MISTRAS A World of NDT Solutions | Services Division

Application Brief

Automated Thickness Measurement using Line Scanning Thermography (LST)™

Introduction

MISTRAS Services is dedicated to developing and providing innovative solutions to the power and paper mill industry that yields increased productivity and more accurate inspection results in order to allow utility employees to operate their plants safely and more efficiently. MISTRAS Services utilizes advancements in technology and our research scientists to enhance speed and accuracy developments.

Current Condition

Many power plants and paper mill facilities experience leaks and failures in their boiler systems due to internal deposits and external corrosion. Corrosion occurs when deposits are collected on the exterior or interior surfaces of boiler tubes creating a potential corrosion cell. Currently, spot ultrasonic thickness readings on a sample basis (customer based incremental heights), using handheld thickness gages, are performed to identify potential problem corrosion areas. This normally requires a crew of approximately 6-10 employees depending on the size of the boiler. Ultrasonic readings are either manually documented or uploaded to a computer software program that maps the testing results.

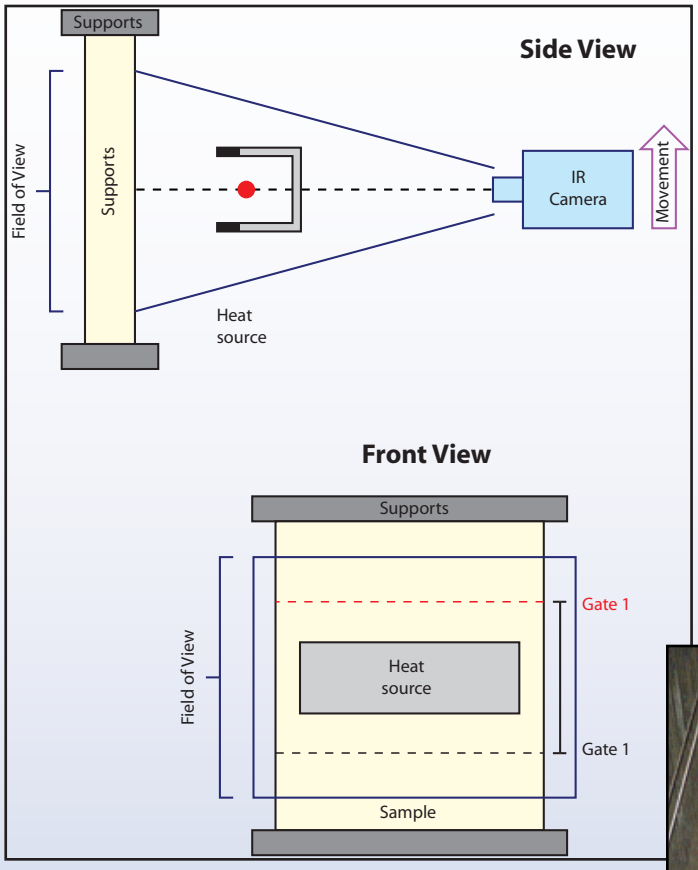
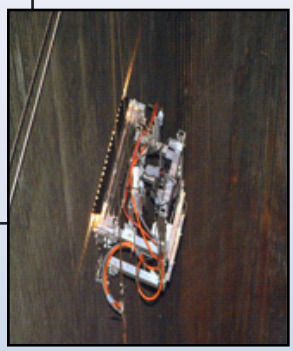


Figure 1. *Set up of LST™. Top figure shows the side view and bottom figure shows the front view. Compared with Flash thermography, in LST™ the camera and heat source move along the sample and the IR camera images a region of the sample.*

Application Solutions

MISTRAS Services, with the support of our Software and Systems division, has developed an inspection methodology that quickly determines the integrity of boiler systems by paying special attention to failure concerns. Using Infrared Automated Thickness Imaging with LST™, MISTRAS Services comprehensively inspects large areas of the boiler using topographical maps and qualitative data, enabling us to map out tubes for preventative failure analysis. This approach utilizes a combination of visual inspection, automated ultrasonics and infrared thermography to identify and evaluate problem areas. It offers owners the benefits of globally inspecting boiler systems more rapidly along with yielding more quantitative and qualitative data. Specific areas of the boiler are identified to be inspected while no follow up manual ultrasonic inspection is required. Ultimately, this comprehensive approach allows owners to continue to operate their boiler systems with the confidence that they have thoroughly evaluated a complete wall instead of predictive inspection with typical industrial "Boiler Striping" inspections.



