	
Bolt 2	85 ft.-lbs.	
Bolt 3	50 ft.-lbs.	
Bolt 4	65 ft.-lbs.	
Bolt 5	45 ft.-lbs.	
Bolt 6	70 ft.-lbs.	
Bolt 7	60 ft.-lbs.	
Bolt 8	50 ft.-lbs.	
Bolt 9	70 ft.-lbs.	
Bolt 10	50 ft.-lbs.	
Bolt 11	90 ft.-lbs.	
Bolt 12	30 ft.-lbs.	

SECTION 4- TENSILE TESTING, ASTM A370-19

Tensile testing was performed on round specimens that were removed from the six harness rods and the twelve coupling bolts. The tensile mechanical properties of the fasteners were measured and the results are summarized in Table 6. No mechanical property requirements were provided for the fasteners.

TABLE 6 – FASTENER TENSION TEST RESULTS

Component	Ultimate Tensile Strength, ksi	0.2% Offset Yield Strength, ksi	Elongation, %^②	Reduction in Area, %
Rod 1 ①	107	65.5	25	51
Rod 2 ①	108	65.0	25	50
Rod 3 ①	108	64.0	26	51
Rod 4 ①	108	65.0	25	50
Rod 5 ①	107	64.5	26	49
Rod 6 ①	108	65.0	25	49
Bolt 1 ①	85.5	60.0	34	75
Bolt 2 ①	85.5	63.0	34	74
Bolt 3 ①	86.5	65.5	33	72
Bolt 4 ①	83.0	60.0	35	76
Bolt 5 ①	85.0	62.5	34	74
Bolt 6 ①	86.0	60.5	35	74
Bolt 7 ①	83.0	62.0	36	76
Bolt 8 ①	86.0	58.5	34	74
Bolt 9 ①	85.5	62.5	33	74
Bolt 10 ①	85.5	64.0	34	75
Bolt 11 ①	85.5	62.5	35	75
Bolt 12 ①	85.5	62.0	34	75

① Specimen Dimensions; Diameter 0.350” with gage length of 1.40”

② Percent elongation was measured using elongation-after-fracture measurements

SECTION 5- ROCKWELL HARDNESS, ASTM E18-20

Small sections of the twelve lugs were excised for hardness testing. Rockwell hardness testing was performed on sectioned segments of the lugs after the removal of surface roughness by sanding. The obtained results are provided in Table 7 and are suggestive of a moderate strength level. No requirements were provided for comparison.

TABLE 7 – LUG HARDNESS TEST RESULTS – ROCKWELL B – HRBW

Results	Average ^①
Lug A1	66
Lug A2	79
Lug A3	81
Lug A4	78
Lug A5	78
Lug A6	53
Lug B1	76
Lug B2	75
Lug B3	68
Lug B4	78
Lug B5	53
Lug B6	53

① Reported hardness is an average of four individual readings

SECTION 6- NONDESTRUCTIVE EXAMINATION

The two separated ends of the disassembled coupling were sent to a third party NDE laboratory for inspection. Visual and liquid dye penetrant inspections were performed on the lug attachment welds. Inspection was performed in accordance with the acceptance criteria of API 1104 “Welding of Pipelines and Related Facilities”. The inspection results are provided as Appendices A and B. Two representative welds are shown in Figures 11 and 12 with the dye penetrant test media remaining.



Figure 11. Image of the Lug A4 exterior top weld after dye penetrant media had been used during inspection.

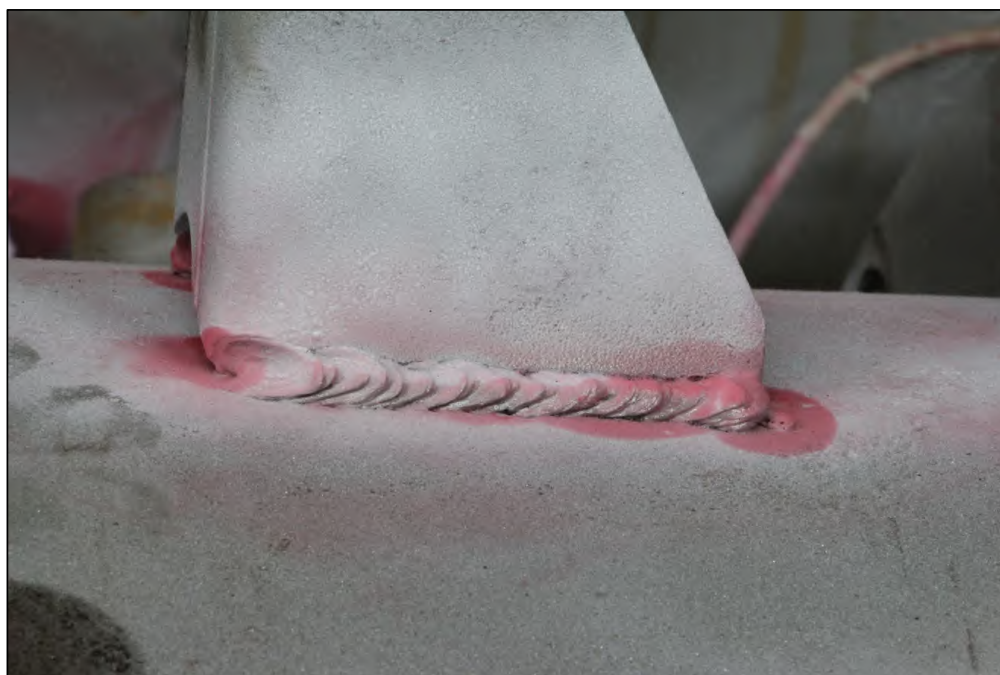


Figure 12. Image of the Lug B1 exterior top weld after dye penetrant media had been used during inspection.

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Respectfully submitted

Brett A. Miller, P.E. FASM
Technical Director

Concurrence

Brian Kelly
Failure Analyst

All procedures were performed in accordance with the IMR Quality Manual, current revision, and related procedures; and the PWA MCL Manual F-23 and related procedures. The information contained in this test report represents only the material tested and may not be reproduced, except in full, without the written approval of IMR Test Labs ("IMR"). IMR maintains a quality system in compliance with the ISO/IEC 17025 and is accredited by A2LA, certificates #1140.03 and #1140.04. IMR will perform all testing in good faith using the proper procedures, trained personnel, and equipment to accomplish the testing required. Conformance will be based on results without measurement uncertainty applied, unless otherwise requested by the customer. IMR's liability to the customer or any third party is limited at all times to the amount charged for the services provided. All test samples will be retained for a minimum of 3 months and may be destroyed thereafter, unless otherwise specified by the customer. The recording of false, fictitious, or fraudulent statements or entries on this document may be punished as a felony under federal statutes. IMR Test Labs is a GEAE S-400 approved lab (Supplier Code T9334).

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APPENDIX B – LIQUID DYE PENETRANT INSPECTION RECORD

		Liquid Penetrant Examination Report	
4100 Bishop Lane Louisville, KY 40218 P: (502) 966-5558; F: (502) 966-5401		www.mistrasgroup.com	
Client: <u>IMR</u>	Date: <u>11-19-2022</u>	Page: <u>1</u> of <u>2</u>	
Address: <u>4510 ROBARDS LN</u> <u>LOUISVILLE, KY 40218</u>	Job Number: _____	Purchase Order: <u>7697FA</u>	
Contact: <u>BRETT MILLER</u>	Reference Number: <u>202202296</u>	Part No/Description: <u>STEEL GAS COUPLINGS</u>	
Location: <u>MGI SHOP</u>		<u>LIFTING LUGS</u>	

Code/Specification AMSE SEC.V ARTICLE 6	Procedure 100-PT-001 REV 22	Acceptance Criteria API 1104
---	---------------------------------------	--

Type and Method			
<input type="checkbox"/> Fluorescent: (Type I)	<input type="checkbox"/> Water Wash [Method A]	<input checked="" type="checkbox"/> Red Visible Dye: (Type II)	<input type="checkbox"/> Water Wash [Method A]
	<input type="checkbox"/> Solvent Removable [Method C]		<input type="checkbox"/> Solvent Removable [Method C]
	<input type="checkbox"/> Post Emulsified: <input type="checkbox"/> Hydrophilic [D] <input type="checkbox"/> Lipophilic [B]		<input type="checkbox"/> Post Emulsified [Method B]
Sensitivity Level: <input type="checkbox"/> 1/4 <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> N/A		<input type="checkbox"/> Other: _____	

