

NDE Tool for Evaluation of Electrofusion Fittings

Description: Identify, investigate and select a non-destructive evaluation (NDE) method to evaluate electrofusion (EF) fittings on polyethylene (PE) pipe joints.

Status: Feasibility of NDE Xray technique proven and endorsed by project funders. Field tests pending.

BENEFITS

The benefit of performing Non-Destructive Evaluation (NDE) on polyethylene (PE) pipe ElectroFusion (EF) joints is to confirm the internal PE pipe ends and fitting are positioned correctly and to ensure no obvious debris has been embedded within the final joint configuration during the fusion process.

BACKGROUND

Inspecting PE EF pipe joints is an important quality control check to confirm that the fusion between the pipe and EF fitting has been properly formed and to ensure its long term performance. Currently, the extent of inspection is limited to visual observation on the final exterior joint surface due to the internal configuration of the EF joint being concealed. If each step in the preparation of the PE pipe and EF fitting could be confirmed through direct observation, then we would be able to fully assess a final EF joint's internal configuration. This would provide higher confidence in the quality of the EF joint.

There are some NDE methods available to look beyond the outer surfaces of PE pipe electrofusions. Various NDE methods provide high granularity inspection of the joined material between the PE pipe and fitting. However, many of these NDE techniques, such as phased array, ultrasonics, microwave, and Terahertz, require highly trained and experienced NDE personnel to perform the interrogation and interpret the results.

A method of NDE inspection is needed that will enable a non-NDE expert to see within the EF joint to: 1) observe the general configuration within the EF joint, 2) confirm that the PE pipe ends and the fitting were positioned correctly and, 3) to show that no obvious foreign objects have

been embedded within the final joint configuration during the fusion process.

An NDE method is needed such that it can convey the results of inspection in a practical and easily interpretable way to non-NDE experts all the while still revealing the conditions within the EF joint(s). These non-NDE experts could be experienced PE technicians and/or quality inspectors who would recognize and interpret NDE inspection results.



Figure 1: 2 Inch PE Pipe EF Joint

TECHNICAL APPROACH

The objective of the project is to identify and evaluate non-destructive (NDE) tools and instruments capable of enhanced visual inspection of electrofusion (EF) PE pipe joint interiors for assessing general assembly configuration and final fabrication.

A NYSEARCH working group developed field

application requirements for the application of x-ray inspection to be performed, which included safety protocol, training pre-requisites, and environmental concerns. In parallel, various PE EF pipe joints samples were made with specific anomalies representing typical defects that may be found within a EF joint. Samples of these typical defects embedded in an PE EF pipe joints were used to test the digital x-ray NDE instrument and provide images of the field procedures.

The working group also engaged a digital x-ray expert to aid in the development of the field application procedure. The digital x-ray expert is providing the bounding application conditions to develop an appropriate training process and operational procedure for the non-NDE expert to follow when performing inspections. Sufficient practical details on the x-ray field set up, a clear investigation process, and interpretation are to be provided to the non-NDE expert while performing an PE EF joint internal examination. Three (3) field tests at funder training facilities and/or field sites are being conducted by company crews to test and prove the field procedures for practical use and application.

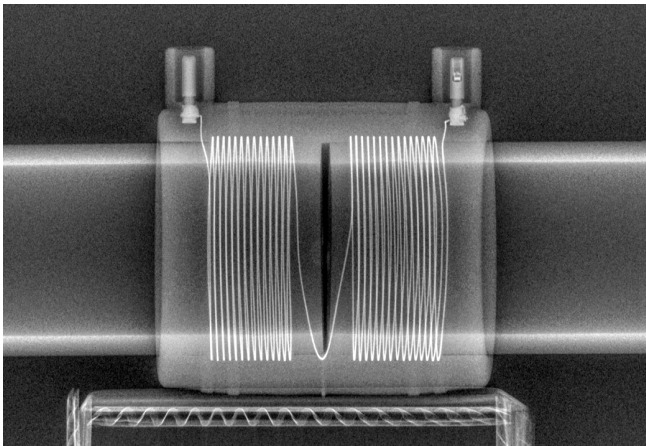


Figure 2: Internal xray view of 2 Inch PE Pipe EF Joint with symmetry of heating wire uniform and melt zones clearly indicated

The final planned task is to review all field tests for lessons learned and improvements. Also, a formal application procedure is being written along with training materials that summarize the NDE objectives developed by the working group and Subject Matter Experts (SMEs). Additionally,

a report on initial x-ray images of specific PE EF joints is being completed and reviewed to determine the effectiveness of an x-ray NDE approach.

Also, an NDE expert is being engaged to develop field training and procedures for the effective use of the digital x-ray NDE method to be performed by non-expert NDE PE technicians and quality control personnel.

PROGRAM STATUS

The project working group developed a detailed test program. The new NDE x-ray tool was utilized to inspect two (2) inch EF HD/MDPE joint samples and the results have been reviewed favorably. Currently, field test applications and training are being developed and field test NDE EF PE joint procedures are under development.

Highlights

- NDE x-ray acceptance criteria imagery provides pass/fail interrogation results
- Field testing planned for May -July 2023

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