



AEROSPACE STANDARD

AS4787™**REV. A**

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Superseding AS4787

(R) Eddy Current Inspection of Circular Holes in Nonferrous Metallic Aircraft Engine Hardware

RATIONALE

AS4787A is an extensive revision of this Aerospace Standard resulting from a Five-Year Review and update.

AS4787A has been reaffirmed to comply with the SAE Five-Year Review policy.

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1. SCOPE

1.1 Purpose

This SAE Aerospace Standard (AS) establishes minimum requirements for eddy current inspection of circular holes in nonferrous, metallic, low conductivity (less than 5% IACS) aircraft engine hardware with fasteners removed. The inspection is intended to be performed at maintenance and overhaul facilities on engine run hardware.

1.2 Application

This standard has been typically used to inspect for service-induced surface and near surface cracks, but usage is not limited to such applications.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 U.S. Military Specifications and Standards

Copies of these documents are available at <http://quicksearch.dla.mil>.

A-A-59474 Insulation Tape, Electrical, High Temperature, Polytetrafluoroethylene, Pressure Sensitive

2.1.2 ANSI Accredited Publications

Copies of these documents are available online at <http://webstore.ansi.org/>.

ANSI Z540-1 General Requirements for Calibration Laboratories and Measuring and Test Equipment

2.1.3 ASNT Publications

Available from ASNT, 1711 Arlington Lane, P.O. Box 28518, Columbus, OH 43228.

SNT-TC-1A Recommended Practice, Personnel Qualification and Certification in Nondestructive Testing

2.1.4 A4A Publications

Available from Airlines for America, 1301 Pennsylvania Avenue, N.W., Suite 1100, Washington, DC 20006.

Spec 105 Guidelines for Training and Qualifying Personnel in Nondestructive Testing Methods

2.2 Definitions

2.2.1 PURCHASER

The organization that issued the procurement document invoking this specification.

2.2.2 SUPPLIER

Source, other than the purchaser, who provides inspection services.

2.2.3 INSPECTION PROCEDURE

Document written by the purchaser detailing inspection requirements.

2.2.4 QUALITY ASSURANCE PLAN

Document written by the supplier outlining specific requirements unique to his/her facility in accordance with inspection procedure.

3. TECHNICAL REQUIREMENTS

3.1 Materials

The high temperature, high speed environment in which many aircraft engine components operate results in an increased sensitivity to mechanical or chemical damage during maintenance activities. Personnel performing eddy current inspections must be aware of the need to ensure that the materials they use which come in contact with the hardware must be carefully chosen to avoid introducing chemical contamination or causing physical damage. Engine manufacturers can provide information regarding the suitability of specific materials or procedures for use on their hardware.

3.1.1 Tape

A-A-59474, Type I, 0.003 to 0.005 inch (0.08 to 0.13 mm) thick. Alternate tapes may be used if specified in the appropriate inspection procedure.

3.1.2 Cleaning Materials

Mild abrasive cleaning products may be used, if allowed by the purchaser, for the removal of surface contamination. Such products shall not be aggressive enough to remove the base metal or otherwise alter or damage the part. If allowed, mild, nonmetallic abrasive cleaning pads can be torn in strips or circular nonmetallic brushes may be used to clean the inside diameter of holes. These materials shall be specified in the inspection procedure.

3.1.3 Marking Devices

Approved marking device for numbering part features and identifying the locations of suspect test indications that are acceptable to the purchaser.

3.2 Equipment

3.2.1 Eddy Current Probes

3.2.1.1 Select probes based on the minimum diameter of the holes to be inspected. The hole diameter and appropriate probe for any particular inspection shall be as specified in the inspection procedure. Depending on the type of probe, it is recommended that the purchaser consider the hole diameter range for the probe being specified.

3.2.1.2 Absolute (single coil), differential (dual coil), reflection (driver-pickup), and hybrid coil configurations, with or without magnetic shielding, shall be used as specified in the inspection procedure.

3.2.1.2.1 Absolute coils (Figure 1) use one coil as both the driver coil and sensing coil. Absolute coils often have a ferrite core to improve the path of the eddy currents into the material inspected.