	Manufacturer	Type	Batch Number(s)	Application Method	Process Time (minutes)	
					Pre-clean Dry Time:	5MIN
Cleaner:	MAGNAFLUX	SKC-S	20L01K	DAMP CLOTH	Penetrant Dwell Time:	10 MIN
Penetrant:	MAGNAFLUX	SKL-SP2	18L04K	BRUSH	Emulsifier Time:	N/A
Developer:	MAGNAFLUX	SKD-S2	21J046	SPRAY	Developer Time:	10 MIN
Emulsifier:	N/A	N/A	N/A		Post Clean Method:	N/A

Developer Form: <input type="checkbox"/> a. Dry Powder <input type="checkbox"/> b. Water Soluble <input type="checkbox"/> c. Water Suspended <input type="checkbox"/> d. Nonaqueous Wet <input type="checkbox"/> e. Specific Application		
Penetrant Removal Method & Dry Time SKC-S DAMP CLOTH @ 5MIN	Black Light (Model and S/N) N/A	White Light Source L.E.D. FLASHLIGHT

<input checked="" type="checkbox"/> Original <input type="checkbox"/> Repair	Material & Thickness C/S	Test Temperature 67 F
--	------------------------------------	---------------------------------

Surface Condition			
<input checked="" type="checkbox"/> As Welded	<input type="checkbox"/> As Ground	<input type="checkbox"/> As Cast	<input type="checkbox"/> Rough Machined <input type="checkbox"/> Final Machined <input checked="" type="checkbox"/> Meets Code Requirements

Test Results	Quantity Inspected: 12	Quantity Accepted: _____	Quantity Rejected: 12
---------------------	-------------------------------	--------------------------	------------------------------

RED DYE PENETRANT INSPECTION PERFORMED ON THE FOLLOWING:
 DESCRIPTION: (202202296) COUPLINGS- LUG WELDS
 WELD I.D.: A1(REJECTED)--UNDERCUT, LACK OF FUSION
 WELD I.D.: A2(REJECTED)--UNDERCUT,LACK OF FUSION
 WELD I.D.: A3(REJECTED)--UNDERCUT,LACK OF FUSION
 WELD I.D.: A4(REJECTED)--UNDERCUT,LACK OF FUSION,POROSITY,UNDERFILL
 WELD I.D.: A5(REJECTED)--UNDERCUT,LACK OF FUSION
 WELD I.D.: A6(REJECTED)--UNDERCUT,LACK OF FUSION

 WELD I.D.: B1(REJECTED)--UNDERCUT,POROSITY
 WELD I.D.: B2(REJECTED)--UNDERCUT,LACK OF FUSION
 WELD I.D.: B3(REJECTED)--UNDERCUT,LACK OF FUSION
 WELD I.D.: B4(REJECTED)--UNDERCUT

The content of this document may be defense article/service related as described and controlled by International Traffic in Arms Regulations (ITAR)(22 CFR 120-130). Distribute only to entities meeting ITAR requirements. Discard by shredding. At no time during testing did these parts or material come into contact with mercury.

Technician Name, Level & Date <u>CHRIS DADDONA LVL.II 11-19-2022</u>	Customer (if applicable): _____	Reviewed By (if applicable): _____
---	---------------------------------	------------------------------------

Certification of Inspection, Liquid Penetrant [Basic Report Form] 100-PTFORM-002 | Rev 1

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APPENDIX B – LIQUID DYE PENETRANT INSPECTION RECORD (CONTINUED)

		Liquid Penetrant Examination Report			
4100 Bishop Lane Louisville, KY 40218 P: (502) 966-5558; F: (502) 966-5401		www.mistrasgroup.com			
Client: <u>IMR</u>	Date: <u>11-19-2022</u>	Page: <u>2 of 2</u>			
Address: <u>4510 ROBARDS LN</u>	Job Number: _____				
<u>LOUISVILLE, KY 40218</u>	Purchase Order: <u>7697FA</u>				
Contact: <u>BRETT MILLER</u>	Reference Number: <u>202202296</u>				
Location: <u>MGI SHOP</u>	Part No/Description: <u>STEEL GAS COUPLINGS</u>				
	<u>LIFTING LUGS</u>				
Code/Specification <u>AMSE SEC.V ARTICLE 6</u>	Procedure <u>100-PT-001 REV 22</u>	Acceptance Criteria <u>API 1104</u>			
Type and Method <input type="checkbox"/> Fluorescent: <input type="checkbox"/> Water Wash [Method A] <input checked="" type="checkbox"/> Red Visible Dye: <input type="checkbox"/> Water Wash [Method A] [Type I] <input type="checkbox"/> Solvent Removable [Method C] [Type II] <input type="checkbox"/> Solvent Removable [Method C] <input type="checkbox"/> Post Emulsified: <input type="checkbox"/> Hydrophilic [D] <input type="checkbox"/> Lipophilic [B] <input type="checkbox"/> Post Emulsified [Method B] Sensitivity Level: <input type="checkbox"/> 1/2 <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> N/A <input type="checkbox"/> Other: _____					
	Manufacturer	Type	Batch Number(s)	Application Method	Process Time (minutes)
Cleaner:	MAGNAFLUX	SKC-S	20L01K	DAMP CLOTH	Pre-clean Dry Time: 5MIN
Penetrant:	MAGNAFLUX	SKL-SP2	18L04K	BRUSH	Penetrant Dwell Time: 10 MIN
Developer:	MAGNAFLUX	SKD-S2	21J046	SPRAY	Emulsifier Time: N/A
Emulsifier:	N/A	N/A	N/A		Developer Time: 10 MIN
					Post Clean Method: N/A
Developer Form: <input type="checkbox"/> a. Dry Powder <input type="checkbox"/> b. Water Soluble <input type="checkbox"/> c. Water Suspended <input type="checkbox"/> d. Nonaqueous Wet <input type="checkbox"/> e. Specific Application Penetrant Removal Method & Dry Time: <u>SKC-S DAMP CLOTH @ 5MIN</u> Black Light (Model and S/N): <u>N/A</u> White Light Source: <u>L.E.D. FLASHLIGHT</u>					
<input checked="" type="checkbox"/> Original <input type="checkbox"/> Repair	Material & Thickness <u>C/S</u>			Test Temperature <u>67 F</u>	
Surface Condition <input checked="" type="checkbox"/> As Welded <input type="checkbox"/> As Ground <input type="checkbox"/> As Cast <input type="checkbox"/> Rough Machined <input type="checkbox"/> Final Machined <input checked="" type="checkbox"/> Meets Code Requirements					
Test Results		Quantity Inspected: <u>12</u>	Quantity Accepted: _____	Quantity Rejected: _____	
RED DYE PENETRANT INSPECTION PERFORMED ON THE FOLLOWING: DESCRIPTION: (202202296) COUPLINGS- LUG WELDS (CONTINUED) WELD I.D.: B5(REJECTED)--UNDERCUT, UNDER FILL WELD I.D.: B6(REJECTED)--UNDERCUT, LACK OF FUSION					
<small>The content of this document may be defense article/service related as described and controlled by International Traffic in Arms Regulations (ITAR)[22 CFR 120-130]. Distribute only to entities meeting ITAR requirements. Discard by shredding. At no time during testing did these parts or material come into contact with mercury.</small>					
Technician Name, Level & Date <u>Chris Daddona LVL II 11-19-2022</u>		Customer (if applicable): _____		Reviewed By (if applicable): _____	
Certification of Inspection, Liquid Penetrant [Basic Report Form]				100-PTFORM-002 Rev 1	

Bolt-Style Coupling (pressures > 3 psig)

This form will be completed when LG&E or LG&E contractors expose a bolt-style coupling in a system where **the pressure is > 3 psig (medium and high-pressure distribution and transmission)** and the coupling will be backfilled. The purpose of the form is to provide Operations, Engineering and Gas Regulatory personnel with information about the bolt style coupling installation.

