STRESS ENGINEERING SERVICES INC.
an employee-owned company

13800 Westfair East Drive, Houston, Texas 77041-1101
Phone: (281) 955-2900 Fax: (281) 955-2638 Website: www.stress.com
HOUSTON • CINCINNATI • NEW ORLEANS

PRCI Co-sponsored Long-term Composite Repair Study

Year 0 Burst Test Progress Report (December 2008)

Prepared by: Chris Alexander (chris.alexander@stress.com and 281-897-6504)
Prepared for: Air Logistics (3-year study participant)
Subject: Test results for Year 0 burst test involving 12.75-inch x 0.375-inch, Grade X42 pipe. Composite repair of three samples having corrosion depths of 40, 60, and 75% relative to nominal pipe wall thickness.

Burst and Strain Gage Results

The table below lists the results recorded during the burst tests. Consider the following points reviewing the provided data.

- The pressure levels for the pipe are MAOP = 1,778 psi and SMYS = 2,470 psi.
- Refer to **Figure 1** on the attached page for the strain gage locations. Gage #4 on the outside of the repair is lined up with Gage #3 on the machined corrosion region.
- The strain gage results are in units of microstrain ($\mu\varepsilon = 10^{-6}$ in/in). Elastic stress is calculated by multiplying strain by the material's elastic modulus (i.e. 30 Msi for steel). For example, if the strain in the steel is 1000 με, the stress is calculated to be 1000 με x 30 Msi = 30,000 psi. For the composite material, the elastic modulus will be less than steel.
- The average measured composite thickness values for the 40, 60, and 75 percent samples were 0.690, 0.750, and 0.900 inches, respectively.

Corrosion Depth (%)	Pressure Level	Hoop Strain Under Repair (center)	Hoop Strain Under Repair (offset)	Hoop Strain on Outside Repair	Hoop Strain on Base Pipe	Burst Pressure (psi)
40	MAOP	1,167	1,197	675	815	4,147
	SMYS	1,999	2,088	1,005	1,084	
60	MAOP	1,879	1,894	919	924	4,090
	SMYS	3,714	3,734	1,809	1,498	
75	MAOP	2,999	3,227	1,597	864	4,291
	SMYS	5,224	5,787	2,661	1,197	

Photographs

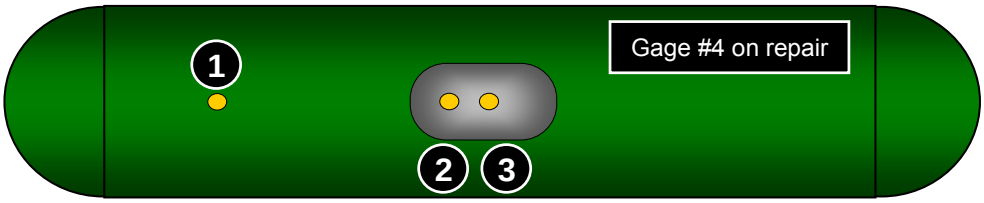
STRESS ENGINEERING SERVICES INC.
an employee-owned company

13800 Westfair East Drive, Houston, Texas 77041-1101
Phone: (281) 955-2900 Fax: (281) 955-2638 Website: www.stress.com
HOUSTON • CINCINNATI • NEW ORLEANS

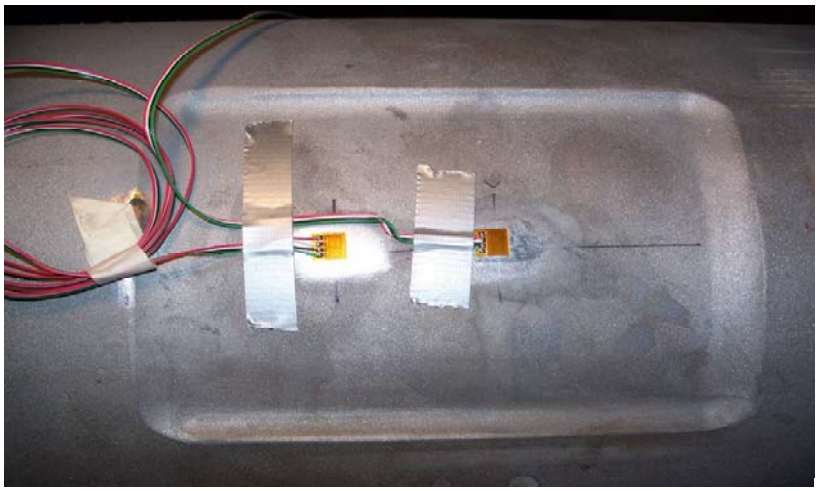
General comments

All burst test failures occurred outside of the repairs. The recorded strain gage readings were relatively low and would be considered acceptable for design conditions associated with a typical transmission pipeline system

A website has been prepared for this program (www.compositerepairstudy.com). In 2009 we will be contacting manufacturers and pipeline companies to request their participation in completing an on-line survey currently posted on the website. Information from the operator and manufacturer surveys will be important to communicate overall trends associated with using composite materials to repair pipelines. Additionally, it is expected that this website will serve as a communication vehicle for this study in the future.



Location of strain gages installed on the test sample



Photograph of strain gages installed in a machined corrosion region

Figure 1 – Details on strain gage installation

This document prepared by:

Chris Alexander

Dr. Chris Alexander, Principal
Stress Engineering Services, Inc.
December 30, 2008