MISTRAS
A World of NDT Solutions
Products & Systems Division

**Application Brief**

# Line Scanning Thermography (LST)™

***A dynamic thermography technique that reduces inspection time.***

## Introduction

Line Scanning Thermography (LST)™ is a dynamic thermography technique successfully applied to the inspection of metallic surfaces and composites. LST™ has been used to estimate material thickness and indicate thinning patterns In metallic panels and plates. In composites, LST™ has been used to detect the presence of defects such as delaminations, impact damage and the presence of inclusions or voids. Thanks to a patented analysis procedure, LST™ is capable of inspecting large areas in minimum time.

LST ™ is another non-destructive inspection technique offered by MISTRAS Group's Products & Systems Division, making it possible to find defects hidden inside structural components.

## LST™ Technology

In LST™, a line of heat is focused on the surface under inspection. The width of the heat source or line is dictated by the scanner used, Figure 1 shows a picture of our THELIS-P scanner with an inspection width of 10 inches. In LST the heat source is moved across the sample's surface at a constant speed and an infrared imager is used to record the temperature changes in the surface during the heating protocol. The IR detector moves in tandem with the heat source and the imager's field of view is set to contain a region above and below the location where heat is deposited (see Figure 2). Temperature recorded from the unheated region provides information related to the baseline or initial temperature distribution of the sample. The temperature recorded in the heated region is used to analyze the cooling behavior after heat deposition detecting the presence of defects or material property changes.

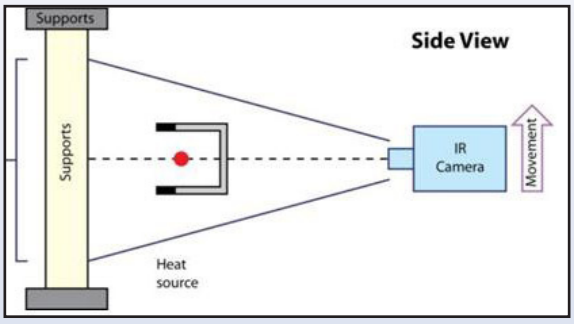



*Figure 2. Diagram showing the main components involved in an LST system, such as IR imager, surface to be scanned and heat source.*

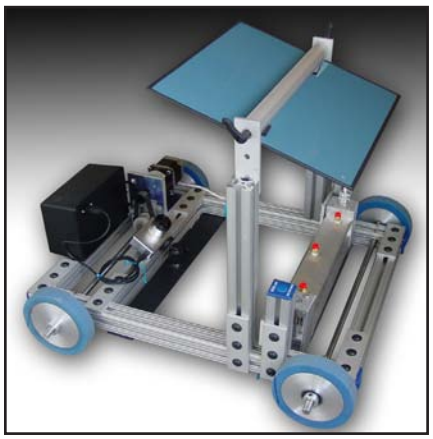


*Figure 1. THELIS-P (Thermography Line Inspection System -Portable), developed to use the LST™ technique to inspect several feet of flat laminate composite samples.*

The dynamic heat application is used to reveal the presence of defects, cracks, voids or local changes in material (thermal) properties. This is possible because a region containing a void, crack or defect will diffuse the applied heat at a different rate than a good region. A crack or void will be observed as a region with higher surface temperature or as a region that diffuses heat at a slower rate than the undamaged region.

The thermal signature detected with the IR imager depends on the transmitting medium, its thickness, its temperature, the distance between the surface in consideration and the heat source, as well as the optical properties of the surface such as emissivity and reflectivity. Depending on the magnitude of these quantities, the need for applying a coat of non-reflective paint might be necessary.

## Advantages of LST™

- Automated lateral motion provides heating uniformity and allows image processing capabilities that improve detectibility among defect region, image noise and sound area.
- LST™ is capable of large scale inspection without loss of resolution.
- LST™ can be used to analyze materials with directional properties.
- LST™ is capable of inspecting large areas at high scan speeds.
- In LST™, the inspection data is immediately available for analysis once the scan is completed.