Part A- Discovery of Coupling

Precautions:

1. Stop excavation upon discovering the bolt-style coupling in the excavation
2. Set-up a perimeter around the excavation to keep the public away from the excavation

General Information:

1. Contact Employee for the bolt style coupling found: **James McGough** [REDACTED]
2. Date of exposure: **07/08/2022**
3. Location: **Bardstown to Cannons Line (Approximate Address: 554 Cannons Ln. Louisville, KY 40207)**
4. Size of coupling (based on pipe size if not exposed enough to determine): **12"**
5. Type of soil: Sandy Clay Gravel Topsoil Other (take picture and describe)
6. Soil Density test: Type A Type B Type C
7. Status: Removed Abandoned in place Backfilled- left in service
8. Discovery Method: Leak on Coupler Other Maintenance Excavation Facility Replacement
 Facility Retirement Other:
9. Pressure Class: Medium Pressure (MP) High Pressure (HP) Transmission

Pictures:

1. Take at least two pictures of the coupling. The pictures should be from different angles (additional pictures can be taken).
2. Email pictures to supervisor. Ensure pictures are attached to this form:

Sketch: Provide a sketch showing the coupling orientation (vertical/horizontal), nearby branches, pipe, valves and fittings, other utilities or structures, etc.

Leak Survey:

1. Use an instrument designed to detect natural gas to check for the presence of natural gas after backfilling the excavation. Include readings in the above sketch in relation to the coupling. If the contact employee is not leak survey qualified, they should contact:
 - a. Their supervisor to call Gas Regulatory to complete the survey after the excavation is backfilled. Call [REDACTED]
 - b. If Gas Regulatory is not available contact Gas Dispatch to have the survey assigned to a Gas Trouble Technician.

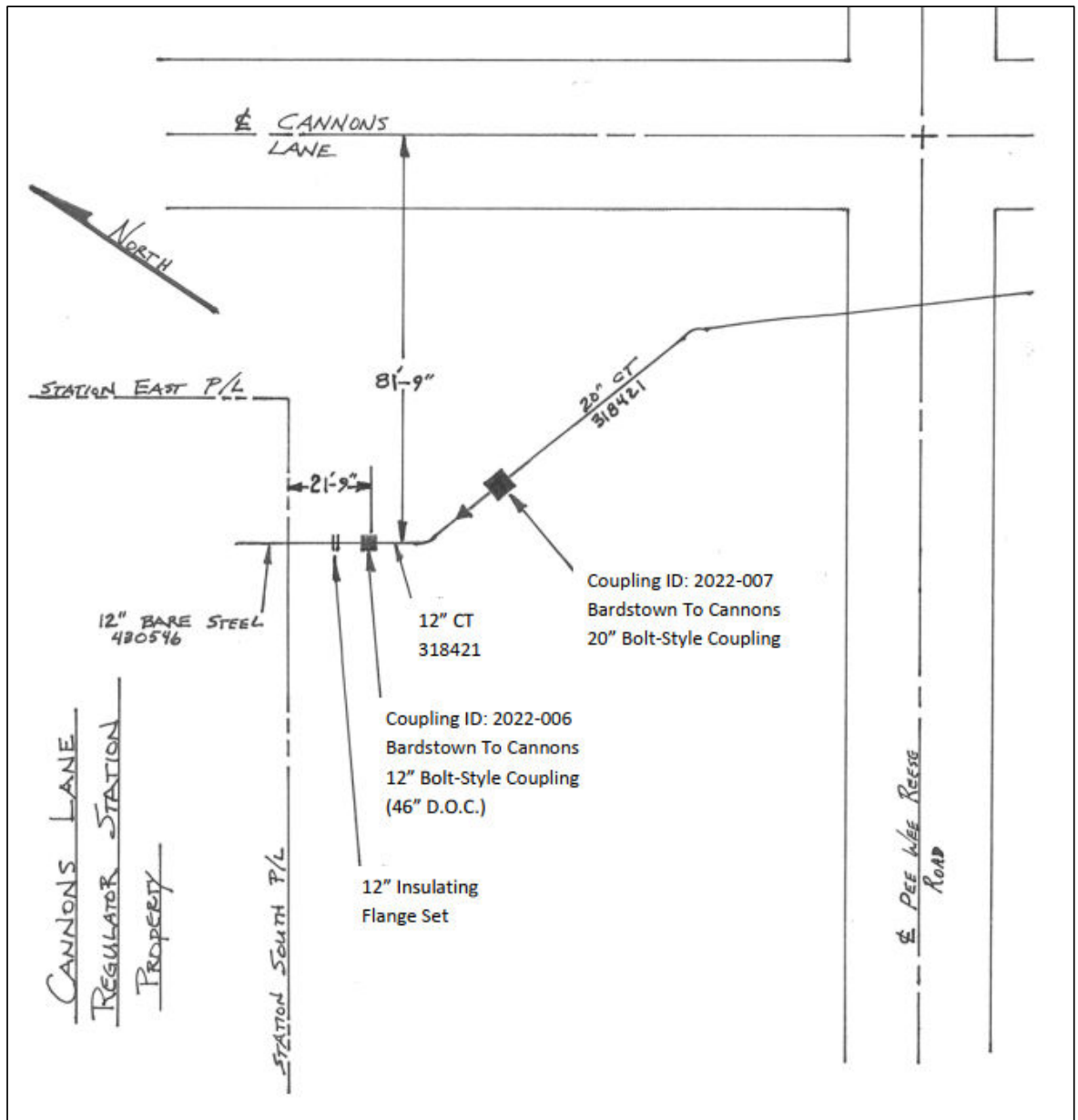
Leak Survey completed at time of backfill (circle one) yes no **not applicable**

Include completed form in the main report and email a scanned copy of the completed form (back and front) to the DIMP group at [REDACTED]

Field Pictures



Sketch



Safety Briefing

Date: October 3, 2022

Employee Name	Employee ID
Sarah Nicholson	██████
Ethan Hinkson	██████

Hazards Identified	
<input checked="" type="checkbox"/>	Sharp edges on cut pipe ends. Wear gloves when handling.
<input checked="" type="checkbox"/>	Pinch points on couplings. Wear gloves when handling.
<input checked="" type="checkbox"/>	Some couplings samples are heavy. Use a partner to assist with moving. Use proper lifting techniques. Wear hard toes shoes.
<input checked="" type="checkbox"/>	Debris may on samples. Wear eye protection.
<input checked="" type="checkbox"/>	Tripping hazards on floor. Keep area clean and free of tripping hazards

PPE Required	
<input checked="" type="checkbox"/>	Hard toed shoes
<input checked="" type="checkbox"/>	Safety glasses
<input checked="" type="checkbox"/>	Gloves (leather preferred)

Part B- Coupling Information

General Information		Tracking #: 2022-007	
PO Number 1121185	Expense Org 004610	Project 158276	Task COUPLER
Address/Location Bardstown to Cannons Line @ 554 Cannons Ln. Louisville, KY 40207			
Size 20"	Material STL	Coating CT	MAOP 178 PSIG
Main/Service Number 318421	Soil Type (from Part A) Clay (Type B)	Manufacturer Dresser	Model Style 38
Pipe Connection:	Steel to Steel	Steel to Plastic	Plastic to Plastic

Historical Information	
Installation Date 09/09/1987	Document Source Quest
Installation Company Southern Pipeline	Document Source Quest
Foreman Campbell	Document Source Quest
Welder Paul Howard & Don Gousha	Document Source Quest

GIS Information
Sys Id (of Coupler) 73387319
Screen Capture

Pictures (Label the following parts before taking pictures.)



