

Nondestructive Evaluation of PE Pipe Lap Joints Using Ultrasonic Phased Array

Description: To optimize ultrasonic phased array NDE instruments to detect and size the most common defects found in electrofusion couplings.

Status: Procedures have been optimized for PE and UPA - NDE equipment is being evaluated on a variety of defects.

BENEFITS

As our PE pipeline systems age and the tendency to operate new PE or non-metallic systems at higher pressures (100 psi and greater) grows, 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. Based on this, it is important for NYSEARCH and the gas industry to support and invest in PE inspection technologies that will reliably detect problems to help assure the integrity of pipelines now and in the future.

BACKGROUND

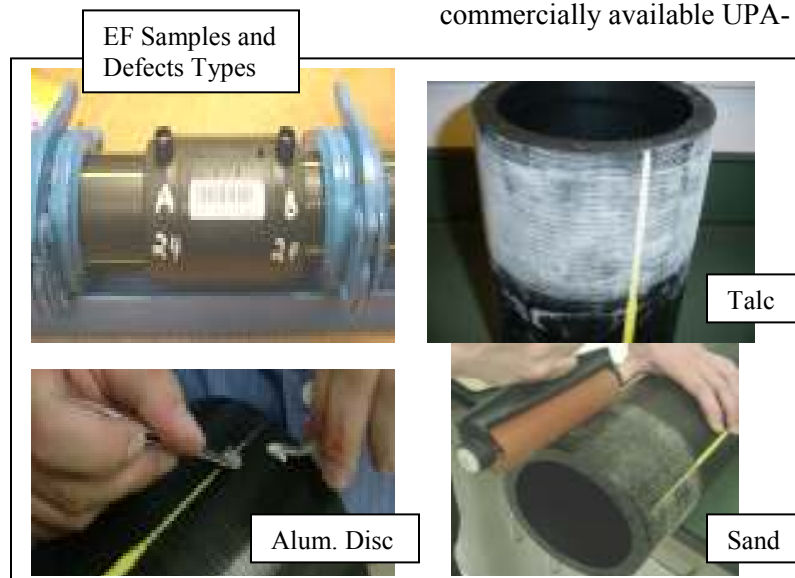
Today there is no effective means to non-destructively examine “lap type” joints (electrofuse couplings, branch or service saddles). Gas industry experience has shown that EF connection failures for PE systems are generally a rare occurrence. However, there still remains a need to develop tools to non-destructively evaluate (NDE) pipeline fittings.

In 2004, NYSEARCH commissioned Edison Welding Institute (EWI) to evaluate Ultrasonic Phased Array (UPA) techniques using the latest in commercially available UPA-

NDE instruments. EWI concluded that real-time UPA imaging system can be applied to nondestructive evaluation for EF connections and is able to detect a variety of defects such as; implanted/seeded Kapton® tape, aluminum and steel foils, and pipe compound flaws. Destructive testing showed a good agreement between UPA results and destructive tests for certain pipe flaws and contaminants. However, the instruments tested were not optimized for PE applications and were originally designed for other materials.

TECHNICAL APPROACH

NYSEARCH has teamed up with Edison Welding Institute (EWI) as the primary contractor to provide a full scale-comprehensive test program to evaluate EF fittings using ultrasonic phased array equipment that will be optimized for PE pipe and fittings. To help accomplish this, additional funding was provided through the DOT/PHMSA program. Under this program, several NDE equipment manufacturers and service providers were



invited to participate in the project.

EWI plans to optimize this technology for PE applications and incorporate these procedures into UPA instruments that are considered to be state-of-the-art. The instruments will be evaluated for a variety of PE electrofusion fitting defects /contaminants that are most likely to be encountered. The key deliverable for this project will be a complete library of defect images, types and sizes, for future analysis. Due to the scope and impact of the project, NYSEARCH and EWI have obtained support and participation from AGA, EPRI, major utilities and instrument /service providers.

The major objectives are:

- 1) Define detection and sizing capabilities of current UPA techniques for NDE inspection of EF lap joints in PE gas distribution pipelines,
- 2) Develop an optimized UPA procedure (includes hardware and software),
- 3) Validate performance of the technique and proposed improvements, and,

4) Assess the detection limits and defect-sizing accuracy using this technique.

The project involves fabricating a total of (200) samples comprised of 2" and 6" high density materials. In addition, (140) of these will not be destructively tested and will be retained for a planned future phase directed at long term integrity testing to establish and validate acceptance criteria. The major defect types to be investigated are: 1) No scraping (poor scraping and oxidation levels), 2) inadequate pipe insertion, 3) Sand/dirt/dust, and, 4) water/grease contamination.

The project workscope was extended to include a limited number of butt fusion and fusion saddle joints by using optimized UPA techniques.

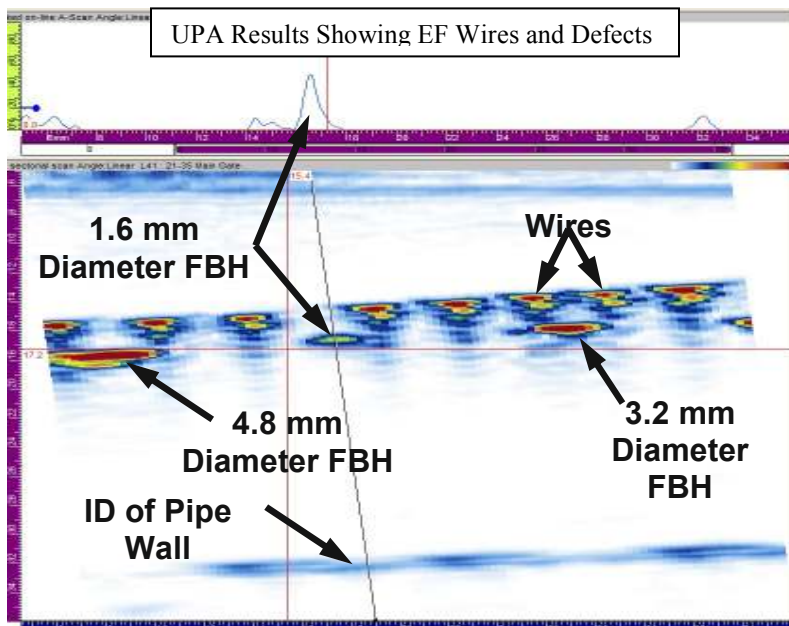
PROJECT STATUS

The project that began in 2006 will be completed by mid-2008 and is on schedule. To date, EWI, with oversight from NYSEARCH and other advisors, has completed preparation of all samples and NDE testing based on an approved matrix of defects

provided by NYSEARCH. EWI has developed and optimized a procedure for UPA equipment suppliers to apply during the test program. Both open and blind testing of several UPA tools were performed to validate the procedure and begin the process of creating the library of defects.

HIGHLIGHTS

- Develop NDE - UPA procedure and create a library of defects
- Consider 2" and 6" HD PE pipe and joints
- Establish first stage of a validated NDE acceptance criteria for these PE joints



FOR ADDITIONAL INFORMATION

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