INCREMENTAL CHANGE Release Notification Date: 05/13/2022

SPM 70-32-07 HIGH SPEED AND SLOW SPEED EDDY CURRENT INSPECTION OF CIRCULAR HOLES IN INCONEL OR TITANIUM ENGINE PARTS

DISCLAIMER

The Incremental Changes published by GE Aviation are considered Instructions for Continued Airworthiness. These Incremental Changes, along with the current Manual revision and published Temporary Revisions, constitute the latest Instructions for Continued Airworthiness.

GE Designated: -CONFIDENTIAL-

HIGHLIGHTS

HIGHLIGHT REFERENCE	DESCRIPTION OF CHANGE
tk70-32-07-250-001	Technical Change: Changed instrument descriptions for the Uniwest US-454 EddyView and US-454 EddyVision.

TASK 70-32-07-250-001

1. General.

NOTE: SAE Aerospace Standard AS4787 can be used in conjunction with this procedure. AS4787 is considered equivalent to this procedure, but lacks specific inspection requirements for GE Aircraft Engines CF6 products. Therefore both documents will be necessary if inspecting the parts per AS4787.

A. This practice describes the equipment and processes used for eddy current inspection of circular holes in engine parts. These techniques are used to detect flaws or discontinuities at, or near, the surface of metallic parts which may be detrimental to the part life or limit its intended use.

B. Only qualified operators specifically designated, trained and approved to perform a specified inspection shall perform that test. Operators must be capable of performing equipment calibrations, carrying out the intended inspection and be capable of acceptable interpretation of output test data before his acceptance or rejection of hardware in accordance with an inspection procedure.

C. There are three inspection methods:

Method A (High Speed) is in Subtask 70-32-07-250-011, High Speed Eddy Current Inspection (Method A).

Method B (Slow Speed) is in Subtask 70-32-07-250-012, Slow Speed Eddy Current Inspection (Method B).

Method C (High Speed with Electronic Data Acquisition) is in Subtask 70-32-07-250-013, High Speed Eddy Current Inspection with Electronic Data Acquisition and Storage (Method C).

2. High Speed Eddy Current Inspection (Method A).

Subtask 70-32-07-250-011

A. Method A: High Speed Eddy Current Inspection.

(1) Scope.
  (a) This document describes the equipment, technique and procedure necessary to do a 2 MHz high speed eddy current inspections of circular holes in aircraft engines hardware for the detection of cracking. A Service Bulletin or Engine/Shop Manual procedure is required for the detailed information needed for inspection of specific parts.
  (b) This document describes the general procedure and equipment which have been approved for the performance of high speed eddy current hole inspections. Exceptions to this procedure may be required for specific cases where the procedure or equipment described in this procedure cannot be used or is not appropriate. Such exceptions should be obtained in writing from GE Aircraft Engines.

(2) Applicable Documents.
  (a) Instruction manuals or other information provided by equipment manufacturers.
  (b) The appropriate Service Bulletin or Engine/Shop Manual inspection for the hardware inspection.
  (c) Kit preparation and quality assurance plan, M & FQT Procedure 1480 (applies to GEAE/QTC only).

(3) Personnel Requirements.
  (a) Personnel performing this inspection shall be certified in accordance with one of the following:
    1 National Aerospace Standard 410 (NAS 410), which replaces MIL-STD 410
    2 American Society of Nondestructive Testing specification ASNT-TC-1A (ASNT-TC-1A)
    3 Air Transport Association Specification No. 105 (ATA 105)
    4 Comite Sectoriel Aeronautique Cofrend (COSAC)
    5 A locally approved certification program.
  (b) Personnel performing this inspection should receive practical training in the use of this procedure and must demonstrate proficiency in calibration of the inspection equipment, inspection of hardware, and evaluation of indications before the authority to accept and reject hardware is delegated.
  (c) Any training which may be provided regarding the performance of this inspection does not imply that the personnel who receive that training have met the requirements for inspector certification in accordance with paragraph (3)(a)..

(4) Equipment Requirements.

NOTE: Items (a) through (b) are to be supplied by the inspection site.

NOTE: Items (c) through (i) can be obtained from GE Aircraft Engines. The correct service bulletin or shop manual inspection procedure will specify (by GE kit number) the necessary tooling requirements.

NOTE: Get items (c) through (i) from:
GE Aircraft Engines, QTC. Refer to the List of Suppliers in Step 4 of 70-80-00.

  (a) The eddy current instruments listed in Table 1 are approved for use with this procedure.

  NOTE: Nortec NDT 19 Instruments having serial numbers 314 and below will not function correctly with the high speed rotor and cannot be used. Instruments having serial numbers 315 and higher may be used if an internal adjustment is made.

  NOTE: This is to be done by the manufacturer. All NDT 19E models should function without internal adjustments.

  NOTE: The Hocking Phasec 1.1 must have the appropriate software to ensure that the correct filtering is available to perform high speed bolthole inspections at the appropriate inspection sensitivity and noise levels. To determine if the unit has the correct software, the filter display must show actual frequency values (in Hz). Highlighting the High Pass (HP) filter field on the instrument and advancing through all the frequency settings, should show the following HP filters: DC, 2 Hz, 25 Hz, 100 Hz, and 500 Hz. If these values cannot be displayed, and instead, "STD", 1, 2, 3, 4, and 5 are displayed, then the instrument does not have the software needed to perform this inspection.

Initial Instrument Control Settings - Table 1

Control Description	Setting
Rohmann Elotest B1:	
Frequency	2.0 MHz
Gain	60 dB
X Axis Gain	0 dB
Y Axis Gain	0 dB
Preamplifier	Maximum value possible
Bandwidth	HF
Phase	0°
Dot position	0/0
Filter type	BP (Band pass)
Filter frequency	800 Hz
Rohmann Elotest B1V3 and B1V4:	
Frequency	2.0 MHz

Bandwidth	HF
Gain	58/58 dB
Y-Spread	0
X-Spread	0
Phase	328°
Filter: High Pass	400 Hz
Filter: Low Pass	1.25 kHz
Rohmann Elotest B2:	
Sweep: Display (Switch)	X-Y
Sweep: Fine	N/A
Sweep: Coarse	N/A
HP Filter: Hz	33
HP Filter: Range	X10
HP Filter: BP	0
HP Filter: Switch	On
Sensitivity: Y x 2	0
Sensitivity: dB	05
Phase	4.0
Frequency: Switch	Display
Frequency: Fine	Adjust as required to get 2000 kHz
Frequency: Range	5
Filter	HF
LPF	1 kHz
Driver circuit	-12
Receiver pre-amp	30 dB
Forster Defectoscope SD 2.832:	
Power (1/0)	1 (On)
Filter (TP/HP)	5 (160 Hz High Pass)
Sensitivity	26.5 dB
Frequency	200 kHz (Use Exp. button)
Phase	184
1p	1
U1	0
Yo (Y Position)	50
Xo (X Position)	0
Intense	As needed
XY (dB Spread)	0
Store time	1
Display	Impedance mode (TR)
Signal display	Off (0)
X1, X10 Switch	X10
I/O Switch on motor	As desired
Forster Defectoscope SD 2.833:	
Drive	25 Ohms
Att.	0 dB
Frequency	2 MHz
Phase	218
Gain	66 dB
Y Spread	0 dB
X Spread	0 dB
HP Filter	150 Hz
LP Filter	1 kHz
Time	0.1s
Hocking 2200:	
RPM	3000
Display	XY

