

# Corrosion Protection for Welded Joints

## Overview

Welders routinely perform mechanical cleaning of weld joint surfaces to remove corrosion prior to welding two or more components together. The process is time consuming and results in irregular surfaces that can affect weld integrity, especially on pre-machined chamfers. Cortec® has received independent verification of corrosion inhibiting product(s) that can eliminate this problem.

## Solution to eliminate mechanical cleaning of weld joints

The following matrix describes the pipe and weld configurations that received independent testing. The parts were welded using the SMAW process per ASME Section IX. Mason & Overstreet performed the welding at their facility in Pearl, Mississippi.

Mason & Overstreet  
Welding & Machine Works, Inc.  
Pearl, MS 39288  
601-932-1794

<u>Product Applied</u>	<u>Pipe Tested</u>	
	ASTM A53B 4" (100 mm) Pipe	
	.250" (8 mm) thick (Sch 40)	.500" (8 mm) thick (Sch 80)
VpCI®-391 (clear)	1 piece	1 piece
EcoShield® 386 Water Based Coating (clear)	1 piece	1 piece
Base line (no coating)	1 piece	1 piece

Below are pictures of the four (4) test pieces (left) and the two (2) base line or control pieces (right).



Upon welding completion, test coupons were sent to Challenge Engineering & Testing, Inc., Mobile, Alabama, for mechanical testing.

Challenge Engineering & Testing  
4234 Halls Mill Rd  
Mobile, AL 36691  
251-666-1435

## Corrosion Protection for Welded Joints

Challenge Engineering & Testing sent sections of all test coupons to Faircloth & Roberts Metallurgical Services, LLC, in Mobile, Alabama, for macro examination of weld geometry (see Attachment 1).

Metallography results (Attachment 1) and mechanical testing (Attachments 2 – 7) showed no major differences between control parts and parts coated with either VpCI®-391 or EcoShield® 386 Water Based Coating (clear). The tensile failure for all parts exceeded the minimum requirements shown below for A53B material.

### Mechanical Properties – Tensile Requirements

<b>Seamless and ERW</b>	<b>Grade A</b>	<b>Grade B</b>
Tensile Strength, min, psi	48,000	60,000
Yield Strength	30,000	35,000

### Summary

Metallographic and mechanical testing demonstrate that the use of VpCI®-391 or EcoShield® 386 Water Based Coating (clear) on weld joints does not negatively impact the weld geometry or mechanical properties of the weld.

Application of VpCI®-391 or EcoShield® 386 Water Based Coating (clear) to components at the manufacturing site provides multi-year corrosion protection of equipment exposed to the elements. It protects from corrosion and, by leaving a clear, smooth hard surface, minimizes the ability of foreign substances to adhere to the metal. All that is required prior to welding is to wipe the surfaces with alcohol or a similar product to remove any grime present. This eliminates the need for time-consuming mechanical cleaning prior to welding and removes associated fit up issues.

## Corrosion Protection for Welded Joints

### Attachments

Number	Description
1	Macro Examination with Photographs
2	386 Sch 40 Carbon Steel Pipe A53B (coated with EcoShield® 386)
3	386 - A Sch 80 Carbon Steel Pipe A53B (coated with EcoShield® 386)
4	391 Sch 40 Carbon Steel Pipe A53B (coated with VpCl®-391)
5	391 Sch 80 Carbon Steel Pipe A53B (coated with VpCl®-391)
6	Control Sch 40 Carbon Steel Pipe A53B
7	Control Sch 80 Carbon Steel Pipe A53B

