The Effect of Continual Gasoline Dispensing Line Service on Epoxy Fiberglass Pipe

For nearly half a century, fiberglass reinforced epoxy and vinyl ester piping systems have been employed in the petroleum and chemical industries for corrosive service. Since problems due to corrosion take years to develop, it is incumbent upon manufacturers of fiberglass reinforced pipe to study the long-term performance of their products. Unfortunately, ittle information concerning the long-term corrosion resistance of fiberglass reinforced pipe (FRP) has been published. This study was performed to determine the corrosive effects that continuous gasoline service might have on aromatic amine-cured fiberglass reinforced epoxy pipe.

Since it is not feasible to perform long-term corrosion testing in the laboratory, the only practical way to obtain long-term test samples is to recover them from installations. This case study involves aromatic amine-cured epoxy FRP that has been in gasoline service for nearly 20 years. The pipe samples were recovered from two service stations that were being closed in the Dallas, Texas area. In this application, the pipe was used to carry gasoline from an underground storage tank to the gasoline dispenser.

The unlined epoxy FRP piping reviewed for this study was installed in the 1980's.

Pipe from the first station was tagged "24514." This station went into operation November 1, 1983 and ceased operation February 20, 2002. This was a buried pipeline conveying regular leaded, regular unleaded, mid grade premium and super unleaded fuels. The fuels were at ambient temperatures.

Pipe from the second station was tagged "26178." This station went into operation April 1, 1985 and ceased operation May 31, 2002. This was a buried pipeline conveying regular leaded, regular unleaded, mid grade premium and super unleaded fuels. The fuels were at ambient temperatures.

Both pipelines were used to transfer fuels from underground storage tanks to dispenser sumps at approximately 35 psig.

TEST PROCEDURES

The first test performed was ASTM D 1599: This is the "Standard Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe and Fittings." This test entails filling a section of pipe with water, applying hydrostatic pressure via a pump, and increasing the pressure until the test pipe fails. The failure pressure readings from this test and the pipe wall thickness are used to calculate the ultimate hoop stress.

The second test performed was to ASTM D 2290: This is the "Standard Test Method for Apparent Tensile Strength of Ring or Tubular Plastic and Reinforced Plastics by the Split Disk Method." This test requires the cutting of narrow rings from the test pipe. Two 180° steel disks are placed inside the test pipe ring. A tensile load is then applied pulling the steel disks in opposite directions until the test ring breaks. The failure load required to break the test rings and the pipe wall thickness are used to calculate the hoop tensile strength and ultimate hoop stress.

The final test performed was to ASTM D 2992: "Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for Fiberglass Pipe and Fittings". NOV Fiber Glass Systems developed cyclic regression curves for this product in the 1980's to predict long-term performance. Performing cyclic pressure tests on the test pipe will reveal how well the test pipe compares to the new "off the shelf" strength of the product.

CONCLUSIONS

Based on the results of this study, gasoline has little, if any, corrosive effect on unlined, amine-cured fiberglass reinforced epoxy pipe. The results from the short-term burst test indicate that the ultimate hoop stress of the product was unaffected by long-term gasoline service. In addition, cyclic pressure test data shows agreement with control data derived from new pipe that has not been exposed to gasoline.

*Please review Fiber Glass Systems' written warranty to determine the terms and conditions.

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TEST RESULTS

ASTM D1599 Quick Burst @ Standard Laboratory Temperature Test Results:
Average Burst Pressure . . . . 2,375 psig
Average Hoop Stress. . . . . 47,528 psig
Average Strength Retention 100%

ASTM D2290 Split Disk Method @ Standard Laboratory Temperature Test Results:
Average Hoop Tensile Load . . . . 2,527 lbs
Average Hoop Stress. . . . . 68,377 psig
Average Strength Retention 84%

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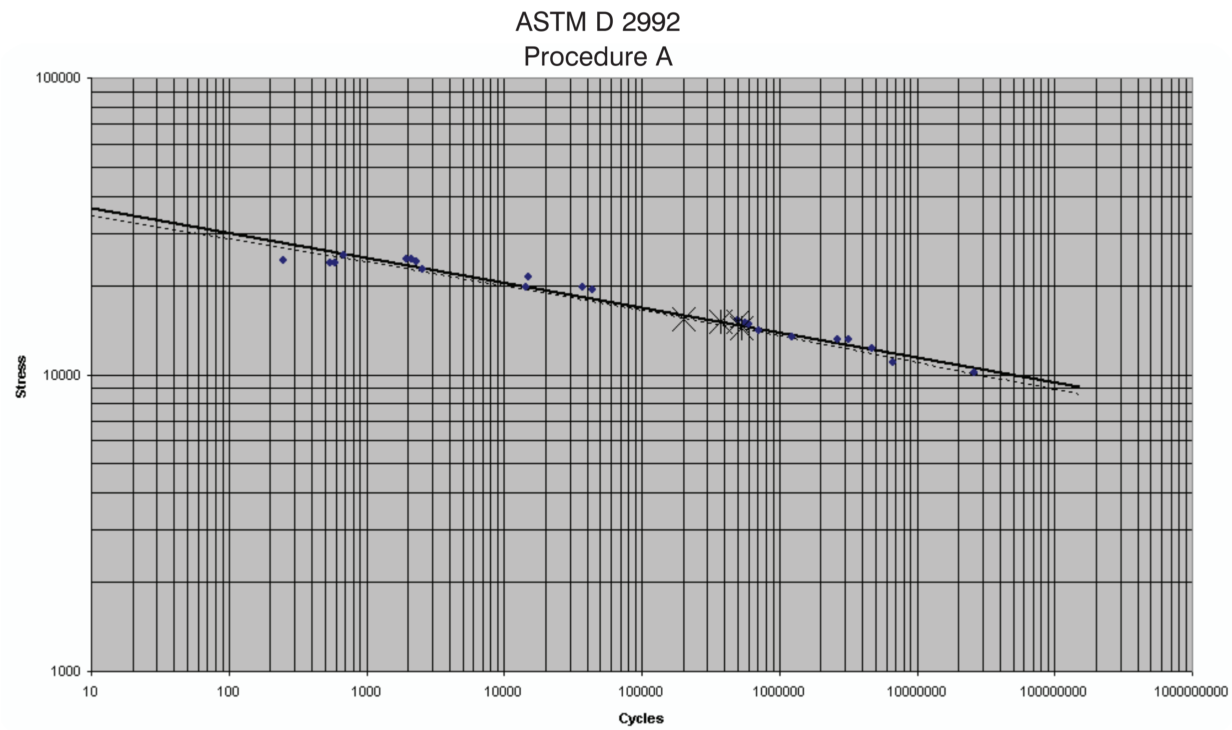
NOV FIBER GLASS SYSTEMS

ASTM D2992 Cyclic Test Results @ Ambient Laboratory Temperature:

Pipe #	Stress (PSI)	Lower Confidence Level (LCL)	Lower Prediction Level (LPL)	Actual Cycles to Failure	Results
26178#1	15,054	196,571	124,176	499,891	Pass
26178#2	15,054	196,571	124,176	375,135	Pass
24514#1	14,308	402,266	255,957	530,266	Pass
24514#2	15,321	152,630	96,290	203,096	Pass

CYCLIC REGRESSION CURVE WITH (4) DATA POINTS FROM TEST PIPE



• = Original Data Point
X= Data Point from test pipe

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