

MILITARY SPECIFICATION

PROBES, EDDY CURRENT, UNSHIELDED, SINGLE COIL, ABSOLUTE

This specification is approved for use by the Naval Air Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers unshielded, single coil, absolute eddy current probes used with an eddy current flaw detector (see 6.1).

1.2 Classification. The probes covered by this specification shall be of the following types, classes and styles, as specified (see 6.2.1):

1.2.1 Type.

Type I	-	Straight surface probes
Type II	-	Angled surface probes
Type III	-	Hole probes

1.2.2 Class.

Class 1	-	Probe with integral microdot female connector.
Class 2	-	Probe with integral microdot female connector and collar.
Class 3	-	Probe with 6 ft RG 174U cable and two conductor Amphenol (or equivalent) male connector.
Class 4	-	Probe with 6 ft RG 174U cable and two conductor Amphenol (or equivalent) male connector and collar.
Class 5	-	Probe with 6 ft RG 174U cable and BNC male connector.
Class 6	-	Probe with 6 ft RG 174U cable and BNC male connector and collar.

1.2.3 Style (Type III only).

Style A	-	For 3/16 inch to 1/4 inch holes
Style B	-	For 1/4 inch to 5/16 inch holes
Style C	-	For 5/16 inch to 3/8 inch holes
Style D	-	For 3/8 inch to 7/16 inch holes

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Engineering Specifications and Standards Department (Code 93), Naval Air Engineering Center, Lakehurst, NJ 08733, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

MIL-P-85585(AS)

Style E	-	For 7/16 inch to 1/2 inch holes
Style F	-	For 1/2 inch to 9/16 inch holes
Style G	-	For 9/16 inch to 5/8 inch holes
Style H	-	For 5/8 inch to 11/16 inch holes
Style I	-	For 11/16 inch to 3/4 inch holes
Style J	-	For 3/4 inch to 13/16 inch holes
Style K	-	For 13/16 inch to 7/8 inch holes
Style L	-	For 7/8 inch to 15/16 inch holes
Style M	-	For 15/16 inch to 1 inch holes
Style N	-	For 1 inch to 1-1/16 inch holes

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

STANDARDS

MILITARY

MIL-STD-794 - Parts and Equipment, Procedures for Packaging of.

(Copies of specifications, standards, handbooks, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 First article. When specified, a sample shall be subjected to first article inspection (see 4.3 and 6.3).

3.2 Component parts. Each eddy current probe shall consist of the principle parts identified in 1.2.2, assembled and purchased as a complete unit.

3.3 Design. The eddy current probes shall be designed to induce an electromagnetic field into and detect the reflected electromagnetic field from the material or part being inspected (see 1.2.1). The design shall include tip wear prevention by incorporation of an aluminum oxide ring bonded to the ferrite core (see Figure 1).

3.4 Identification and information plates. Pertinent probe information shall be permanently and legibly engraved, stamped or etched in the probe body or a plate attached to the probe body. The following information shall be included:

MIL-P-85585(AS)

- a. Manufacturer's name or identification.
- b. Federal stock number.
- c. Range of hole size (Type III only).

3.5 Performance characteristics. The performance characteristics of the probes shall be in accordance with Table I, when tested in accordance with 4.5.2.

3.6 Workmanship. The probes, including all accessories, shall be fabricated and finished in a workman-like manner and shall be free from blemishes, defects, burrs, sharp edges and incorrect dimensions and markings.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.3).
- b. Quality conformance inspection (see 4.4).

4.3 First article inspection. First article inspection of the probes shall consist of all the tests and examinations of this specification.

4.3.1 First article sample. The first article sample shall be one (1) complete unit for test. The first article sample shall be a representative production item and it shall be forwarded to the Commander, Naval Air Development Center, Attention: Aircraft and Crew Systems Technology Directorate, Code 6063, Warminster, PA 18974. The sample shall be plainly identified by a securely attached durably marked tag containing the following information:

FIRST ARTICLE SAMPLE
 PROBES, EDDY CURRENT, SINGLE COIL, ABSOLUTE
 Type I, II or III; Class 1, 2, 3, 4, 5 or 6;
 Style A, B, C, D, E, F, G, H, I, J, K, L, M or N (as applicable)
 Manufacturer's designation or number
 Name of manufacturer
 Part number
 Submitted by (name) (date) for first article inspection in
 accordance with the requirements of MIL-P-85585(AS) under
 authorization (reference letter authorizing test) (see 6.3).