The LST™ method of inspection utilizes a camera and a portable heat source. The heat source is moved vertically over the area to be inspected thus capturing the thermal data emitted from the material as it thermally reacts to the heat source (See Figure 1). Initially, a wall wash down of the boiler system is performed. This includes a boiler cleaning that removes any surface scale, and the application

of a thermal coating to allow for even surface heating during the thermal scans. Next, LST™, utilizing Infrared Thermography, is performed in order to determine specific areas of concern for evaluation. The inspection allows us to scan large areas

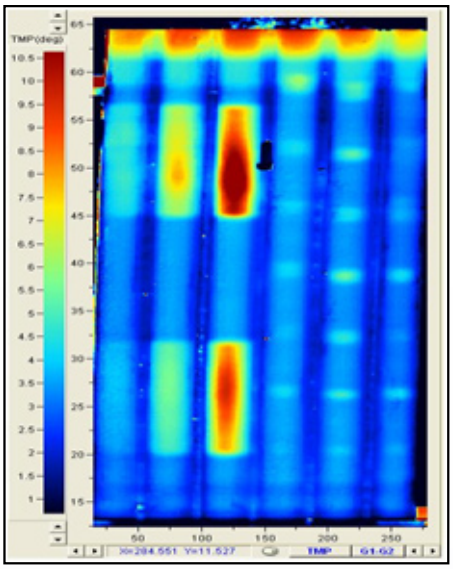


Figure 2. *Thermal Image of scanned Boiler Water Wall Tubes.*

with a scanning rate of up to three inches per second. The Thermal image data is captured in a real time scan with a field of view eighteen inches wide (See figure 2).

The thermal images from the scans are analyzed to look for trending of the scanned surfaces. The data is presented using a customizable palletized pattern based on the owner's preference. In addition, the data is presented in a numerical thickness format that is exported into a data management program that further enhances qualitative trending. This process is performed by examining each tube separately or as a group (See figure 3). The ability to generate images utilizing the IR camera data that correspond to the thermal history of the entire sample constitutes the main advantage of line scanning thermography, as compared to flash or pulsed thermography.

In LST™ the movement of the source and the thermal camera in tandem allows the study of long samples ensuring uniform heat deposition, which is difficult to achieve with flash thermography or other dynamic thermographic methods that analyze a section of a large sample at one time.

Accurate thickness determination depends on a sound calibration procedure (i.e. the selection of several spots with thicknesses covering the maximum and minimum thickness in the sample) and the utilization of an image with good thermal contrast, i.e. a large intensity difference (or gray scale difference) between the brightest and darkest values encountered in the image. Due to the tube geometry, there is a 5% reduction in thickness accuracy based on the measured thickness used. The minimum defect size detectable in any thermography technique, including Line Scanning Thermography, depends on three main factors: (1) the camera sensitivity, (2) the thickness of the material studied and its thermal properties, and (3) image post processing, which is distinctive of the thermography technique.

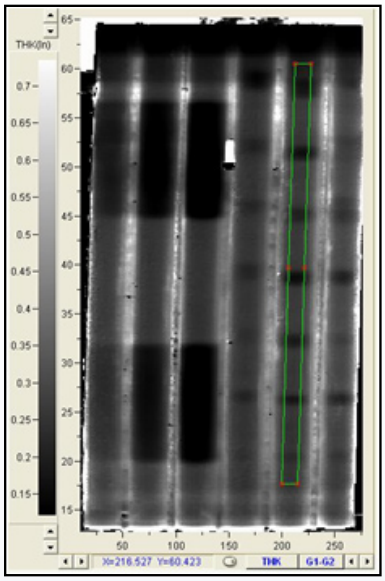


Figure 3. *Statistical box for export data.*

MISTRAS Services, a member of MISTRAS Group, Inc., is team of skilled researchers, engineers, technicians and manufacturing personnel dedicated to the development of practical and cost saving solutions to your challenging inspection needs.

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