Persist	1 S
CH 1 Frequency	2 MHz
CH 1 Gain	50 dB
CH 1 X:Y	0.0 dB
Angle	83
Low Pass Filter	2000 Hz
High Pass Filter	200 Hz
IMP Gain	+20 dB
X-Pos 1	0
Y-Pos 1	0
Hocking Phasec 1.1:	
Power	On
Frequency	2 MHz
Gain	30 dB
Phase	300
Store	---
Hi-Pass Filter	250
Lo-Pass Filter	1500
I/P	---
Horizontal position	0
Vertical position	0
V/H Ratio	1:1
Sweep	Off
RPM	1500
Staveley Nortec 19/19e/19ell:	
Power	On
Display	Frequency 1
Sweep	Off
Program	01
Memory 2	Off
Latch	Off
Frequency	2000 kHz
Gain (Horizontal and Vertical)	60.000
Position	128 (50%)
Angle	00
High Pass Filter	200
Low Pass Filter	500
SP 02 (Probe drive)	Mid
SP 03	Off
SP 01, 04, 05, 07	Optional
Continuous null	Off
Display erase	As required
Null	As required
F1/F2 (Frequency)	Frequency 1
C/F (Coarse/Fine)	As required
Staveley Nortec 24:	
Frequency	2 MHz
Gain	60 dB
H Gain	72.0
V Gain	72.0
HP Filter	200
LP Filter	500
Display	60.000
Sweep	Off
V Position	50%
H Position	50%

Screen	---
Persist	Off
Sweep Erase	On
Display Erase	1 s
Graticule	On
Scanner	
Sweep	Off
Scan RPM	1200
Staveley Nortec 2000 series	
Frequency	2.0 MHz
Angle	187°
H Gain	60 dB
V Gain	60 dB
Probe Drive	Mid
LP Filter	500
HP Filter	200
HPF Pole	2-Pole
Sweep	Off
V Position	50%
H Position	50%
Persist	Off
Sweep Erase	As required
Display Erase	As required
Graticule	On
Scan RPM	1500
Uniwest US-454/454A EddyView	
Frequency	2 MHz
F1 Gain	25.7 dB
F1 Rot	29 Deg
Freq 2	Off
Drive	High
LP Filter	1.25 kHZ
HP Filter	400 Hz
X Sens	0.5 V/Div
Y Sens	=X
X Null point	0.0 Div
Y Null point	0.0 Div
EC disp	I - Plane
Auto CLR	2 sec (as required)
Persist	Off
Nortec 500D, 500S, Series and Spitfire (Cable PN 9122090.00) or Mini Mite Scanner (Cable PN 9122089.02)	
Main:	
Frequency	2 MHz
Angle	8.0
Gain	56.3 dB
PreAmp	Off
Cont. Null	Off
Balance	Off
LP FLT	500 Hz
HP FLT	200 Hz (adjust as needed to get equal legs)
Display: Screen Set-Up	
H-Pos	50%
V-Pos	50%
Dot/Box	Dot
D-Erase	
Persist	Off

Disp. Erase	1.0 Sec (as needed)
Sweep Erase	Off (as needed)
Graticule	On
Main DSP	F1
Scan:	
Sweep Mode	Off
RPM	1500
Sync. Ang.	0
Set-Up: Instrument Set-Up	
Probe Drive	Mid
Ang. Step	1.0
Freq. Mode	Single (500D)
Vmix Gain	0
Hmix Gain	0
Nortec 600 Series and Spitfire (Cable PN 9122090.00) or Mini Mite Scanner (Cable PN 9122089.02)	
Main/Filter Set-Up - 1st Screen Freq 1:	
Frequency	2 MHz
Angle	146.0
Gain H	55.0 dB (Keep the Gain Settings in Same Value)
Gain V	55.0 db
Main/Filter Set-Up - 2nd Screen Filter:	
LP FLT	1500 Hz
HP FLT	500 Hz (adjust as needed to get equal legs)
Cont. Null	Off
Link	On
RPM	1500
Main/Filter Set-Up - 3rd Screen Special:	
Probe Drive	Medium
Probe Canon	Lemo-16
Filter Type	Fig.8
Display Menu - 1st Screen:	
Display Mode	Imp.
Channel	Freq.1
Position	Custom
H-Pos	50% (As Needed)
V-Pos	50% (As Needed)
Display Menu - 2nd Screen:	
D. Erase	.1 Sec (As Needed)
Persist	Off
Cursor	Dot
Grid	10x10
Zoom	Off
Alarm Menu	Adjust as Needed
Rohmann Elotest M3	
Frequency	2.0 MHz
Bandpass	400 Hz - 1.0 KHz
Gain	60 dB
Pre-Amp	Max possible
Y-Spread	0.0 dB
Phase	175°
Filter: High Pass	400 Hz
Filter: Low Pass	1.25 kHz
Hocking Phasec 2d / 2s / 3d / 3s	
Power	On
Frequency	2.0 MHz

Filter	BP Lock (3d/3s)
Gain (X&Y)	41 dB
Phase	80
Input Gain	High
Probe	Reflection (3d/3s)
Hi-Pass (Filter)	250
Lo-Pass (Filter)	1500
Display	Spot
Probe Load uH	8.2 (3d/3s)
Probe Drive	+8 (3d/3s)
Trace Display - Graticule	Grid 2 (3d/3s)
Horizontal Position	50% (2D) As Required
Vertical Position	50% (2D) As Required
RPM	2000

(b) Probe rotors, associated cables, and adapters are listed in Table 2.

(c) Eddy Current Probe: SPO-5000 series or a GE-approved probe. The probe to be used will be specified in the appropriate approved Engine/Shop Manual or Service Bulletin for the specific hardware to be inspected.

NOTE: If a different filter setting is specified in an Engine Shop Manual for a specific part, that setting must be used.