Figure 1 – Coupler Top View



Figure 2 – Pipe Side A (Top)



Figure 3 – Pipe Side B



Figure 4 – Coupler Bottom View



Figure 5 – Lug A1



Figure 6 – Lug A2



Figure 7 – Lug A3



Figure 8 – Lug A4



Figure 9 – Lug A5



Figure 10 – Lug A6



Figure 11 – Lug B1



Figure 12 – Lug B2



Figure 13 – Lug B3



Figure 14 – Lug B4



Figure 15 – Lug B5



Figure 16 – Lug B6

Part C- Visual Inspection of Coupling

Visual Inspection Performed by: Ethan Hinkson & Sarah Nicholson Date: 10/3/2022

Table 1- Component Quantities

Number of Bolts on Coupler Body	12
Number of Reinforcement Rods	6
Number of Lugs	12

Table 2- Corrosion

	Pipe A	Pipe B	Coupler Body	Bolts	Rods	Lugs	Nuts
General External Corrosion?	Yes	Yes	No	No	No	No	No
Localized External Corrosion?	No	No	No	No	No	No	No
Pits Present?	No	No	No	No	No	No	No
Internal Corrosion?	No	No					

* If Pits are present take maximum depth measurements and put in the Additional Comments section.

Table 3- Coupler Body

Bolt	Washer Present	Nut present?
1	No	Yes
2	No	Yes
3	No	Yes
4	No	Yes
5	No	Yes
6	No	Yes
7	No	Yes
8	No	Yes
9	No	Yes
10	No	Yes
11	No	Yes
12	No	Yes

Table 4- Reinforcement Rods

Rod	Length (in.)	Diameter (in.)	Washer present at head of bolt?	Washer present at end of bolt?	Nut Present? Type?	Type of rod?
1	30 ½"	¾"	Yes	Yes	Hexagonal & Square	Standard
2	30 ½"	¾"	Yes	Yes	Hexagonal & Square	Standard
3	30 ¾"	¾"	Yes	Yes	Hexagonal & Square	Standard
4	33"	¾"	Yes	Yes	Hexagonal & Square	Standard
5	33"	¾"	Yes	Yes	Hexagonal & Square	Standard
6	31"	¾"	Yes	Yes	Hexagonal & Square	Standard

Type of Lug

(Please indicate the shape of the lug by circling one below. If the lug shape is different than any preset shape below, sketch the shape.)

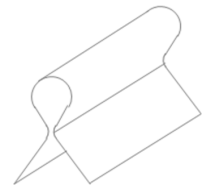
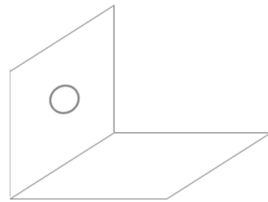
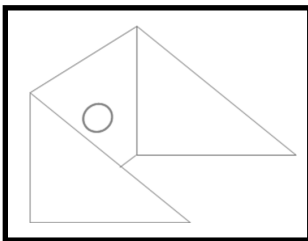


Table 5- Lugs (Measurements)

Pipe Side	Lug Number	Thickness (in.)	Circumference (in)	
			Distance to next lug, clockwise	Distance to next lug, counter-clockwise
A	1	0.22"	7"	6 ½"
A	2	0.22"	7"	7"
A	3	0.22"	7 ½"	6 ½"
A	4	0.22"	6 ½"	9"
A	5	0.22"	9"	6 ½"
A	6	0.23"	6 ½"	7"
B	1	0.23"	7 ¼"	7 ¼"
B	2	0.23"	7 ½"	7 ¼"
B	3	0.23"	7"	7 ½"
B	4	0.22"	8 ¼"	7"
B	5	0.23"	7 ½"	8 ¼"
B	6	0.23"	7 ¼"	7 ½"

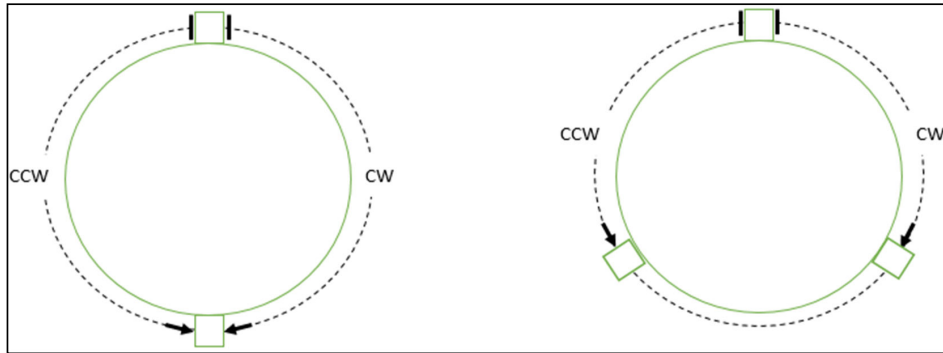


Table 6- Lugs (Observations)

Lug	Lug	Assembly sets aligned?	Deformed?	Deflected? (angle of)
A1	B1	Yes	No	No
A2	B2	Yes	No	No
A3	B3	Yes	No	No
A4	B4	Yes	No	No
A5	B5	Yes	No	No
A6	B6	Yes	No	No

Table 7- Lugs (Weld Quality)

Pipe Side	Lug Number	Any failed welds causing detachment?	Welded on all sides of exterior? If no, describe	Are welds on exterior continuous? If no, describe
A	1	No	Yes	Yes
A	2	No	Yes	Yes
A	3	No	Yes	Yes
A	4	No	Yes	Yes
A	5	No	Yes	Yes
A	6	No	Yes	Yes
B	1	No	Yes	Yes
B	2	No	Yes	Yes
B	3	No	Yes	Yes
B	4	No	Yes	Yes
B	5	No	Yes	Yes
B	6	No	Yes	Yes

Pipe Side	Lug Number	Welded on all sides of interior? If no, describe	Are welds on interior continuous? If no, describe
A	1	N/A (Obscured)	N/A (Obscured)
A	2	Yes	Yes
A	3	Yes	Yes
A	4	Yes	Yes
A	5	Yes	Yes
A	6	Yes	N/A (Obscured)
B	1	Yes	Yes
B	2	Yes	Yes
B	3	Yes	Yes
B	4	Yes	Yes
B	5	Yes	Yes
B	6	Yes	Yes

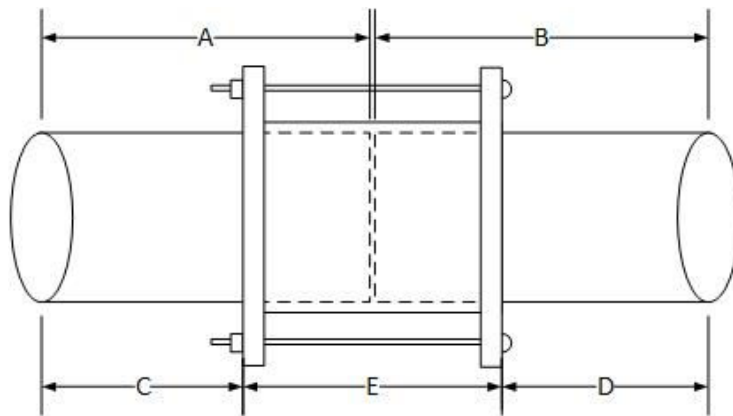


Table 8- Stab Depth

	A	B	C	D	Stab Depth (A-C) or (B-D)
Pipe Side A	16 ¾"		13"		3 ¾"
Pipe Side B		16 ½"		12 ½"	4"
	Sum of stab depths (should be closely equal to measurement E)				7 ¾"
	Coupler Length (E)				8 ¼"
	Difference				½"

Additional Comments - General Observations, Pit Depths, etc.

LG&E - Kentucky Utilities
6900 Enterprise Drive
Louisville, KY 40214

December 16, 2022

Attention: Sarah Nicholson

Exhibit E
Report No. 202202625

Metallurgical Evaluation of a 6" Coupling and Associated Hardware

Location: 26th and Bank Street

DESCRIPTION AND PURPOSE

A natural gas pipe section was submitted for metallurgical evaluation. The section was a 6" pipe with a Dresser Style 39 coupling which had been disassembled prior to receipt. Two joint harnesses were also affixed to the pipe section. Copies of the installation information for the coupling and harnesses were provided for this investigation. It was reported that the coupling had been installed in the field at the 26th and Bank Street on August 10, 1951. The pipe section was subsequently excavated after substantial service duration without failure. It was requested that the general dimensions, weld quality, corrosion condition and mechanical properties of the coupling components be determined as directed.