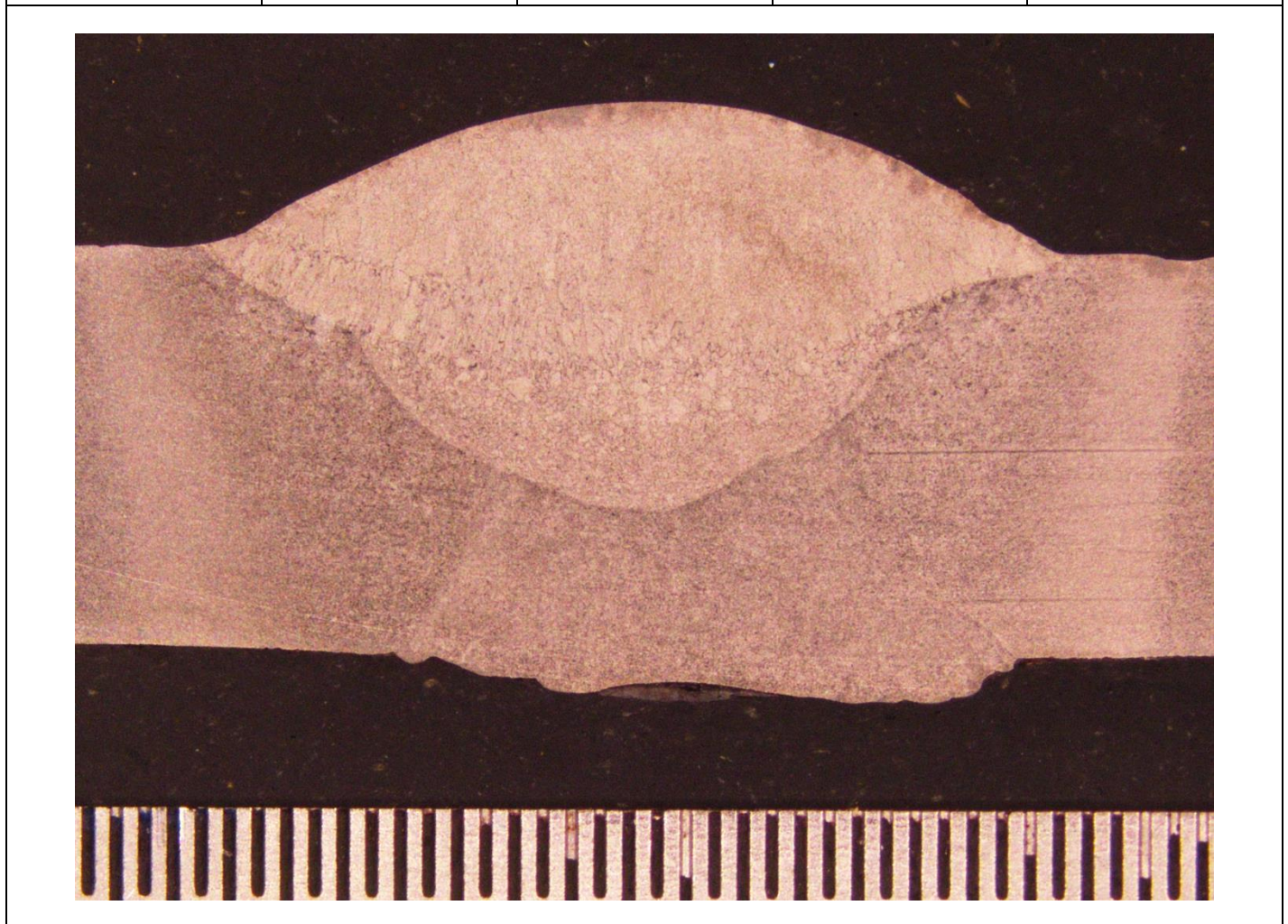


Client:  
Challenge Engineering  
4234 Halls Mill Rd  
Mobile, AL 36693

Document Number: L170913-RPT-101  
Date: 12/15/17  
Revision: 0  
P.O.: 033-51  
Material: Sch. 40 and Sch. 80 C/S Pipe  
Description: Sample #'s 386, 391, and Control