3.2.1.2.2 Differential coils (Figure 2) consist of two or more coils. Each coil acts as both a driver coil and sensing coil. Any change detected by one coil but not the other will result in a signal.

3.2.1.2.3 Reflection coils (Figure 3) consist of two or more coils. A driver coil imparts the eddy currents into the material and the sensing coil(s) detect the resulting field.

- 3.2.1.2.4 Hybrid coils consist of a combination of absolute, differential, or reflection coils. A common hybrid probe for eddy current inspection of circular holes is the reflection differential combination (Figure 4). The driver coil imparts the eddy currents into the material and the differential sensing coils detect the resulting field. Any change detected by one sensing coil, but not the other will result in a signal.
- 3.2.1.3 All probes shall be identified with the manufacturer's name, frequency or frequency range, and a unique serial number (Figure 5).
- 3.2.1.4 Eddy current probe sensing coils shall be prevented from directly contacting the surface of the part being inspected. This may be accomplished by covering the coil surface with low-friction tape, by recessing the coil from the surface of the probe, by manufacturing the probe with a suitable wear surface over the coil, or by other means specified in the inspection procedure (Figure 6).
- 3.2.1.5 Probes shall be designed to maintain compliance with the inspection surface at all times during the inspection. Probes which operate with a gap between the probe and the inspection surface are not recommended (Figure 7) unless an allowable gap size is specified by the appropriate inspection procedure. Probes with a split to improve compliance are recommended. The use of shims (foam, etc.) may be used to expand the probe further and help maintain compliance (Figure 8).
- 3.2.1.6 Precautions shall be taken to protect the part being inspected from wear or abrasion from contact with any metallic portion of the probe or test equipment.
- 3.2.1.7 Probes shall not give interfering responses from handling pressures, manipulation, or normal operating pressure variations on the sensing coil.
- 3.2.1.8 Multiple probe housing types are available, such as housings which contact the entire circumference of the hole or only partially contact the circumference (Figure 5). Partial circumferential contact probes are preferred because they minimize friction while maintaining probe compliance to the inspection surface.