RESULTS

The submitted pipe section is shown in Figures 1 through 4. Four lugs of the joint harnesses had been fillet welded to both pipe segments. Only one of the tension rods was submitted with the pipes. Prior to receipt, the ends of the pipe segments were labelled as Ends A and B, as shown in Figures 1 and 2. The top and bottom of the coupling sections were not marked but were inferred by the condition of the welds. Lugs A1 and A2 were welded to Pipe A, and Lugs B1 and B2 were welded to Pipe B.

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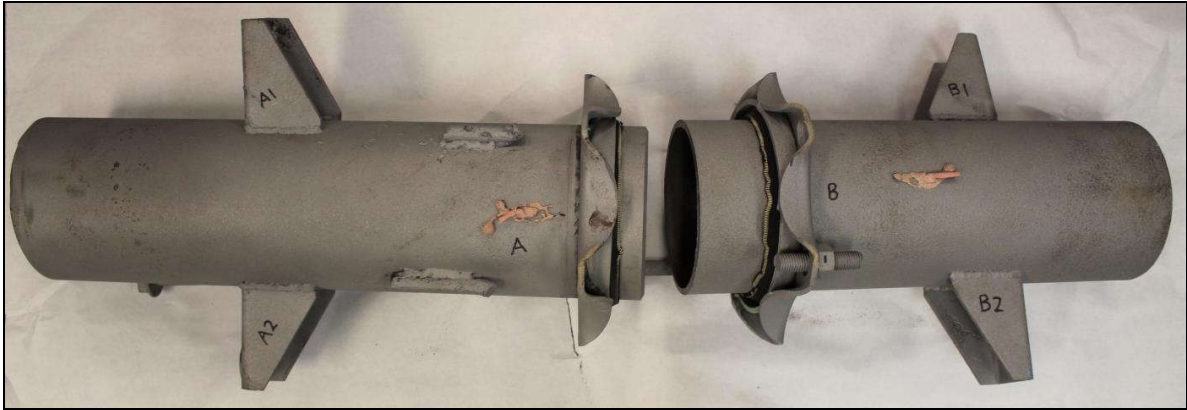


Figure 1. Photograph of the top of the submitted coupling sample.

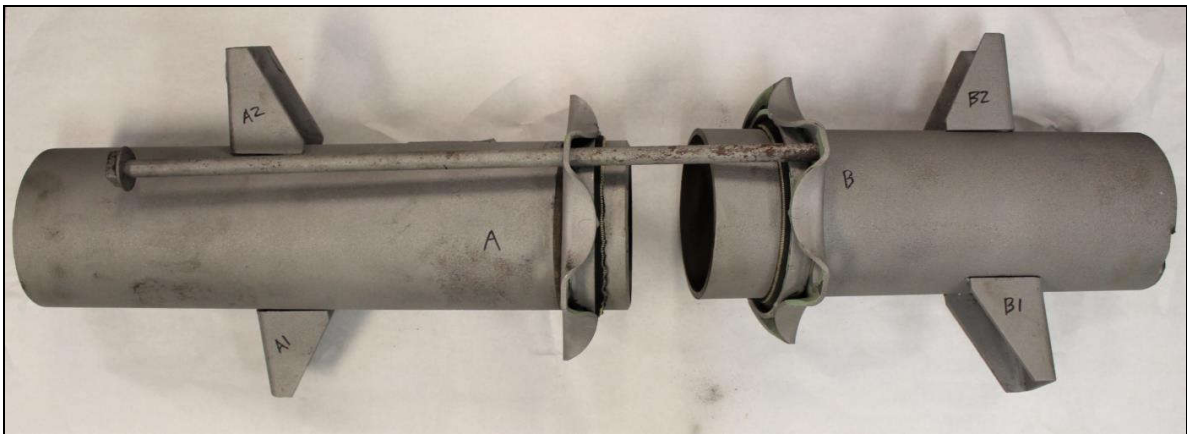


Figure 2. Photograph of the bottom of the submitted sample.

SECTION 1- DIMENSIONAL MEASUREMENT

The two sets of harness lugs were positioned around the pipe. The relative orientations of the harness lugs were measured by photographing the assembly from the ends and applying a protractor overlay for angle measurement. The obtained measurements are shown in Figures 3 and 4 with the data summarized in Table 1. No requirements were provided for these characteristics.

TABLE 1 – LUG SPACING DIMENSIONAL MEASUREMENTS

Compound	Angle	Deviation from 180°	Image
Rod A1 / Rod A2	171	9	Figure 3
Rod B1 / Rod B2	173	7	Figure 4

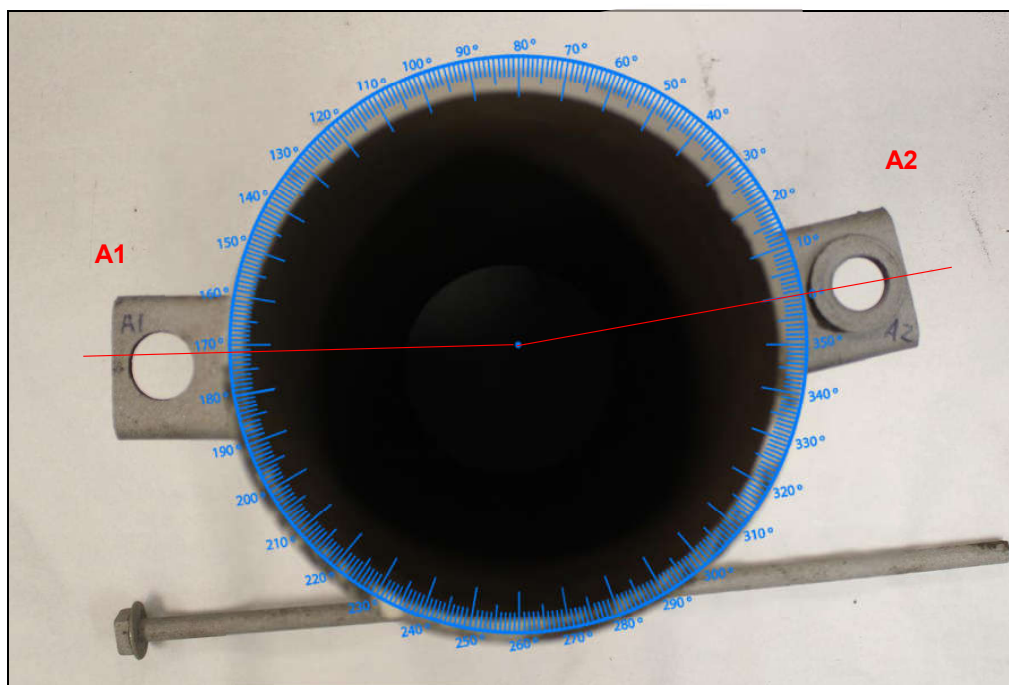


Figure 3. End facing image of the sample at End A with a superimposed protractor.

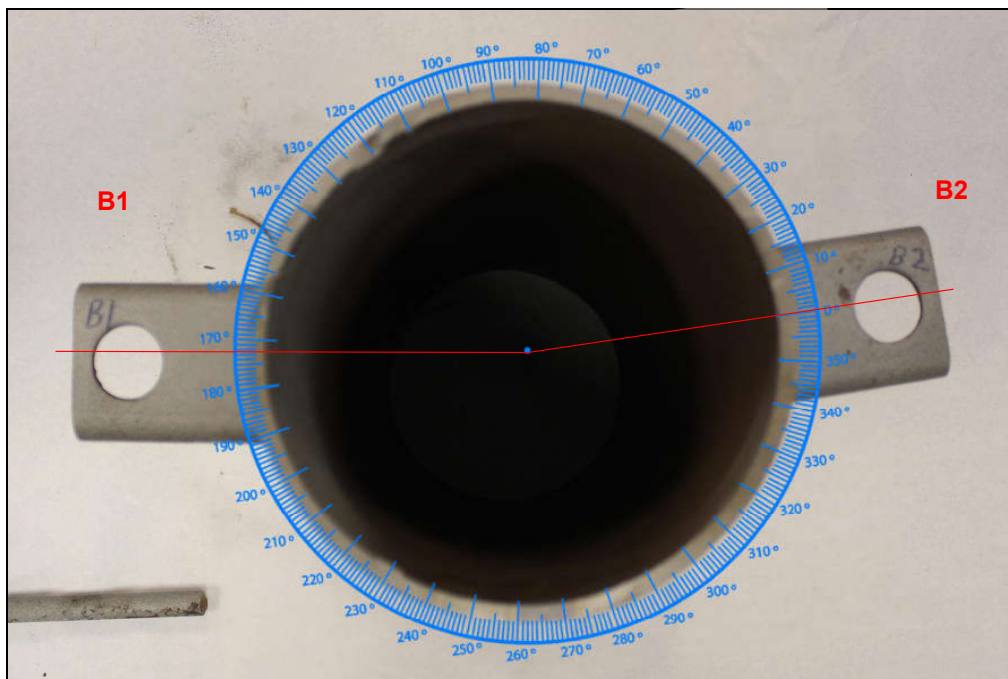


Figure 4. End facing image of the sample at End B with a superimposed protractor.