MIL-P-85585(AS)

4.3.2 Manufacturer's data. The manufacturer shall maintain a file consisting of all test and examination results performed by or for the supplier. The file shall be readily accessible to cognizant Government personnel during the contract term and for a period of three (3) years after delivery of the last item.

4.4 Quality conformance inspection. The quality conformance inspection shall consist of inspection of each end item (see 4.4.2).

4.4.1 Lot. A lot shall consist of all the probes forming a part of one contract or order and submitted for inspection at one time.

4.4.2 End item. Each probe shall be subjected to the applicable inspections and tests of 4.5. Any defect or test failure shall be cause to reject the individual probe.

4.5 Test methods.

4.5.1 Visual inspection. Each probe shall be examined to determine conformance with Table II and other requirements of this specification.

4.5.1.1 Packaging. Each package and shipping container shall be examined for conformance to the requirements of Section 5 and Table III. Any defect shall be cause for rejection.

4.5.2 Performance tests. All performance tests shall be conducted within the temperature range from 16° to 27°C (60° to 80°F).

4.5.2.1 Test instrument. The test instrument shall be an ED 520 eddy current flaw detector manufactured by Magnaflux Corporation.

4.5.2.2 Test standard. The test standard shall be a 7075-T6 aluminum alloy piece, at least 1/4 inch thick with an electrical discharge machined groove measuring 0.040 ± 0.002 inch long, 0.020 ± 0.002 inch deep, by 0.002 ± 0.0005 inch wide.

4.5.2.3 Probe compensation. Probe compensation shall be performed on test standard (see 4.5.2.2) as specified in 4.5.2.3.1 through 4.5.2.3.5.

4.5.2.3.1 Set the "LIFT-OFF/FREQ. and BALANCE" controls to their zero positions (fully counterclockwise).

4.5.2.3.2 Place the probe on the surface of the test standard and adjust the "BALANCE" control so that the meter pointer is on scale.

4.5.2.3.3 If the previous step does not position the meter needle on scale, return the "BALANCE" control to the zero position and advance the "LIFT-OFF/FREQ." control to a higher setting, e.g., 020 on the dial. Repeat step 4.5.2.3.2.

4.5.2.3.4 Place a paper shim, 0.003 to 0.004 inch thick, (writing paper thickness), between the probe and the metal surface to be checked. Note the difference in the meter reading and readjust the "LIFT-OFF/FREQ." control (and "BALANCE" control if necessary to keep the meter pointer on scale) until the same meter indication is obtained with and without the paper shim. This is most easily accom-

MIL-P-85585(AS)

plished by noting the direction of meter needle deflection when the paper shim is pulled from beneath the probe and turning the "LIFT-OFF/FREQ." control to deflect the pointer in the same direction.

4.5.2.3.5 Adjusting the controls as described by the previous steps will achieve the proper "lift-off" or "intermediate layer" compensation necessary for probe performance testing. It will generally be found that lift-off compensation can be obtained at more than one setting of the "LIFT-OFF/FREQ." control. For maximum sensitivity, the "LIFT-OFF/FREQ." control should be set at the lowest dial setting for which lift-off compensation can be achieved when following the previously outlined procedure.

4.5.2.4 Test procedure. With test probe lift-off compensated as above, meter reading shall be recorded for each characteristic requirement specified in Table I.

4.5.2.4.1 Crack sensitivity, 0.0 inch probe lift-off. Place the test probe in direct contact with the test standard with the axis of the coil perpendicular to surface of the standard. While maintaining this alignment, scan the test probe across the groove and record the maximum change in meter reading.

4.5.2.4.2 Crack sensitivity, 0.010 inch probe lift-off. Repeat 4.5.2.4.1 with a 0.010 inch non-conductive shim inserted between the test probe and the surface of the standard.

4.5.2.4.3 Crack sensitivity, 10° tilt. Repeat 4.5.2.4.1 with the axis of the coil tilted 10° from the perpendicular position.

4.5.2.4.4 Lift-off noise. Place the test probe in direct contact with the test standard with the axis of the coil perpendicular to the surface of the standard in an area away from the groove. Note the meter reading. Insert a 0.010 inch thick non-conductive shim between the probe and the standard and note the meter reading. Record the maximum change in reading.