**Table 1- Macro Examination with Photograph**

Sample ID	Pipe	Weld Orientation	Etchant	Scale
70913-1-M1 (#386)	Sch. 40 C/S	Transverse	Nital	1/64 <sup>th</sup> Inch



Attachment 1





Client:  
Challenge Engineering  
4234 Halls Mill Rd  
Mobile, AL 36693

Document Number: L170913-RPT-101  
Date: 12/15/17  
Revision: 0  
P.O.: 033-51  
Material: Sch. 40 and Sch. 80 C/S Pipe  
Description: Sample #'s 386, 391, and Control

**Table 2- Macro Examination with Photograph**

Sample ID	Pipe	Weld Orientation	Etchant	Scale
70913-1-M2 (#391)	Sch. 40 C/S	Transverse	Nital	1/64 <sup>th</sup> Inch



Attachment 1



Client:  
Challenge Engineering  
4234 Halls Mill Rd  
Mobile, AL 36693

Document Number: L170913-RPT-101  
Date: 12/15/17  
Revision: 0  
P.O.: 033-51  
Material: Sch. 40 and Sch. 80 C/S Pipe  
Description: Sample #'s 386, 391, and Control

**Table 3- Macro Examination with Photograph**

Sample ID	Pipe	Weld Orientation	Etchant	Scale
70913-1-M3 (Control)	Sch. 40 C/S	Transverse	Nital	1/64 <sup>th</sup> Inch