SECTION 2- VISUAL OBSERVATIONS

The lug attachment welds were regions of interest on the pipe coupling sample. Each lug contained four fillet weld locations; exterior top, exterior bottom, interior top, and interior bottom. Each weld that was present was inspected visually using a flashlight and magnifying lens. It was indicated that welding was performed in accordance with API 1104. General weld inspection was performed initially, followed by visual inspection by an outside NDE company. For comparison purposes, the welds were rated as substantial fusion, partial fusion, and minimal fusion. The summarized weld fusion and corrosion observations are provided in Table 2. Representative weld regions are shown in Figures 5 through 8. The welds contained localized discontinuities including undercut, arc strikes, porosity, and spatter. No cracking in the welds or base metal heat affected zones (HAZ) was visually identified. No gross corrosion was observed anywhere on the pipe or associated hardware.

The single harness rod was also inspected for damage. The observations for the rod are provided in Table 3. No corrosion cracking was evident. The rod was not necked down or stretched.

TABLE 2 – LUG WELD VISUAL EXAMINATION RESULTS

Component	Location	Weld	Observations
Lug A1	Exterior	Top	Substantial
		Bottom	No fusion
	Interior	Top	No fusion
		Bottom	Substantial
Lug A2	Exterior	Top	Substantial
		Bottom	No fusion
	Interior	Top	No fusion
		Bottom	Substantial
Lug B1	Exterior	Top	Substantial
		Bottom	No fusion
	Interior	Top	No fusion
		Bottom	Substantial
Lug B2	Exterior	Top	Substantial
		Bottom	No fusion
	Interior	Top	No fusion
		Bottom	Substantial

TABLE 3 – FASTENER VISUAL EXAMINATION RESULTS

Component	Observations
Rod 1	Straight



Figure 5. Image of the Lug A1 exterior top weld which exhibited substantial fusion except for some undercut, spatter, and arc strikes.



Figure 6. Image of the Lug A1 exterior bottom weld which exhibited no fusion.



Figure 7. Image of the Lug B2 exterior top weld which exhibited substantial fusion except for some undercut and arc strikes.



Figure 8. Image of the Lug B1 interior bottom weld which exhibited substantial fusion except for some undercut and arc strikes.

SECTION 4- TENSILE TESTING, ASTM A370-19

Tensile testing was performed on a round specimen that was removed from the harness rod. The tensile mechanical properties of the fastener were measured and the results are summarized in Table 4. No mechanical property requirements were provided for the fastener.

TABLE 4 – FASTENER TENSION TEST RESULTS

Component	Ultimate Tensile Strength, ksi	0.2% Offset Yield Strength, ksi	Elongation, %	Reduction in Area, %
Rod 1	69.0	42.7	37	65

Specimen Dimensions; Diameter 0.350" with gage length of 1.40"
Percent elongation was measured using elongation-after-fracture measurements

SECTION 5- ROCKWELL HARDNESS, ASTM E18-20

Small sections of the four lugs were excised for hardness testing. Rockwell hardness testing was performed on sectioned segments of the lugs after the removal of surface roughness by sanding. The obtained results are provided in Table 5 and are suggestive of a moderate strength level. No requirements were provided for comparison.

TABLE 5 – LUG HARDNESS TEST RESULTS – ROCKWELL B – HRBW

Results	Average of Five Measurements
Lug A1	75
Lug A2	75
Lug B1	76
Lug B2	75

SECTION 6- NONDESTRUCTIVE EXAMINATION

The two separated ends of the disassembled coupling were sent to a third party NDE laboratory for inspection. Visual and liquid dye penetrant inspections were performed on the lug attachment welds. Inspection was performed in accordance with the acceptance criteria of API 1104 "Welding of Pipelines and Related Facilities". The inspection results are provided as Appendices A and B. Two representative welds are shown in Figures 9 and 10 with the dye penetrant test media remaining.



Figure 9. Image of the Lug A4 exterior top weld after dye penetrant media had been used during inspection.



Figure 10. Image of the Lug B2 exterior top weld after dye penetrant media had been used during inspection.

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Respectfully submitted

Brian Kelly
Failure Analyst

Concurrence

Jennifer Breetz
Laboratory Director

All procedures were performed in accordance with the IMR Quality Manual, current revision, and related procedures; and the PWA MCL Manual F-23 and related procedures. The information contained in this test report represents only the material tested and may not be reproduced, except in full, without the written approval of IMR Test Labs ("IMR"). IMR maintains a quality system in compliance with the ISO/IEC 17025 and is accredited by A2LA, certificates #1140.03 and #1140.04. IMR will perform all testing in good faith using the proper procedures, trained personnel, and equipment to accomplish the testing required. Conformance will be based on results without measurement uncertainty applied, unless otherwise requested by the customer. IMR's liability to the customer or any third party is limited at all times to the amount charged for the services provided. All test samples will be retained for a minimum of 3 months and may be destroyed thereafter, unless otherwise specified by the customer. The recording of false, fictitious, or fraudulent statements or entries on this document may be punished as a felony under federal statutes. IMR Test Labs is a GEAE S-400 approved lab (Supplier Code T9334).

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APPENDIX B – LIQUID DYE PENETRANT INSPECTION RECORD



Liquid Penetrant Examination Report

4100 Bishop Lane | Louisville, KY 40218 | P: (502) 966-5558; F: (502) 966-5401

www.mistrasgroup.com

Client: IMR Date: 12-13-2022 Page: 1 of 1
 Address: 4510 ROBARDS LN Job Number: _____
LOUISVILLE, KY 40218 Purchase Order: 7719FA
 Contact: BRETT MILLER Reference Number: 2022022
 Location: MGI SHOP Part No/Description: 6" STEEL GAS COUPLINGS
LIFTING LUGS

Code/Specification AMSE SEC.V ARTICLE 6	Procedure 100-PT-001 REV 22	Acceptance Criteria API 1104
--	--------------------------------	---------------------------------

Type and Method

Fluorescent: Water Wash [Method A] Red Visible Dye: Water Wash [Method A]
 [Type I] Solvent Removable [Method C] [Type II] Solvent Removable [Method C]
 Post Emulsified: Hydrophilic [D] Lipophilic [B] Post Emulsified [Method B]

Sensitivity Level: 1/2 1 2 3 4 N/A Other: _____

	Manufacturer	Type	Batch Number(s)	Application Method	Process Time (minutes)	
					Pre-clean Dry Time:	
Cleaner:	MAGNAFLUX	SKC-S	20L01K	DAMP CLOTH	5MIN	Penetrant Dwell Time: 10 MIN
Penetrant:	MAGNAFLUX	SKL-SP2	18LO4K	BRUSH		Emulsifier Time: N/A
Developer:	MAGNAFLUX	SKD-S2	21J046	SPRAY		Developer Time: 10 MIN
Emulsifier:	N/A	N/A	N/A			Post Clean Method: N/A

Developer Form: a. Dry Powder b. Water Soluble c. Water Suspended d. Nonaqueous Wet e. Specific Application

Penetrant Removal Method & Dry Time SKC-S DAMP CLOTH @ 5MIN	Black Light (Model and S/N) N/A	White Light Source L.E.D. FLASHLIGHT
--	------------------------------------	---

Original Repair Material & Thickness C/S Test Temperature 67 F

Surface Condition
 As Welded As Ground As Cast Rough Machined Final Machined Meets Code Requirements

Test Results	Quantity Inspected: 4	Quantity Accepted:	Quantity Rejected: 4
---------------------	-----------------------	--------------------	----------------------

RED DYE PENETRANT INSPECTION PERFORMED ON THE FOLLOWING:
 DESCRIPTION: (2022022) COUPLINGS- LUG WELDS
 WELD I.D.: A1(REJECTED)--UNDERCUT,LACK OF FUSION
 WELD I.D.: A2(REJECTED)--UNDERCUT,LACK OF FUSION

 WELD I.D.: B1(REJECTED)--UNDERCUT,LACK OF FUSION
 WELD I.D.: B2(REJECTED)--UNDERCUT,LAC K OF FUSION

The content of this document may be defense article/service related as described and controlled by International Traffic in Arms Regulations (ITAR)(22 CFR 120-130). Distribute only to entities meeting ITAR requirements. Discard by shredding. At no time during testing did these parts or material come into contact with mercury.