## Detectability of Thinning in Boiler Tubes

LST ™ has been used successfully to determine thickness of boiler tubes; the technology can also be applied to inspect metallic plates or shells. During the inspection, a reduction in the thickness will be observed as a hot spot in the surface and the increase in temperature is associated to a thickness measurement. Figure 3 shows the calculated thickness map of the surface scanned. The thickness map is readily available immediately after the scan is completed. T he scan presented in this thickness map extends 50 inches in length and 18 inches in width (a total of 900 sq in), is obtained in 25 seconds. The numbers shown in the image indicate the percentile reduction in nominal thickness of the sample scanned.

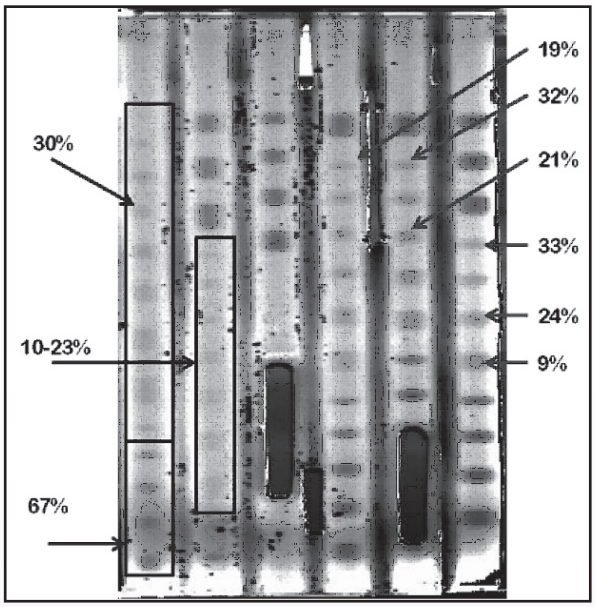



*Figure 3: Thickness map obtained after performing a scan of a section of a boiler wall. In this image darker areas are associated to thickness reductions. The map generated provides the thickness at every point of the area scanned.*

MISTRAS Products & Systems Division is a team of skilled researchers, engineers, technicians and manufacturing personnel dedicated to the development of practical and cost saving solutions to your challenging inspection needs.

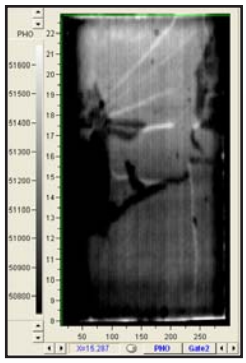
For a demonstration or additional information, please contact our Princeton Junction headquarters at 609-716-4000.

## Other applications of LST™

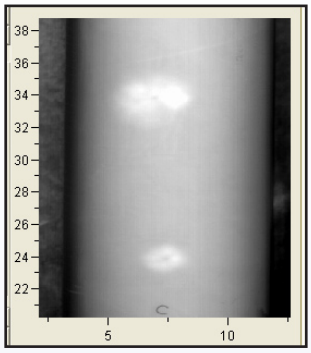
The LST™ technique has been applied to inspect composites and a variety of materials such as fiber reinforced plastics, concrete surfaces and in general materials that will react to thermal excitation evaluation. Figure 4 shows several examples regarding these applications.

*Figure 4: Below are examples of different successful applications of LST ™ for the inspection of non-metallic materials.*

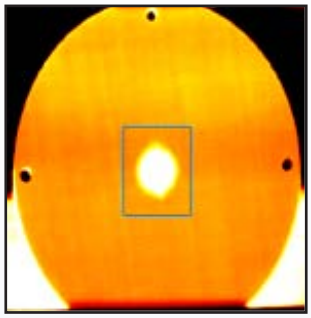
*Delamination between a 3mm-thick fiber reinforced composite and a concrete substrate.*



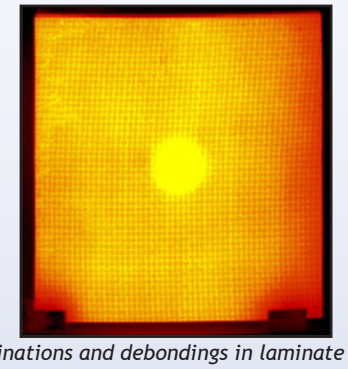
*LST™ detects delaminations between skin and honeycomb and the presence of humidity ingress.*




*LST™ detects delaminations in composite cylinders produced by impact damage.*



*LST™ detects heat damage in a laminate composite.*



*LST™ detects delaminations and debondings in laminate composites.*

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