Attachment 1



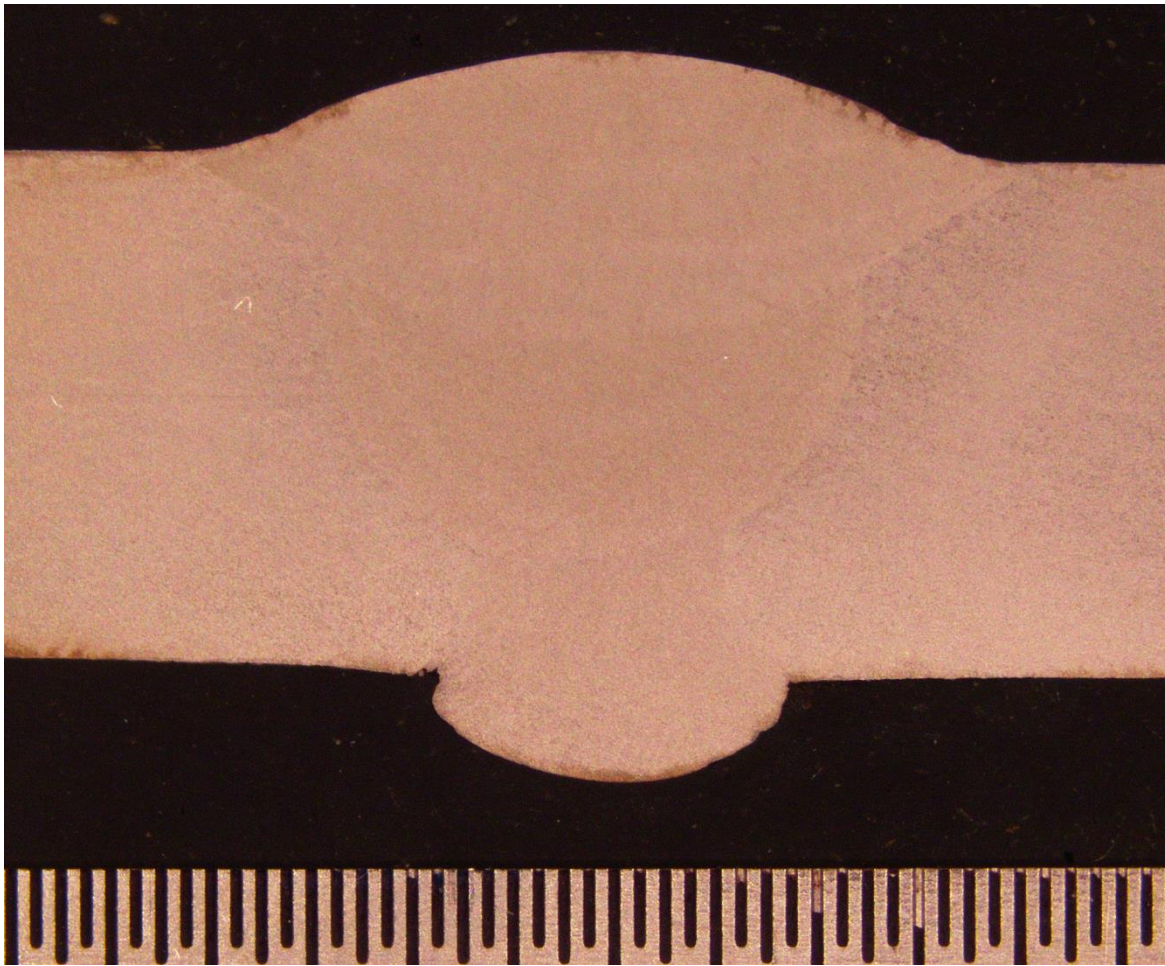


Client:  
Challenge Engineering  
4234 Halls Mill Rd  
Mobile, AL 36693

Document Number: L170913-RPT-101  
Date: 12/15/17  
Revision: 0  
P.O.: 033-51  
Material: Sch. 40 and Sch. 80 C/S Pipe  
Description: Sample #'s 386, 391, and Control

**Table 4- Macro Examination with Photograph**

Sample ID	Pipe	Weld Orientation	Etchant	Scale
70913-1-M4 (#386)	Sch. 80 C/S	Transverse	Nital	1/64 <sup>th</sup> Inch