Technician Name, Level & Date CHRIS DADDONA LVL.II 12-13-2022 Customer (if applicable): _____ Reviewed By (if applicable): _____

Bolt-Style Coupling (pressures > 3 psig)

This form will be completed when LG&E or LG&E contractors expose a bolt-style coupling in a system where the pressure is > 3 psig (medium and high-pressure distribution and transmission) and the coupling will be backfilled. The purpose of the form is to provide Operations, Engineering and Gas Regulatory personnel with information about the bolt style coupling installation.

Part A- Discovery of Coupling

Precautions:

1. Stop excavation upon discovering the bolt-style coupling in the excavation
2. Set-up a perimeter around the excavation to keep the public away from the excavation

General Information:

1. Contact Employee for the bolt style coupling found: **Lee Perry**
2. Date of exposure: **11/11/2022**
3. Location: **26th & Bank St. Louisville, KY 40212**
4. Size of coupling (based on pipe size if not exposed enough to determine): **6"**
5. Type of soil: Sandy Clay Gravel Topsoil Other (take picture and describe)
6. Soil Density test: Type A Type B Type C
7. Status: Removed Abandoned in place Backfilled- left in service
8. Discovery Method: Leak on Coupler Other Maintenance Excavation Facility Replacement
 Facility Retirement Other:
9. Pressure Class: **High Pressure**

Pictures:

1. Take at least two pictures of the coupling. The pictures should be from different angles (additional pictures can be taken).
2. Email pictures to supervisor. Ensure pictures are attached to this form:

Sketch: Provide a sketch showing the coupling orientation (vertical/horizontal), nearby branches, pipe, valves and fittings, other utilities or structures, etc.

Leak Survey:

1. Use an instrument designed to detect natural gas to check for the presence of natural gas after backfilling the excavation. Include readings in the above sketch in relation to the coupling. If the contact employee is not leak survey qualified, they should contact:
 - a. Their supervisor to call Gas Regulatory to complete the survey after the excavation is backfilled. Call [REDACTED]
 - b. If Gas Regulatory is not available contact Gas Dispatch to have the survey assigned to a Gas Trouble Technician.

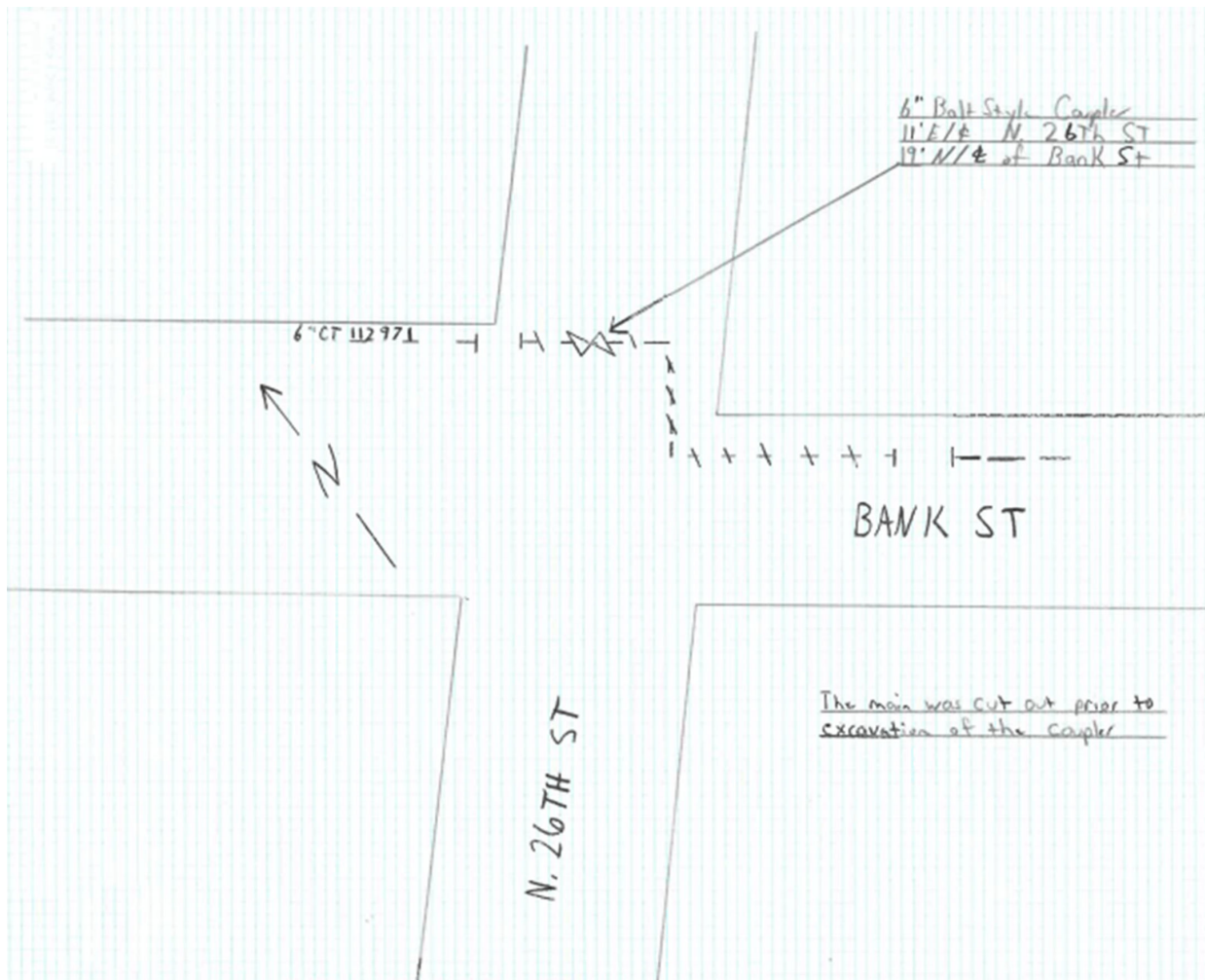
Leak Survey completed at time of backfill (circle one) yes no not applicable

Include completed form in the main report and email a scanned copy of the completed form (back and front) to the DIMP group at [REDACTED]

Field Pictures



Sketch



Safety Briefing

Date: 11/22/2022

Employee Name	Employee ID
Sarah Nicholson	
Ethan Hinkson	

Hazards Identified	
<input checked="" type="checkbox"/>	Sharp edges on cut pipe ends. Wear gloves when handling.
<input checked="" type="checkbox"/>	Pinch points on couplings. Wear gloves when handling.
<input checked="" type="checkbox"/>	Some couplings samples are heavy. Use a partner to assist with moving. Use proper lifting techniques. Wear hard toes shoes.
<input checked="" type="checkbox"/>	Debris may on samples. Wear eye protection.
<input checked="" type="checkbox"/>	Tripping hazards on floor. Keep area clean and free of tripping hazards

PPE Required	
<input checked="" type="checkbox"/>	Hard toed shoes
<input checked="" type="checkbox"/>	Safety glasses
<input checked="" type="checkbox"/>	Gloves (leather preferred)