4.5.2.4.5 Tilt noise. Place the test probe in direct contact with the test standard with the axis of the coil perpendicular to the surface of the standard in an area away from the groove. Note the meter reading. Tilt the test probe so that the axis of the coil is 10° from the perpendicular position and note the meter reading. Record the maximum change in reading.

4.5.2.4.6- Edge noise. Place the test probe in direct contact with the test standard as in 4.5.2.4.1 and note the meter reading. Move the probe toward an edge of the standard. Record the maximum change in meter reading when the center of the coil is 0.125 inch from the edge.

5. PACKAGING

5.1 Preservation, packing and marking. Preservation, packing and marking shall be Level A, B or commercial in accordance with MIL-STD-794 (see 6.2.1d).

6. NOTES

MIL-P-85585(AS)

6.1 Intended use. The eddy current probes covered by this specification are to be used with the Magnaflux Corporation model ED 520 eddy current flaw detector and are intended to be utilized by Navy fleet personnel in the maintenance inspection of aircraft structures and components at Naval base activities and aboard ships.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number and date of this specification.
- b. Type, class and style (Type III only) required (see 1.2).
- c. Total quantity desired.
- d. Selection of applicable level of preservation and packing (see 5.1).
- e. Whether first article is required (see 6.3.1).
- f. Items of data required (see 6.2.2).

6.2.2 Data requirements. When this specification is used in an acquisition which incorporates a DD Form 1423, Contract Data Requirements List (CDRL), the data requirements identified below shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved CDRL incorporated into the contract. When the provisions of DAR 7-104.9 (n) (2) are invoked and the DD Form 1423 is not used, the data specified below shall be delivered by the contractor in accordance with the contract or purchase order requirements. Deliverable data required by this specification is cited in the following paragraph:

<u>Paragraph no.</u>	<u>Data requirement</u>	<u>Applicable DID no.</u>
4.3.2	First article inspection reports	DI-T-5329

(Copies of data item descriptions required by contractors in connection with specified acquisition functions should be obtained from the Naval Publications and Forms Center or as directed by the contracting officer.)

6.3 First article. When a first article inspection is required, the item will be tested and should be a first production item. The first article should consist of one complete unit. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, test and approval of the first article.

6.3.1 First article approval. When a first article is required for inspection and approval (see 3.1, 4.3, 6.2.1e and 6.2.2), the contract should specify the following provision for first article inspection. When a contractor is in continuous production of these eddy current probes from contract to contract, consideration should be given to waive the first article inspections. If inspection

MIL-P- 85585(AS)

is required, indicate:

- a. If first article inspections are conducted at the contractor's plant or at a Government approved laboratory, an inspection report should be forwarded to the acquiring activity for verification.
- b. That the approval of first article samples or the waiving of the first article inspection should not relieve the contractor of his obligation to fulfill all other requirements of the specification and contract.

6.4 Material selection and protection. Exposed materials which are resistant to corrosion in a moist salt air environment shall be used. The probes, including component parts, shall be functional in a temperature range from -29° to 72°C (-20° to 162°F).

Preparing activity:

Navy - AS

(Project No. 6695-N062)

MIL-P-85585(AS)

TABLE I. Performance characteristics. 1/

Requirement	Meter deflection (units) <u>2/</u>
Crack sensitivity: with lift-off: 0.0 inch	150 min.
0.010 inch	100 min.
with tilt at 10°	140 min.
Lift-off noise with lift-off at 0.010 inch	120 max.
Tilt noise, with tilt at 10°	40 max.
Edge noise, at 0.125 inch from center of coil to edge of test standard	100 max.

1/ Mode switch shall be set on Hi (high) and the sensitivity INC. (increase) shall be set at the same position for all tests.

2/ Meter deflections listed are only for the Magnaflux Corp. Ed 520 flaw detector.