Attachment 1

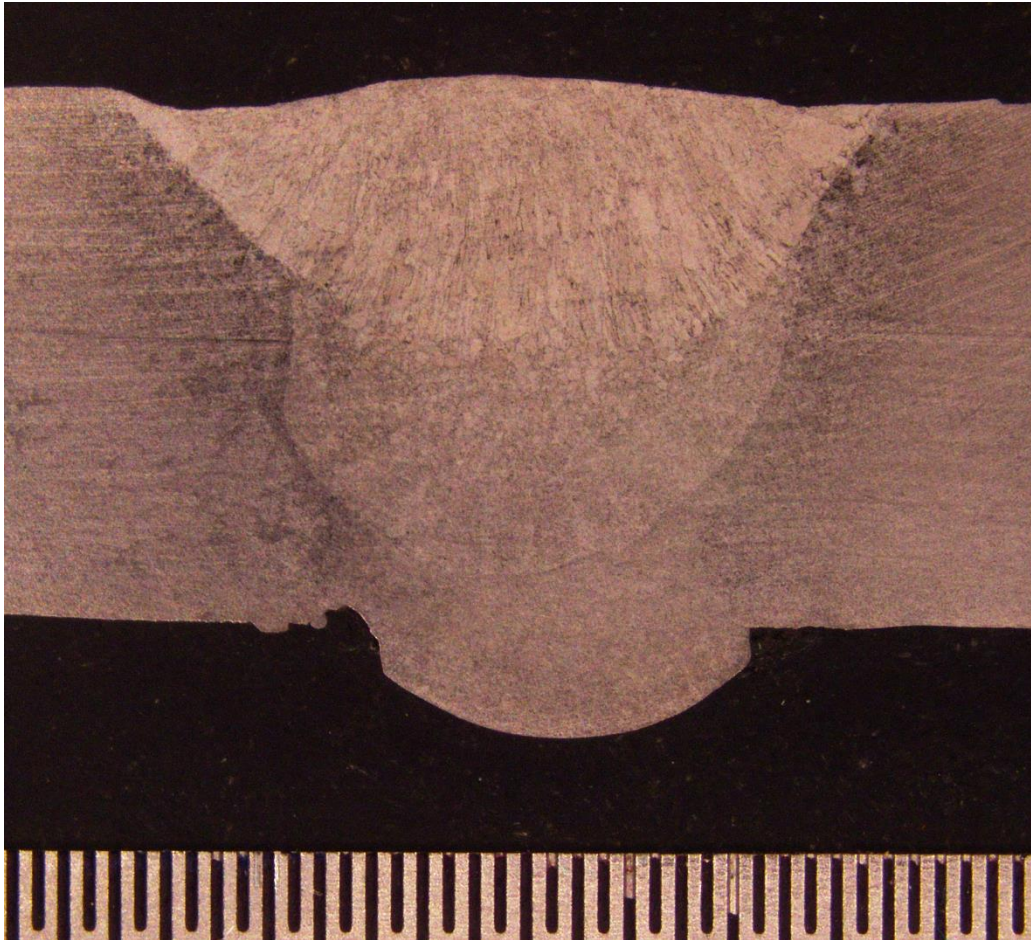


Client:  
Challenge Engineering  
4234 Halls Mill Rd  
Mobile, AL 36693

Document Number: L170913-RPT-101  
Date: 12/15/17  
Revision: 0  
P.O.: 033-51  
Material: Sch. 40 and Sch. 80 C/S Pipe  
Description: Sample #'s 386, 391, and Control

**Table 5- Macro Examination with Photograph**

Sample ID	Pipe	Weld Orientation	Etchant	Scale
70913-1-M5 (#391)	Sch. 80 C/S	Transverse	Nital	1/64 <sup>th</sup> Inch



Attachment 1

**Table 6- Macro Examination with Photograph**

Sample ID	Pipe	Weld Orientation	Etchant	Scale
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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 Faircloth & Roberts Metallurgical Services, LLC. Faircloth & Roberts Metallurgical Services will perform all testing in good faith using proper procedures, trained personnel, and equipment to accomplish the testing required. Faircloth & Roberts Metallurgical Services' liability to the client or any third party is limited at all times to the amount charged for the services provided. All samples and remnants will be discarded in 30 days from completion of tests unless FRMS is notified in writing within the 30 days. A storage fee may be required for additional storage.