Probe Rotors, Associated Cables, and Adapters - Table 2

Instrument	Maker	Rotor	Adapter	Cable	Guide Fixture
Elotest B1	Rohmann	HF or STD	ARM-1*	RK-2N	GE-FQAP-302
Elotest B2	Rohmann	HF or STD	ARM-1*	RK-2N	GE-FQAP-302
Elotest B1V3/V4	Rohmann	HF or STD	ARM-1*	RK-2N	GE-FQAP-302
Elotest M3	Rohmann	HF or STD	ARM-1*	RK-2N	GE-FQAP-302
NDT 19/19e/19ell or Nortec 24	Staveley	19/RA	SPO-5201	9113660	GE-FQAP-302A
Nortec 2000 Series	Staveley	19/RA	SPO-5201	9122084	GE-FQAP-302A
NDT 19ell Nortec 24	Staveley	Spitfire 2000	Not Req.	9122091	GE-FQAP-302D
Nortec 2000 Series	Staveley	Spitfire 2000	Not Req.	9122090	GE-FQAP-302D
Nortec 500D / 500S / 600 / 600D / 600S	Staveley	Spitfire	Not Req.	9122090.00	GE-FQAP-302D
Nortec 500D / 500S / 600 / 600D / 600S	Staveley	Minnie Mite	Not Req.	9122089.02	GE-FQAP-302D
US-454/454A EddyVision	UniWest	JF-15	Not Req.	94142 JF-15	GE-FQAP-302E
Phasec 2d / 2s / 3d / 3s	Hocking	Hocking Mini	Not Req.	33A103	GE-FQAP-302F
		(Rotor PN:33A100)			
Elotest B1.V3/B1.V4	Rohmann	HF or STD	ARM-1*	RK-2N	GE-FQAP-502
Elotest B1.V3/B1.V4	Rohmann	HF or STD	ARM-1*	RK-2N	GE-FQAP-504
Phasec 1.1	Hocking	33A022	Not Req.	33A023	GE-FQAP-302B
2200	Hocking	33A106	Not Req.	33R103	GE-FQAP-302B
Defectoscope SD 2.832 AF 2.833	Forster	HRo 1500	Not Req.	Fixed	GE-FQAP-302C
Defectoscope SD 2.832 AF 2.833	Forster	HRo 860T	Not Req.	140-639-6	GE-FQAP-302C

NOTE: * - an approved alternate is the RB1 M1 adapter (GK Engineering).

(d) Guide Fixture: An approved guide fixture must be used for all inspections to provide mechanical control of the probe angle. The guide fixtures are listed in Table 2 will be specified (by GE kit number) in the appropriate Service Bulletin or Engine/Shop Manual procedure. Refer to Figure 7.

(e) Calibration Standard: Calibration standards will be specified in the appropriate Service Bulletin or Engine/Shop Manual procedure for the part to be inspected. Refer to Figure 6.

(f) Mineral Oil: A small amount of mineral oil or other lubricant may be used to reduce friction for smoother probe rotation, reduced probe and standard wear, and less noise. It is important that the lubricant be a relatively inert material to avoid chemical reactions which may affect probe performance or reduce its useful life. The use of mineral oil or another lubricant is not required but is left to the discretion of the user.

(g) Cleaning Materials: Approved cleaning materials and solvents should be used to make sure the part is clean before inspection.
(h) Flex-Hones: Flex-Hones may be used when more aggressive cleaning is required and shall be specified in the appropriate Service Bulletin or Engine/Shop Manual procedure.
(i) Marking Materials: Action Marker Q404, black, or equivalent, shall be used to perform any marking of hardware.

(5) Pre-inspection Part Preparation.
(a) Clean the holes to be inspected in accordance with TASK 70-22-06-110-043, Special Cleaning Procedure No. 6, Bolthole Cleaning for Eddy Current Inspection.
(b) Number the holes for reference. The reference location for numbering is the "/" in the designation "S/N" where the part serial number is located. Hole number 1 is the first hole clockwise from the "/", aft looking forward (ALF). If the "S/N" mark does not exist, the number 1 hole will be the first hole clockwise from the initial digit of the serial number. All remaining holes are then numbered in sequence moving clockwise, aft looking forward.
(c) Visually inspect the holes under white light. Clean the holes again, as required, to remove any remaining dirt or foreign material. TASK 70-22-06-110-043, Special Cleaning Procedure No. 6, Bolthole Cleaning for Eddy Current Inspection.

(6) Initial Equipment Setup.
(a) Select the appropriate inspection kit, as specified in the Service Bulletin or Engine/Shop Manual procedure for the hardware to be inspected.

NOTE: Refer to Table 2 for instrument and tooling compatibility.

(b) Install the eddy current probe rotor into the appropriate guide fixture. Refer to Figure 5.
(c) Connect the cable from the probe rotor to the eddy current instrument.
(d) Insert the probe in the calibration standard hole to check the probe fit. Refer to Figure 6 and Figure 4. It is necessary that the probe contacts the surface of the hole but there should be no interference or binding. Significant probe drag may slow or stop the rotor.
(e) If the difference between the probe and hole diameters is too great, either too large or too small, it may be necessary to use a slightly larger or smaller probe.

NOTE: It is not recommended to alter the probe ball diameter by any means.

(f) Insert the probe into the probe rotor or probe adapter, as appropriate for the type of rotor being used. Refer to Figure 5.
(g) Adjust the eddy current instrument to the initial settings, as specified in Table 1.

(7) Equipment Calibration.
(a) Turn on the probe rotor and apply a very small amount of mineral oil to the tip of the probe, if desired.

NOTE: Spraying of oil from the spinning probe can be avoided by placing a small drop of oil on a fingertip and then briefly holding the finger against the probe tip.

(b) Place the guide fixture on the calibration standard, center it over the calibration hole, and translate the probe carefully into the hole.
(c) With the probe placed well into the calibration hole but away from the electric-discharge machined (EDM) notch, null (compensate) the instrument.
(d) Translate the probe through the hole until the notch signal is located. Refer to Figure 3.
(e) Scan the length of the EDM notch and observe the response on the CRT.
(f) Hold the rotor at the position where the largest notch signal response is obtained.
(g) Adjust the instrument phase (rotation) control to orient the notch signal vertically. Refer to Figure 3.
(h) Adjust the gain control to produce a notch signal with a vertical peak-to-peak amplitude of four major screen divisions. It may be helpful to offset the dot position from the center of the screen as an aid in setting the correct notch signal amplitude.

NOTE: If the selected instrument gain adjustments are in 1 dB steps, it may not be possible to achieve a notch signal amplitude of exactly four major screen divisions. If the exact calibration amplitude cannot be obtained, use the next higher gain setting.

(i) Translate the rotor to scan the complete length of the notch to make sure that the calibration was performed at the location of the largest notch signal amplitude.

NOTE: Two peaks will be obtained from most notches which have a length that is smaller than the probe sensing coil diameter. Check the amplitude of both peaks to make sure the calibration is performed on the peak which provides the largest response.

(j) Record the instrument calibration settings on the inspection data sheet, Form 699-1(Figure 2).

(8) Hardware Inspection.
(a) After completion of the instrument calibration, either the impedance plane (X/Y) or timebase (Y/T) display mode can be used during the inspection of hardware. Refer to Figure 3 and Figure 1. The gate and alarm may also be used if desired.
(b) Remove the probe from the rotor and check the probe fit by inserting the probe into several randomly selected holes around the hardware.
1 It is necessary that the probe contacts the surface of the hole but there should be no interference or binding.
2 If the selected probe does not meet the criteria described in the proceeding paragraph, the probe may be worn or the hole may be oversized. Another probe should be selected.

