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Standard Practice for Use of a Calibration Device to Demonstrate the Inspection Capability of an Interferometric Laser Imaging Nondestructive Tire Inspection System[1]

This standard is issued under the fixed designation F 1364; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ε1 NOTE—3 was modified editorially in March 1998.

1. Scope

1.1 This standard practice describes the construction and use of a calibration device for demonstrating the anomaly detection capability of interferometric laser imaging nondestructive tire inspection system. A common practice within the industry is to refer to these systems as shearographic/holographic (S/H) systems.

1.2 This standard practice applies to S/H systems that are used for evaluating the structural integrity of pneumatic tires, (for example, presence or absence of anomalies within the tire).

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Adjuncts:
Straining Block Drawings[2]

3. Terminology

3.1 *Definitions:*

3.1.1 *analysis*, *n*—an act of inspecting the S/H image and associating this image with a known calibration reference. **F 538**

3.1.2 *anomoly*, *n*—a change in the strain pattern of the rubber surface of a straining block as a result of applied stress brought about through a change in atmospheric pressure on the rubber surface. **F 538**

3.1.3 *shearogram/hologram*, *n*—the common term for an interferometric image provided by S/H systems. **F 538**

3.1.4 *shearographic or holographic (S/H) systems*, *n*—a shearographic or holographic system using interferometric laser imaging to nondestructively inspect tires. **F 538**

3.1.5 *straining block*, *n*—a rigid aluminum test block with a rubber surface on one side capable of simulating an anomaly in a tire (see Fig. 1). **F 538**

3.1.6 *straining block holding fixture*, *n*— a device for holding one or more straining blocks in the S/H system during the calibration process (see Fig. 2). **F 538**

4. Summary of Practice

4.1 The straining block (Fig. 1) is designed to create an image of a known anomaly against which the performance of the S/H system may be evaluated. This image is created when the rubber, which is affixed to the outer surface of the block, is stressed by a vacuum. The interior of the block is vented to atmospheric pressure through the calibration hole, thus allowing a differential pressure on the rubber.

4.2 The size of the holes in a straining block can be used to determine the sensitivity of the S/H system. Generally, larger holes are more readily detectable. However, it is possible for a poorly calibrated S/H system to detect some small holes and miss very large ones. Therefore, the calibration holes in the straining blocks vary between diameters of 1 mm (0.04 in.) and 100 mm (4 in.). The straining blocks contain multiple calibration holes. A drawing of the straining blocks is shown in Fig. 1.

4.3 These straining blocks shall be placed in a series of locations within the S/H system to confirm the detectability of anomalies over the entire field of view within the S/H system. An example of a typical straining block holding fixture is shown in Fig. 2.

4.4 By studying the presence and clarity of the fringe patterns obtained from each straining block an assessment of machine calibration may be made. Adjustments such as optical alignment, laser power, vacuum level, beam ratio modifications, multiple exposure, viewer maintenance and other alterations shall be made to optimize the ability to detect the various hole sizes in the straining blocks.

5. Significance and Use

5.1 All S/H systems degrade with time and use. Therefore, a calibration procedure for evaluating the operation of an S/H system is desirable. This calibration procedure provides a method of obtaining an optimized interferometric image pattern associated with a given size anomaly.

[1] This practice is under the jurisdiction of ASTM Committee F-9 on tires and is the direct responsibility of Subcommittee F09.10 on Equipment, Facilities, and Calibration.

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[2] Available from ASTM Headquarters. Order PCN 12–613640–20.