# FAIRCLOTH & ROBERTS

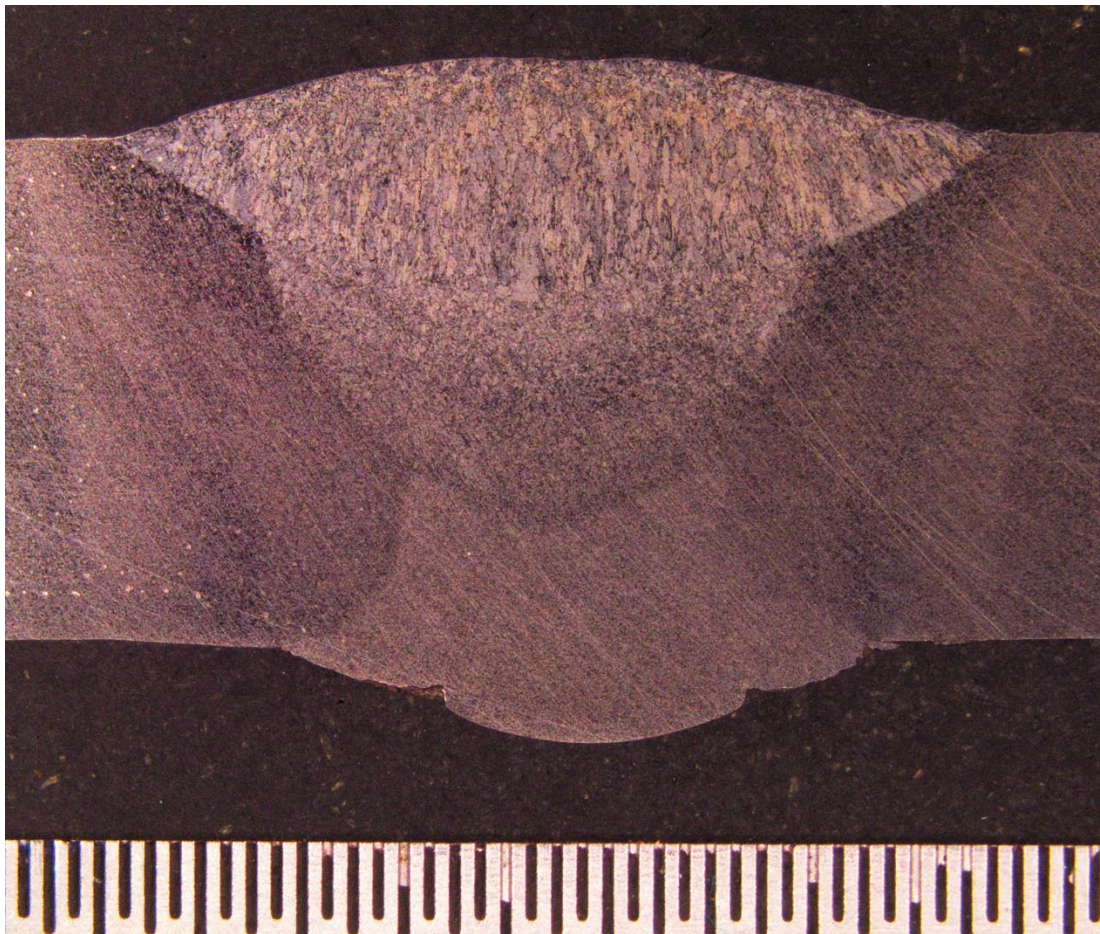
METALLURGICAL SERVICES, LLC

2508 Commercial Park Drive  
 Mobile, Alabama 36606  
 Ph: (251) 473-8389 Fax: (251) 473-8325  
 Email: info@fmsmetallurgical.com

Client:  
 Challenge Engineering  
 4234 Halls Mill Rd  
 Mobile, AL 36693

Document Number: L170913-RPT-101  
 Date: 12/15/17  
 Revision: 0  
 P.O.: 033-51  
 Material: Sch. 40 and Sch. 80 C/S Pipe  
 Description: Sample #'s 386, 391, and Control

70913-1-M4 (Control)	Sch. 80 C/S	Transverse	Nital	1/64 <sup>th</sup> Inch
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*David Roberts*

David Roberts, P.E.

Attachment 1

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(8)  
**CHALLENGE**  
**ENGINEERING & TESTING, INC.**

**WELDING PROCEDURE QUALIFICATION TEST REPORT**

<b>CLIENT:</b> Cortec Corporation	<b>JOB DATE:</b> 12 / 15 / 2011
<b>ORDERED BY:</b> James E. Holden, P.E.	<b>TECHNICIAN:</b> Leonard S. Hobson
<b>P.O. NO.:</b> I # 100364	<b>TYPE OF TEST:</b> WPQT
<b>CHALLENGE JOB NO.:</b> P17-339	<b>CODE OR SPECS:</b> APT 1104
<b>WITNESSED BY:</b> N/A	<b>DATE WITNESSED:</b> N/A

**GUIDED BEND AND NICK- BREAK TEST RESULTS**

SPECIMEN ID.	DESCRIPTION	TYPE	RESULTS
SAMPLE# 386	4" Sch. 40 Carbon Steel Pipe	Face Bend	Acceptable
	A53	Face Bend	Acceptable
		Root Bend	Acceptable
		Root Bend	Acceptable
		Nick-Break	Acceptable
		Nick-Break	Acceptable

**TENSILE TEST RESULTS**

Specimen ID	Width	Thickness	Area	Failure Lbs.	Failure PSI	Results
T-A	.679	.206	.140	9,500	67,857	Base Metal
T-B	.679	.199	.135	9,500	70,741	Base Metal
Remarks:						