NOTE: The eddy current probes used for this procedure are designed to expand and contract over the full range of the specified tolerance of the hole.

(c) Return the probe to the rotor and apply a small amount of mineral oil to the probe tip if desired. If required, adjust the leveling block at the bottom of the guide fixture to keep the probe perpendicular to the bolt hole.

(d) Carefully center the probe over the first hole to be inspected and translate the rotor until the probe coil is well into the hole.

(e) Null the eddy current instrument.

(f) Translate the probe slowly down through the hole and back up again while observing the display of the eddy current instrument. The translation speed should be approximately 0.2 inch (5 mm) per second or less. At this speed the inspection of a hole which is 1.0 inch (25 mm) deep should take at least five seconds in each direction.

(g) Monitor the eddy current instrument display and record any indications that exceed the inspection threshold requirements given in the appropriate Service Bulletin or Engine/Shop Manual procedure for the part being inspected.

(h) Move to each subsequent hole and repeat the inspection process. Periodically reapply mineral oil to the probe tip, if needed.

(9) Post-inspection Calibration Check.

(a) A calibration check shall be performed upon the completion of each inspection, at least every hour, whenever any system component or the inspector is changed, or any time the inspector suspects a change may have occurred in the inspection system.

(b) Return the guide fixture to the calibration standard. Center the fixture over the calibration hole, and move the probe carefully into the hole.

(c) With the probe well into the hole and the coil away from the EDM notch, null the instrument.

(d) Scan the length of the EDM notch and hold the rotor at the position where the largest notch signal response is obtained.

(e) If the notch response obtained is four major screen divisions, ± one-half major division, the test is acceptable.

(f) If the notch response has decreased by more than one-half major screen division, the system must be re-calibrated and any hardware inspected since the last acceptable calibration must be re-inspected.

(g) If the notch response has increased by more than one-half major screen division, the system must be re-calibrated prior to the inspection of any additional hardware. Hardware inspected and determined to be acceptable since the last acceptable calibration need not be re-inspected.

(10) Indication Evaluation/Rejection Criteria.

(a) Evaluate any hole which, during the initial inspection, produced one or more indications exceeding the indication evaluation/rejection threshold requirements given in the appropriate Service Bulletin or Engine/Shop Manual procedure for the part being inspected.

(b) Perform a calibration check as described in paragraph 2.A.(9), Post-inspection Calibration Check.

(c) Repeat the inspection of the hole to relocate the indication and confirm that it exceeds the evaluation/rejection threshold requirements.

(d) If the indication is confirmed, clean the hole using approved cleaning material. Refer to paragraph 2.A.(11), Cleaning Procedure.

(e) Visually inspect the hole and record any unusual conditions which might affect the inspection results on the eddy current inspection data sheet, Form 699-1(Figure 2).

(f) Repeat the inspection of the hole after cleaning. If the indication amplitude has reduced, repeat the cleaning process as necessary until the indication is removed or the amplitude of the eddy current indication is reduced below the evaluation/rejection limit.

(g) If the indication cannot be reduced in amplitude to an acceptable level, or increases in amplitude as a result of the cleaning process, refer to paragraph 2.A.(12), Disposition, Documentation, and Records, and the appropriate Service Bulletin or Engine/Shop Manual procedure for the disposition of the hardware.

(11) Cleaning Procedure.

(a) Refer to TASK 70-22-06-110-043, Special Cleaning Procedure No. 6, Bolthole Cleaning for Eddy Current Inspection.

(12) Disposition, Documentation, and Records.

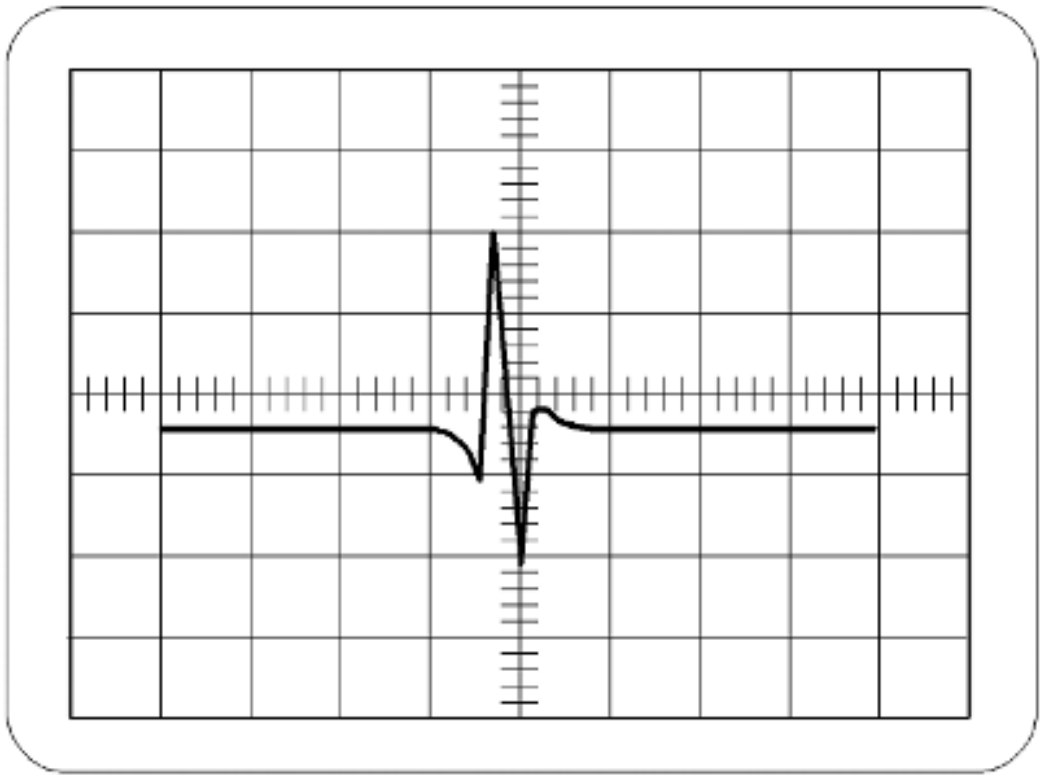
(a) Any indication equal to or greater than the criteria specified in the appropriate Service Bulletin or Engine/Shop Manual procedure for the hardware being inspected shall be evaluated to the requirements of paragraph 2.A.(10), Indication Evaluation/Rejection Criteria.

(b) If the amplitude of any indication, after evaluation, is still equal to or greater than the specified requirements, the hardware shall be considered reject and unserviceable.

(c) If the inspection produces no indications equal to or greater than the specified requirements, the hardware shall be considered serviceable.

(d) As a minimum, record the requested information on Form 699-1(Figure 2).