Part B- Coupling Information

General Information		Tracking #: 2022-021	
PO Number 1124937	Expense Org 004610	Project 158276	Task COUPLER
Address/Location N 26 th St. @ Bank St. Louisville, KY 40212			
Size 6-inch	Material STL	Coating MW	MAOP 99 PSIG
Main/Service Number 112971	Soil Type (from Part A) Sand	Manufacturer Dresser	Model Style 39
Pipe Connection:	Steel to Steel	Steel to Plastic	Plastic to Plastic

Historical Information	
Installation Date August 10, 1951	Document Source Quest
Installation Company N/A	Document Source
Foreman C. Young	Document Source Quest
Welder N/A	Document Source

GIS Information
Sys Id (of Coupler) 1001926668
Screen Capture

Pictures (Label the following parts before taking pictures.)

version 7.0 (10/27/2020)

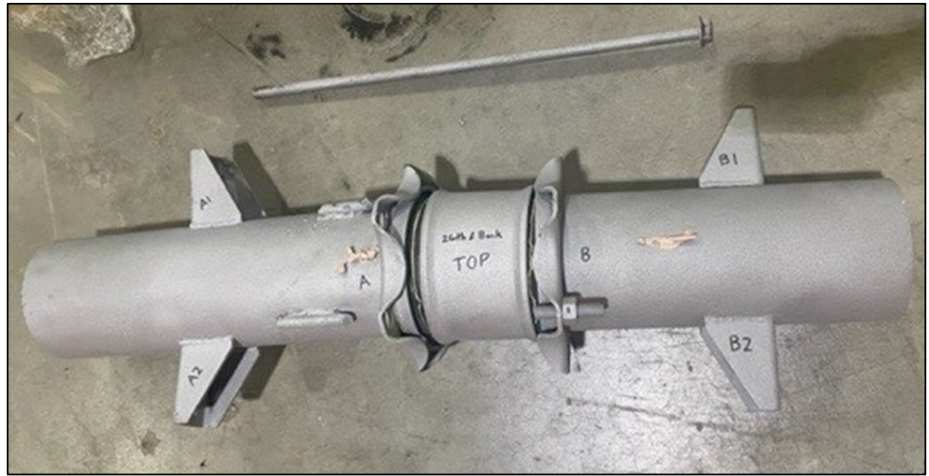


Figure 1 2022-021 Coupling



Figure 2 Coupler Top View



Figure 3 Lugs - Pipe Side A



Figure 4 Lugs - Pipe Side B

Part C- Visual Inspection of Coupling

Visual Inspection Performed by: Ethan Hinkson Date: 11/22/2022

Table 1- Component Quantities

Number of Bolts on Coupler Body	1
Number of Reinforcement Rods	1
Number of Lugs	4

Table 2- Corrosion

	Pipe A	Pipe B	Coupler Body	Bolts	Rods	Lugs	Nuts
General External Corrosion?	Yes	-	-	-	-	-	-
Localized External Corrosion?	-	-	-	-	-	-	-
Pits Present?	-	-	-	-	-	-	-
Internal Corrosion?	-	-					

* If Pits are present take maximum depth measurements and put in the Additional Comments section.

Table 3- Coupler Body

Bolt	Washer Present	Nut present?
1	N/A	Yes
2	-	-
3	-	-
4	-	-
5	-	-
6	-	-

Table 4- Reinforcement Rods

Rod	Length (in.)	Diameter (in.)	Washer present at head of bolt?	Washer present at end of bolt?	Nut Present? Type?	Type of rod?
1	26 ¼"	0.67"	Yes	N/A (cut off)	Square	Standard

Type of Lug

version 7.0 (10/27/2020)

(Please indicate the shape of the lug by circling one below. If the lug shape is different than any preset shape below, sketch the shape.)

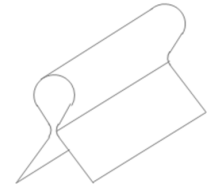
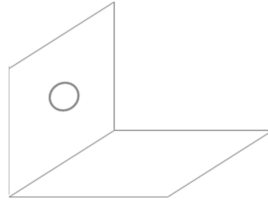
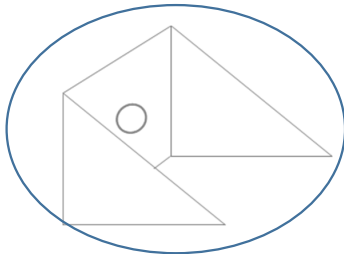


Table 5- Lugs (Measurements)

Pipe Side	Lug Number	Thickness (in.)	Circumference (in)	
			Distance to next lug, clockwise	Distance to next lug, counter-clockwise
A	1	0.23"	6 ¾"	8 ¼"
A	2	0.23"	8 ¼"	6 ¾"
B	1	0.23"	7 ¼"	8"
B	2	0.23"	8"	7 ¼"

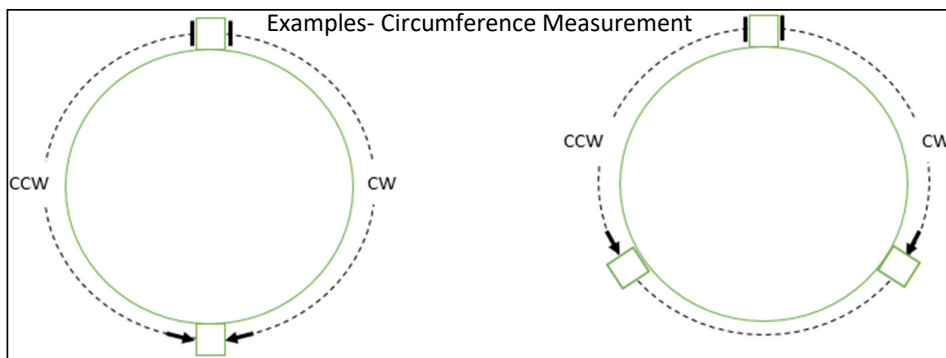


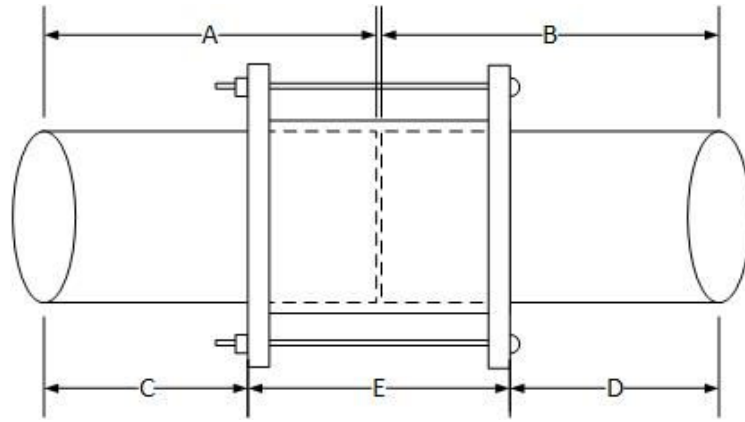
Table 6- Lugs (Observations)

Lug	Lug	Assembly sets aligned?	Deformed?	Deflected? (angle of)
A1	B1	No	N/A	N/A
A2	B2	No	N/A	N/A

Table 7- Lugs (Weld Quality)

Pipe Side	Lug Number	Any failed welds causing detachment?	Welded on all sides of exterior? If no, describe	Are welds on exterior continuous? If no, describe
A	1	No	No, only 1 weld	Yes
A	2	No	No, only 1 weld	Yes
B	1	No	No, only 1 weld	Yes
B	2	No	No, only 1 weld	Yes

Pipe Side	Lug Number	Welded on all sides of interior? If no, describe	Are welds on interior continuous? If no, describe
A	1	No, only 1 weld	Yes
A	2	No, only 1 weld	Yes
B	1	No, only 1 weld	Yes
B	2	No, only 1 weld	Yes



Not applicable; coupler disassembled

Table 8- Stab Depth

	A	B	C	D	Stab Depth (A-C) or (B-D)
Pipe Side A					0
Pipe Side B					0
	Sum of stab depths (should be closely equal to measurement E)				0
	Coupler Length (E)				
	Difference				

Additional Comments - General Observations, Pit Depths, etc.

Coupler received by DIMP cut apart with no evidence of previous failure. According to Inspection group, had to be disassembled due to other facilities obstructing removal.