Signature: Leonard S. Hobson AWS/CWT#98030041  
 Physical Laborator<sup>y</sup>Manager  
 NDE Level II



**WELDING PROCEDURE QUALIFICATION TEST REPORT**

<b>CLIENT:</b> Cortec Corporation	<b>JOB DATE:</b> 12 / 15 / 2011
<b>ORDERED BY:</b> James E. Holden, P.E.	<b>TECHNICIAN:</b> Leonard S. Hobson
<b>P.O. NO.:</b> # 100364	<b>TYPE OF TEST:</b> WPQT
<b>CHALLENGE JOB NO.:</b> PI 7-339	<b>CODE OR SPECS:</b> API 1104
<b>WITNESSED BY:</b> N/A	<b>DATE WITNESSED:</b> N/A

**GUIDED BEND AND NICK- BREAK TEST RESULTS**

SPECIMEN ID.	DESCRIPTION	TYPE	RESULTS
SAMPLE# 386-A	4" Sch. 80 Carbon Steel Pipe	Face Bend	Acceptable
	A53	Face Bend	Acceptable
		Root Bend	Acceptable
		Root Bend	Acceptable
		Nick-Break	Acceptable
		Nick-Break	Acceptable

**TENSILE TEST RESULTS**

Specimen ID	Width	Thickness	Area	Failure Lbs.	Failure PSI	Results
T-A	.682	.306	.209	15,100	72,249	Base Metal
T-B	.686	.304	.209	15,050	72,010	Base Metal
Remarks:						

Signature: Leonard S. Hobson AWS/CWI#98030041  
Physical Laboratory Manager  
NOE Level 11



# CHALLENGE

## ENGINEERING & TESTING, INC.

### WELDING PROCEDURE QUALIFICATION TEST REPORT

<b>CLIENT:</b> Cortec Corporation	<b>JOB DATE:</b> 12/15/2017
<b>ORDERED BY:</b> James E. Holden, P.E.	<b>TECHNICIAN:</b> Leonard S. Hobson
<b>P.O. NO.:</b> # I00364	<b>TYPE OF TEST:</b> WPQT
<b>CHALLENGE JOB NO.:</b> PI 7-339	<b>CODE OR SPECS:</b> APT 1104
<b>WITNESSED BY:</b> N/A	<b>DATE WITNESSED:</b> N/A

### GUIDED BEND AND NICK- BREAK TEST RESULTS

SPECIMEN ID.	DESCRIPTION	TYPE	RESULTS
SAMPLE# 391	4" Sch. 40 Carbon Steel Pipe	Face Bend	Acceptable
	A53	Face Bend	Acceptable
		Root Bend	Acceptable
		Root Bend	Acceptable
		Nick-Break	Acceptable
		Nick-Break	Acceptable

### TENSILE TEST RESULTS

Specimen ID	Width	Thickness	Area	Failure Lbs.	Failure PSI	Results
T-A	.778	.207	.161	10,900	67,702	Base Metal
T-B	.769	.207	.159	11,000	69,182	Base Metal
Remarks:						

Signature: Leonard S. Hobson AWSICW1#9803004  
 Physical Laboratory Manager  
 NDE Level II



**WELDING PROCEDURE QUALIFICATION TEST REPORT**

<b>CLIENT:</b> I Cartee Corporation	<b>JOB DATE:</b> 112/15/2017
<b>ORDERED BY:</b> I James E. Holden, P.E.	<b>TECHNICIAN:</b> I Leonard S. Hobson
<b>P.O. NO.:</b> I # 100364	<b>TYPE OF TEST:</b> I WPQT
<b>CHALLENGE JOB NO.:</b> IP17-339	<b>CODE OR SPECS:</b> I API 1104
<b>WITNESSED BY:</b> I N/A	<b>DATE WITNESSED:</b> I N/A