*** * * FOR ALL**



1098753-01-C

Figure 1 Calibration CRT Display - X/Y Timebase

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HIGH SPEED EDDY CURRENT INSPECTION DATA SHEET

INSPECTOR: _____
DATE: _____ AIRLINE: _____

INSPECTED PART:

PART NAME: _____ DISPOSITION: _____
PART NUMBER: _____ AREA INSPECTED: _____
PART SERIAL NUMBER: _____ ENGINE SERIAL NUMBER: _____
TIME SINCE NEW: _____ CYCLES SINCE NEW: _____

EDDY CURRENT INSTRUMENT:

MANUFACTURER: _____ MODEL: _____
SERIAL NUMBER: _____ FREQUENCY: _____
GAIN: _____ X-AXIS GAIN: _____
Y-AXIS GAIN: _____ PREAMPLIFIER: _____
BANDWIDTH: _____ PHASE: _____
FILTER TYPE: _____ FILTER FREQUENCY: _____

PROBE ROTOR:

MANUFACTURER: _____ TYPE: _____
SERIAL NUMBER: _____

PROBE:

MANUFACTURER: _____ PART NUMBER: _____
SERIAL NUMBER: _____ DIAMETER: _____

CALIBRATION STANDARD:

MATERIAL: _____ SERIAL NUMBER: _____
HOLE SIZE: _____ NOTCH SIZE: _____

INDICATIONS:

HOLE NO.	DEPTH	CLOCK POSITION	AMPLITUDE	COMMENTS

1098754-01-A

Figure 2 High Speed Eddy Current Inspection Data Sheet

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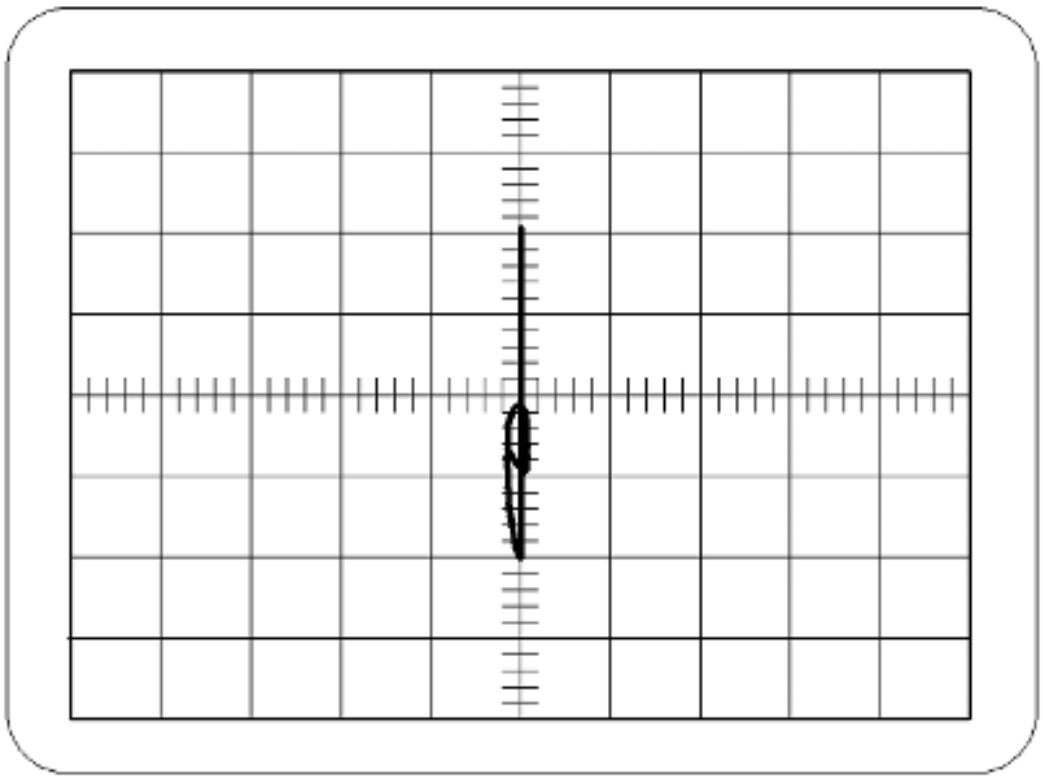

1098752-01-C

Figure 3 Calibration CRT Display - X/Y Impedance Plane

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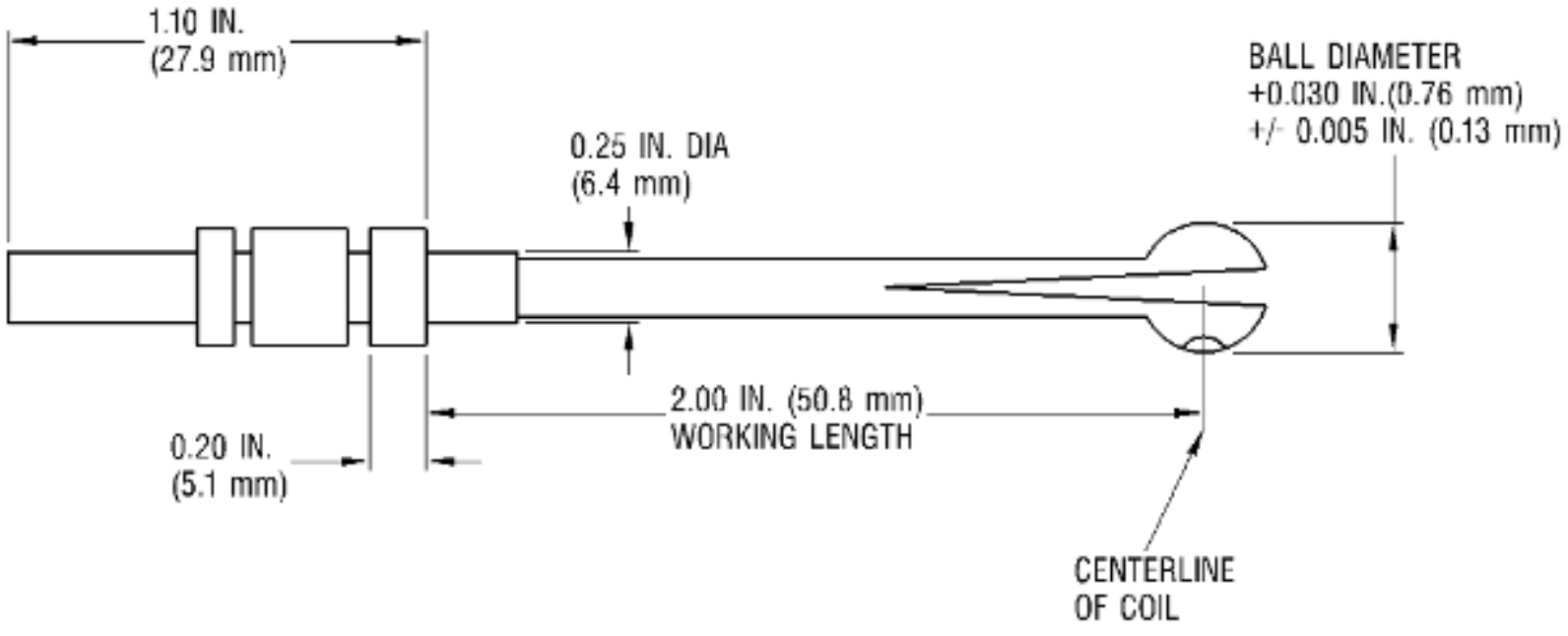

