

Butt Fusion Joint Integrity & NDE Evaluation

Description: To optimize and/or validate the butt fusion process and to evaluate NDE technologies to assure butt fusion joint integrity and long term performance.

Status: The two-year project is in the data gathering and planning stages. An analytical tool to model internal and secondary stress states will be developed in early 2008.

BENEFITS

Over 40 years of in-service experience has amply demonstrated that pipe, fittings, and joints do not fail due to internal pressure, but rather these infrequent failures are a direct consequence of the combined effects of internal pressure and secondary stresses or add-on stresses including bending strain, earth loading, thermal expansion / contraction stresses, etc. As a result, there is a need to validate the overall butt heat fusion process/parameters using novel test methods that take into account actual in-

service stress states and failure mechanisms. LDCs want to ensure the long term performance of butt fusion joints. At a minimum, this should be consistent with the 50-year theoretical intended design life.

BACKGROUND

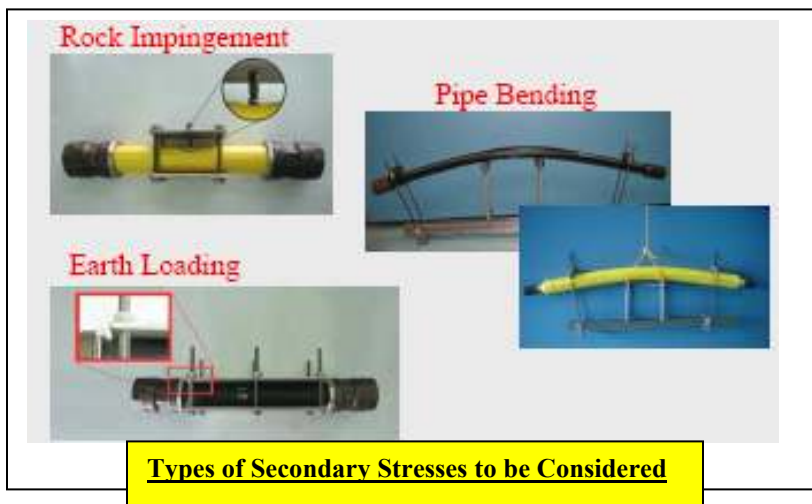
In the 1990s, the plastic Pipe Institute (PPI) and its member companies performed comprehensive tensile testing on 2-inch and 8-inch pipes from various pipe manufacturers which led to the butt fusion guidelines prescribed in PPI's standard TR-33. These results were

based on quick burst tests which were the industry standard at that time. Furthermore, ASTM and industry-accepted test requirements that are in place to characterize the long-term performance of butt fusion joints are essentially quality control tests prescribed for particular pipe specimens. These test requirements only take into account the effects of circumferential stresses due to internal pressure.

As our PE systems age and the tendency to install new PE or non-metallic systems at higher pressures (100 psi and greater) increases, there will be a need to determine joint fusion quality on a routine or periodic basis. Destructive examination will be too costly and visual examination does not always offer an optimal solution.

TECHNICAL APPROACH

This NYSEARCH project is cofunded by Operations Technical Development



(OTD) and DOT/PHMSA. It is comprised of five major tasks with Gas Technology Institute (GTI) performing the research. The five tasks are:

1) Oversight by a joint industry steering committee lead by NYSEARCH with GTI's assistance. It will consist of members from gas utility companies, regulatory agencies, and pipe/fitting and equipment manufacturers. This will ensure an objective review of the data/information that is developed.

2) An analytical model to quantify the impact of both the fusion process variables and in-service stress states will be developed. This is the first step in terms of developing the appropriate test methods to effectively characterize long-term joint performance and will be the basis for identifying and improving NDE technologies.

3) Development of a purely empirical testing approach that takes into account all critical in-service stress combinations as a result of data obtained in the analytical modeling task in task.

After evaluating all sets of parametric combinations, comprehensive testing will be performed to validate safe long-term performance over the intended design life of the joint. GTI will conduct long-term sustained pressure testing at elevated temperatures using the Rate

Process Method (RPM) or other new test methods deemed appropriate.

4) Based on results of the combined analytical modeling and empirical testing, a more proven/validated butt fusion process will be developed. As part of this task, NYSEARCH and GTI will develop suitable verbiage for future integration activities with PPI Guidelines and ASTM standards and other industry documents.

5) Poor performing joints along with properly fused joint samples will serve as the technical basis for the evaluation of a variety of NDE applications. As part of this task, several NDE technologies will be evaluated to identify "most suitable technology". Some NDE technologies that will be considered are Digital X-Ray Imaging, Ultrasonic Phased Array and Microwave Imaging.

PROJECT STATUS

The project was recently initiated and is in the data gathering and planning and lab testing developmental stages.

Highlights

- Determine integrity of sample butt fusion joints with in-service stresses.
- Validate butt fusion procedure using new analytical approaches.
- Develop a butt fusion process that assures intended service life.
- Identify NDE applications that show the most promise.
- Ensure that new or revised butt fusion procedures are incorporated into industry standards.

FOR ADDITIONAL INFORMATION

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