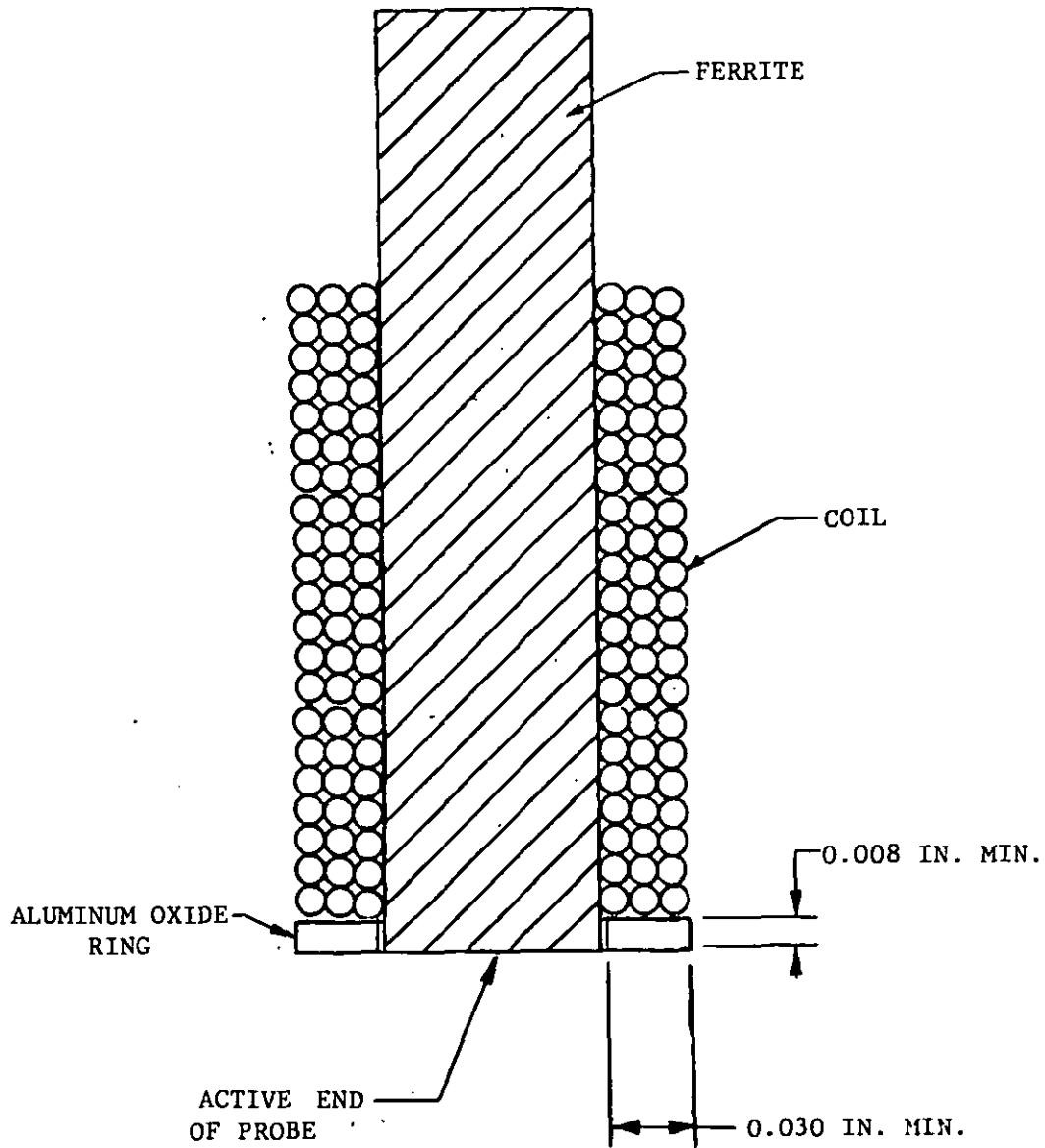
MIL-P-85585(AS)

TABLE II. Visual inspection.

Defect
Probe not complete with all component parts.
Probe cracked, dented, or distorted.
Probe with collar rocks when placed on a flat surface.
Probe with sharp edges or burrs.
Component parts not properly assembled.
Identification marking not complete, legible or permanent.
Finish not free of scratches, chips or blisters.
Probes and connectors not free of dirt, grease or foreign matter.

TABLE III. Packaging inspection.

Item	Defect
Preservation	Not level required by contract or purchase order. Material or construction not as specified.
Packing	Not level required by contract or purchase order. Material or construction not as specified.
Count	Less than specified or indicated quantity per shipping container.
Marking	Marking missing, omitted, illegible, incorrect, incomplete or not in accordance with contract requirements.



NOTE: DRAWING NOT TO SCALE

FIGURE 1. Design for tip wear prevention.

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DOCUMENT IDENTIFIER (Number) AND TITLE

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NAME OF ORGANIZATION AND ADDRESS OF SUBMITTER

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DATE

DD FORM 1426
1 OCT 76

Replaces edition of 1 Jan 72 which may be used.

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