1189679-00-A

Figure 4 High Speed Bolthole Probe, SPO-5000 Series

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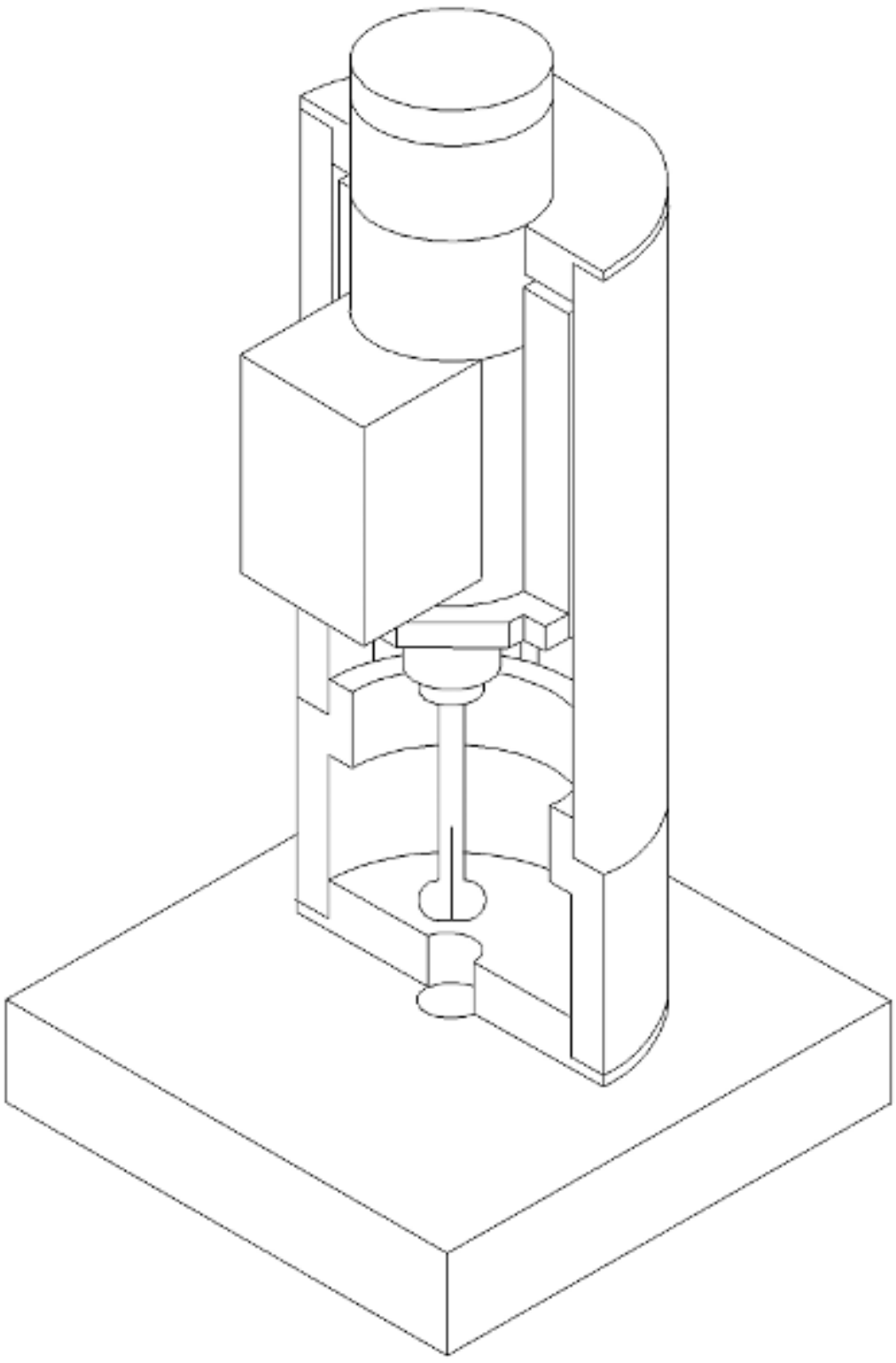

1098750-01-A

Figure 5 Rotor Installed In Guide Fixture

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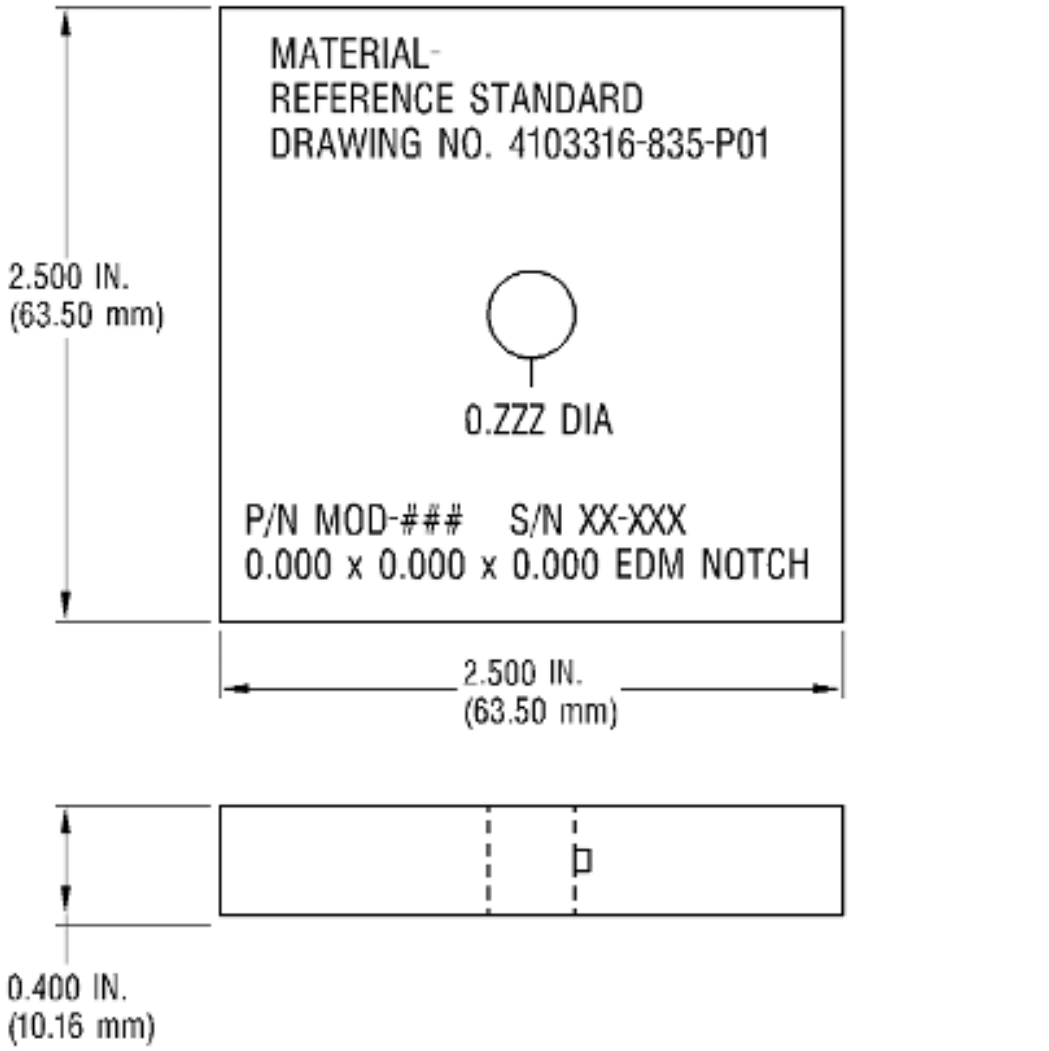