**GUIDED BEND AND NICK-BREAK TEST RESULTS**

SPECIMEN ID.	DESCRIPTION	TYPE	RESULTS
SAMPLE# 391-A	4" Sch. 80 Carbon Steel Pipe A53	Face Bend	Acceptable
		Face Bend	Acceptable
		Root Bend	Acceptable
		Root Bend	Acceptable
		Nick-Break	Acceptable
		Nick-Break	Acceptable

**TENSILE TEST RESULTS**

Specimen ID	Width	Thickness	Area	Failure Lbs.	Failure PSI	Results
T-A	.801	.304	.244	17,500	71, 721	Base Metal
T-B	.800	.310	.248	18,600	75,000	Base Metal
Remarks:						

Signature: Leonard S. Hobson AWS/CWI#98030041  
Physical Laboratory Manager  
NDE Level II

**WELDING PROCEDURE QUALIFICATION TEST REPORT**

<b>CLIENT:</b> I Cartee Corporation	<b>I JOB DATE:</b> I 12 ; 1S ; 2011
<b>ORDERED BY:</b> I James E. Holde P.E.	<b>TECHNICIAN:</b> I Leonard S. Hobson
<b>P.O. NO.:</b> I# 100364	<b>TYPE OF TEST:</b> I WPQT
<b>CHALLENGE JOB NO.:</b> I P17-339	<b>CODE OR SPECS:</b> I APT 1104
<b>WITNESSED BY:</b> I N/A	<b>DATE WITNESSED:</b> IN/A

**GUIDED BEND AND NICK-BREAK TEST RESULTS**

SPECIMEN ID.	DESCRIPTION	TYPE	RESULTS
SAMPLE# Control-A	4" Sch. 80 Carbon Steel Pipe	Face Bend	Acceptable
	A53	Face Bend	Acceptable
		Root Bend	Acceptable
		Root Bend	Acceptable
		Nick-Break	Acceptable
		Nick-Break	Acceptable

**TENSILE TEST RESULTS**

Specimen ID	Width	Thickness	Area	Failure Lbs.	Failure PSI	Results
T-A	.798	.304	.243	17,400	71,605	Base Metal
T-B	.798	.310	.247	18,200	73,684	Base Metal
Remarks:						

Signature: Leonard S. Hobson AWS/CW1#98030041  
Physical Laboratory Manager  
NDE Level II



# CHALLENGE

## ENGINEERING & TESTING, INC.

### WELDING PROCEDURE QUALIFICATION TEST REPORT

<b>CLIENT:</b> Cartee Corporation	<b>JOB DATE:</b> 11/2/2017
<b>ORDERED BY:</b> James E. Holden, P.E.	<b>TECHNICIAN:</b> Leonard S. Hobson
<b>P.O. NO.:</b> I# 100364	<b>TYPE OF TEST:</b> IWPQT
<b>CHALLENGE JOB NO.:</b> P17-339	<b>CODE OR SPECS:</b> J API 1104
<b>WITNESSED BY:</b> N/A	<b>DATE WITNESSED:</b> IN/A

### GUIDED BEND AND NICK-BREAK TEST RESULTS

SPECIMEN ID.	DESCRIPTION	TYPE	RESULTS
SAMPLE# Control	4" Sch. 40 Carbon Steel Pipe	Face Bend	Acceptable
	A53	Face Bend	Acceptable
		Root Bend	Acceptable
		Root Bend	Acceptable
		Nick-Break	Acceptable
		Nick-Break	Acceptable

### TENSILE TEST RESULTS

Specimen ID	Width	Thickness	Area	Failure Lbs.	Failure PSI	Results
I-A	.712	.208	.148	10,000	67,568	Base Metal
T-B	.714	.208	.149	9,950	66,779	Base Metal
Remarks:						

Signature: Leonard S. Hobson AWS/CWI#98030041  
 Physical Laboratory Manager  
 NDE Level II