SUCCESS STORY

Keeping Away the Cold with Foam Insulated Pipes

Ensuring quality and consistency of pre-insulated heating pipe systems on the production line

The Challenge

Centralized heating systems—such as those in large buildings or in the district heating systems used in some European communities—typically have a large heating installation or plant that generates heat for a building or for multiple homes in the district. From this central unit, a web of conduits and pipes transports the warmed air to the various living and working spaces.

The pipes that make up these networks have a layer of insulation to prevent heat loss, prevent exterior condensation and reduce the transfer of noise along the pipes. The pipes are often buried underground, making them difficult to inspect visually, so they have sensor wires connected to a central monitoring system that triggers an alarm if excessive moisture develops (signaling a potential insulation leak). They are attached to secondary service pipes that run alongside the main conduit. These integrated pipe systems are manufactured in sections and then joined together during construction, with all components and sensor wires connected to form a continuous network.

Using the X-ray testing cabinet and customized software, the Customer is able to ensure uniform product standards and maintain continuous quality control during manufacture.

For the entire heating network to function properly, efficiently and safely, it is important that each section of pre-insulated piping has consistent insulation thickness and consistent placement of the alarm wires. The Customer manufactures foam insulated metal and plastic pipe systems for these types of centralized heating systems, and needed a way to inspect the structure of each section of piping during the production process to ensure quality control and consistency.

Sections of insulated heat pipe with embedded sensors

Industry: Manufacturing / Materials

Technology: Digital Radiography

Products & Services: Material evaluation using low-energy X-ray / Component placement

Customer Profile: European manufacturer of foam insulated pipes for use in large heating/HVAC systems

Business Challenge: Inspect pipes on the production line to evaluate foam density and ensure alarm wires and sensors are properly placed before pipes are installed underground as part of community-wide heating systems

Solution: Low-energy X-ray measuring system for production-line inspection

Benefits:

- User-friendly system allows line operators to monitor and adjust production parameters in real time, ensuring consistent quality and eliminating wasted materials
- Verifying correct sensor wire placement and alignment ensures sensors will function once the pipe systems are installed underground, where they are inconvenient and costly to access for visual inspection
- Automatically documents product structure to satisfy end-customer quality requirements

The Solution

Adaptive Energy partnered with FORCE Technology to deliver a solution. A customized X-ray measuring system was designed and built that provides non-destructive testing of the pre-insulated pipes during production. The system consists of a closed cabinet with a tunnel running through the center of it.

X-ray cabinet system for testing pre-insulated heat pipe systems during production

The pre-insulated pipe system units are passed through this tunnel at the end of the manufacturing line. While in the tunnel, the pipe segments are exposed to a fan-shaped spread of X-ray beams that are emitted from two low-energy X-ray sources at a perpendicular angle from the pipe axis, making a cross-section. As the radiation beams are transmitted through the pipe cross-section, an array of sensors mounted on the opposite side measure the intensity of radiation that has passed through the pipe. The sensor signals are then processed to create a detailed map of the foam density and the structures inside the pipe casing.

The system includes an extensive software package that was tailor made for the Customer. The software allows the system to map and scale the cross-sectional positions of the heat pipe, service pipe and alarm wires, and measure the foam density.

Results

Using the X-ray testing cabinet and customized software, the Customer is able to ensure uniform product standards and maintain continuous quality control during manufacture. The system has a quick start-up time, is intuitive for production line employees to use easily, and provides automatic feedback signals allowing an operator to make adjustments as needed and prevent waste of raw materials.

The software also automatically captures the cross-sectional testing results to document and verify product quality for the company's customers: the heat plant operators and municipalities who rely on these pre-insulated pipe systems to serve the residents of their communities through many cold winters.

About Adaptive Energy

Adaptive Energy creates customized, non-destructive material evaluation solutions to address mission-critical, time-sensitive testing needs. By combining the latest digital radiography, computed tomography, and ultrasonic imaging technologies with innovative mechanical and robotic assemblies, Adaptive Energy's integrated systems offer rapid deployment, are easy to learn and maintain, and perform reliably under pressure.

Working collaboratively with organizations in the aerospace, automotive, energy, petro-chemical, defense, infrastructure, and materials industries, our experts develop optimized solutions for flaw and crack detection, composite delamination, weld inspection, hardness testing, custom radiation enclosures and overhead gantry systems, and more.

Adaptive Energy is also the exclusive distributor in the U.S. and Canada of FORCE Technology's P-Scan ultrasonic scanners, including the P-Scan Stack with Phased Array, a next generation automated inspection system.

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