MATERIAL: TO BE SPECIFIED
HEAT TREAT: B50TF14, CLASS D
EDM NOTCH: TO BE SPECIFIED
NOTCH TOL: +/- 0.001 IN. (0.025 mm)
MOD-###: TO BE SPECIFIED
HOLE SIZE: TO BE SPECIFIED

1189676-00-A

Figure 6 Calibration Standard Drawing

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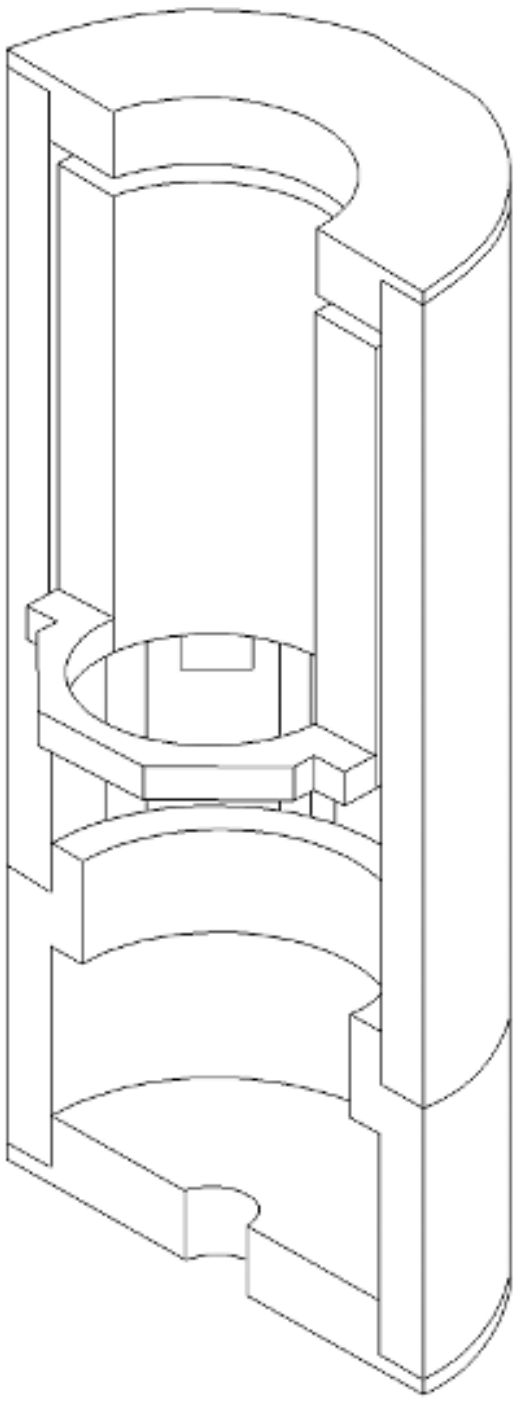

1098749-01-A

Figure 7 Guide Fixture

3. Slow Speed Eddy Current Inspection (Method B).

Subtask 70-32-07-250-012

A. Method B: Slow Speed Eddy Current Inspection Method.

(1) Scope.

(a) This document describes the equipment, technique and procedure required to conduct 2 MHz slow speed eddy current inspections of circular holes in Inconel and titanium alloy engine hardware for the detection of cracking. A service bulletin or shop manual procedure must provide the detailed information needed for inspection of specific parts.

(b) This document describes the general procedure and equipment which have been approved for the performance of slow speed eddy current hole inspections. Exceptions to this procedure may be required for specific cases where the procedure or equipment described here cannot be used or is not appropriate. Such exceptions should be obtained in writing from GE Aircraft Engines.

(2) Applicable Documents.

(a) Instruction manuals or other information provided by equipment manufacturers.
(b) National Aerospace Standard 410 (NAS 410), which replaces MIL-STD 410, and/or American Society of Non Destructive Testing specification ASNT-TC-1A (ASNT-TC-1A).
(c) The appropriate Service Bulletin or Engine/Shop Manual procedure.

(3) Personnel Requirements.

(4) Personnel performing this inspection must be certified in accordance with NAS 410, ASNT-TC-1A, Air Transport Association Specification No. 105 (ATA 105), or locally approved certification program.
(a) Personnel performing this inspection should receive practical training in the use of this procedure and must demonstrate proficiency in calibration of the inspection equipment, inspection of hardware, and evaluation of indications before the authority to accept and reject hardware is delegated.
(b) Any training which may be provided by GE Aircraft Engines for a technique requiring the performance of this inspection method does not imply that the personnel who receive that training have met the requirements for inspector certification in accordance with NAS 410, ASNT-TC-1A, or ATA 105.

(5) Equipment Requirements

NOTE: Items (a) through (f) are to be supplied by the inspection site.