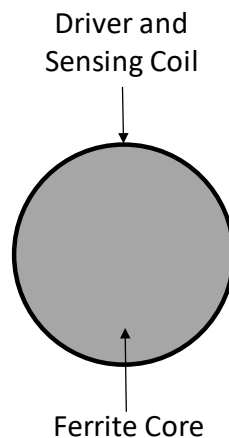


Figure 1 - Absolute eddy current coil

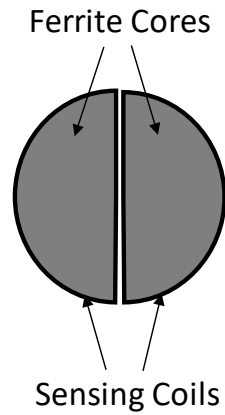


Figure 2 - Differential eddy current coils

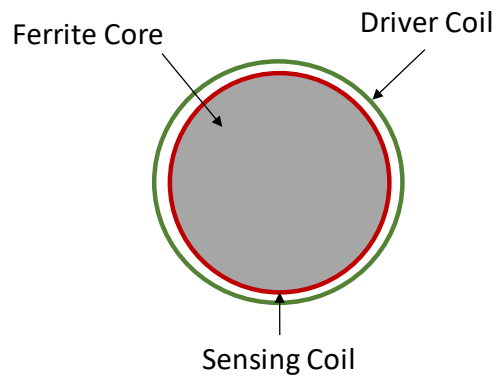


Figure 3 - Reflection eddy current coils

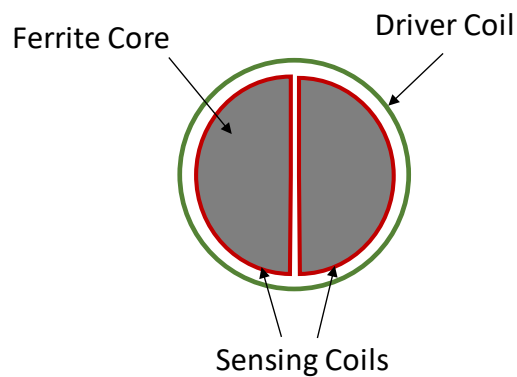
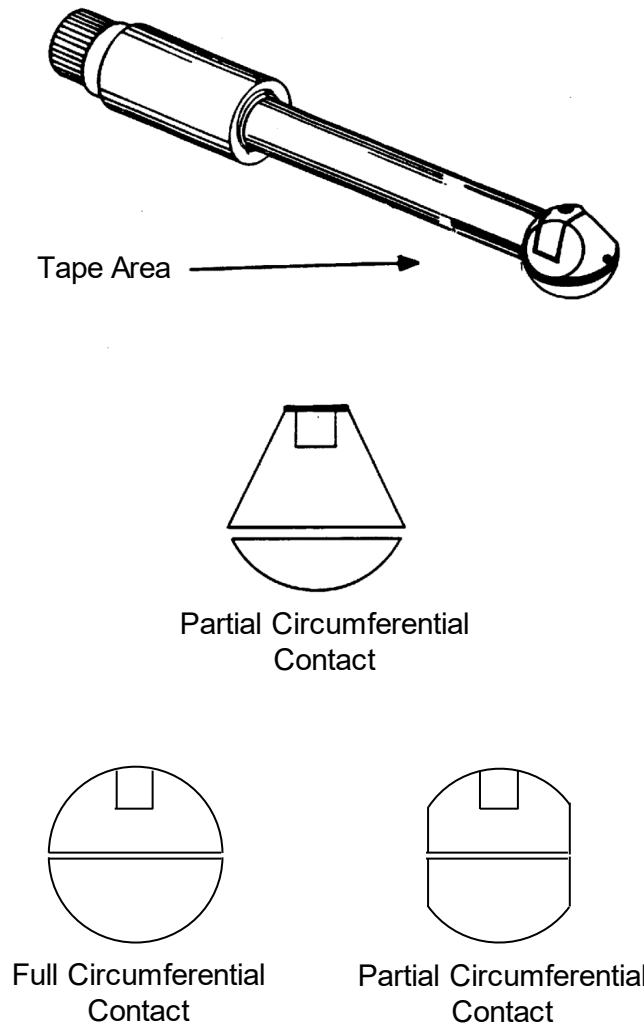


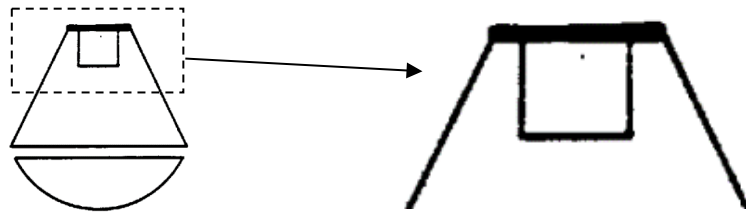
Figure 4 - Hybrid (reflection and differential) eddy current coils

**COMMENTS:**

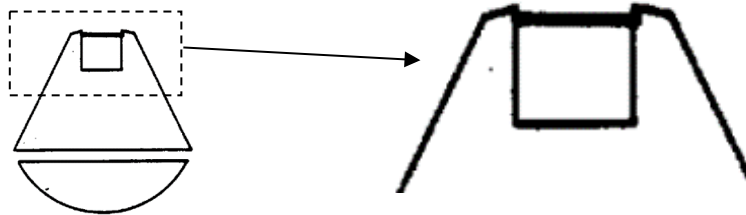
Probes shall be identified as in 3.2.1.3.

Probe details including runout, tape area, coating thickness, and recessed depth shall be detailed in the appropriate inspection procedure.

Figure 5 - Typical eddy current probe

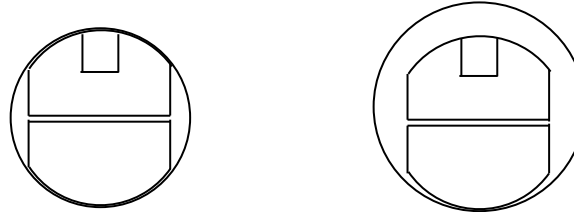


Wear Surface



Recessed

Figure 6 - Eddy current probe - wear surface versus recessed



Recommended Probe
Contact in Hole

Not Recommended
Probe Contact in Hole

Figure 7 - Recommended and not recommended probe contact in hole