NOTE: Items (g) through (l) can be obtained from GE Aircraft Engines. The correct service bulletin or shop manual inspection procedure will specify (by GE kit Number) the necessary tooling requirements.
(a) Eddy current instrumentation - one of the following types of equipment is required in order to accomplish these inspections or approved equivalent.
1 Nortec Model NDT-19/19E Eddyscope.
2 Nortec Model NDT-16 Eddyscope with Model A16-1 amplifier, Model 016-2 oscillator and either a Model F16-1 or Model FS16-1 or FS16-2 filter module.
3 Rohmann Elotest B1 SDM Eddyscope with Probe socket B1-NOB3H or B1-ANO2.
4 Nortec Model NDT-25L
(b) Strip chart recorder: One of the following types of equipment is required in order to accomplish these inspections, or approved equivalent. (All recorders must have a minimum of 2 channels.)
1 Gould 220 recorder.
2 Gould TA240 recorder with two 13-6615-10A signal conditioners.
3 Gould Windowgraf with two 13-6615-10A signal conditioners.
4 Graphtech WR3310 recorder with two AL 3301 signal conditioners.
5 Graphtech WR7500 recorder with two AL3501 signal conditioners.
NOTE: GE has evaluated the strip chart recorders listed above and found them capable of performing the inspection defined in this procedure. Alternate strip chart recorders are permitted for use if the calibration and the inspection can be performed as described in this procedure. It is the user's responsibility to determine that the strip chart recorder is acceptable and to establish the proper settings such that they are consistent with the intent of SPM 70-32-07, Method B, Slow Speed Bolt Hole Inspection.
(c) Strip chart recorder paper as required.
(d) Connecting cables as required for Eddy current instrument, strip chart recorder, scanners, and controllers.
(e) Bolthole Scanner: One of the following sets of scanner equipment is required to accomplish a bolt hole inspection.
1 Nortec model PS-2M scanner with model PS-2 speed control.
2 Nortec Model PS-3R scanner and PS-3T translator with respective controllers.
(f) A rigid fixture for holding the Nortec bolthole scanners. Refer to paragraph 3.A.(4)(e), Bolthole Scanner. The fixture must have provision for positioning the scanner over the bolt or air holes and provision for adjustment so that the probe body can be set parallel to the axis of the bolt or air hole.
(g) Inspection probe: GE-approved 2 MHz hole probe. Refer to Table 3. The correct probe size to be used will be given in the service bulletin or shop manual procedure for the part to be inspected.

2 MHz Bolt Hole Probes - Table 3

Probe No.	Probe Range	Rotation PS2-M PS-3R		Translation PS-3T
GEC.100-S/2	0.100 - 0.104	60 RPM	100 RPM	1.00 in/min
GEC.105-S/2	0.105 - 0.109	60 RPM	100 RPM	1.00 in/min
GEC.110-S/2	0.110 - 0.114	60 RPM	100 RPM	1.00 in/min
GEC.115-S/2	0.115 - 0.119	60 RPM	100 RPM	1.00 in/min
GEC.120-S/2	0.120 - 0.124	60 RPM	100 RPM	1.00 in/min
GEC.125-S/2	0.125 - 0.129	60 RPM	100 RPM	1.00 in/min
GEC.130-S/2	0.130 - 0.134	60 RPM	100 RPM	1.00 in/min
GEC.135-S/2	0.135 - 0.139	60 RPM	100 RPM	1.00 in/min
GEC.140-S/2	0.140 - 0.144	60 RPM	100 RPM	1.00 in/min
GEC.145-S/2	0.145 - 0.149	60 RPM	100 RPM	1.00 in/min
GEC.150-S/2	0.150 - 0.154	60 RPM	100 RPM	1.00 in/min

GEC.155-S/2	0.155 - 0.159	60 RPM	100 RPM	1.00 in/min
GEC.160-S/2	0.160 - 0.173	60 RPM	100 RPM	1.00 in/min
GEC.169-S/2	0.169 - 0.183	60 RPM	100 RPM	1.00 in/min
GEC.179-S/2	0.179 - 0.193	60 RPM	100 RPM	1.00 in/min
GEC.189-S/2	0.189 - 0.204	60 RPM	97 RPM	0.97 in/min
GEC.200-S/2	0.200 - 0.216	60 RPM	92 RPM	0.92 in/min
GEC.212-S/2	0.212 - 0.229	60 RPM	87 RPM	0.87 in/min
GEC.225-S/2	0.225 - 0.243	60 RPM	82 RPM	0.82 in/min
GEC.239-S/2	0.239 - 0.258	60 RPM	77 RPM	0.77 in/min
GEC.254-S/2	0.254 - 0.274	60 RPM	72 RPM	0.72 in/min
GEC.270-S/2	0.270 - 0.292	60 RPM	68 RPM	0.68 in/min
GEC.288-S/2	0.288 - 0.311	60 RPM	64 RPM	0.64 in/min
GEC.307-S/2	0.307 - 0.332	60 RPM	60 RPM	0.60 in/min
GEC.328-S/2	0.328 - 0.354	56 RPM	56 RPM	0.56 in/min
GEC.350-S/2	0.350 - 0.378	53 RPM	53 RPM	0.53 in/min
GEC.374-S/2	0.374 - 0.404	49 RPM	49 RPM	0.49 in/min
GEC.400-S/2	0.400 - 0.432	46 RPM	46 RPM	0.46 in/min
GEC.428-S/2	0.428 - 0.462	43 RPM	43 RPM	0.43 in/min
GEC.458-S/2	0.458 - 0.495	40 RPM	40 RPM	0.40 in/min
GEC.491-S/2	0.491 - 0.530	37 RPM	37 RPM	0.37 in/min
GEC.526-S/2	0.526 - 0.568	35 RPM	35 RPM	0.35 in/min
GEC.564-S/2	0.564 - 0.609	33 RPM	33 RPM	0.33 in/min
GEC.605-S/2	0.605 - 0.653	30 RPM	30 RPM	0.30 in/min
GEC.649-S/2	0.649 - 0.701	28 RPM	28 RPM	0.28 in/min
GEC.697-S/2	0.697 - 0.753	26 RPM	26 RPM	0.26 in/min
GEC.749-S/2	0.749 - 0.809	25 RPM	25 RPM	0.25 in/min
GEC.805-S/2	0.805 - 0.869	23 RPM	23 RPM	0.23 in/min
GEC.865-S/2	0.865 - 0.934	21 RPM	21 RPM	0.21 in/min
GEC.930-S/2	0.930 - 1.004	20 RPM	20 RPM	0.20 in/min
GEC1.000-S/2	1.000 - 1.080	18 RPM	18 RPM	0.18 in/min
GEC1.076-S/2	1.076 - 1.162	17 RPM	17 RPM	0.17 in/min
GEC1.158-S/2	1.158 - 1.251	16 RPM	16 RPM	0.16 in/min
GEC1.247-S/2	1.247 - 1.347	15 RPM	15 RPM	0.15 in/min
GEC1.343-S/2	1.343 - 1.450	14 RPM	14 RPM	0.14 in/min
GEC1.445-S/2	1.446 - 1.562	13 RPM	13 RPM	0.13 in/min

(h) Calibration standard: Calibration standards must be made of the same material as the part to be inspected. Standards must have a hole with an electrical-discharge-machined (EDM) notch cut in the side. Specific details about the dimensions of the calibration standard, the diameter of the hole or holes, and the size and location of the EDM notch will be specified in the service bulletin or Engine/Shop Manual procedure, for the part to be inspected. See Figure 6.

(i) Marking materials: C05-104 Action Marker 44, black, or equivalent, to mark parts.

(j) Rubber wedge material: Parkway Products, G.E. RTV583, 0.375 in. (9.53 mm) sheet thickness or equivalent such as an eraser.

(k) Cleaning materials: Approved cleaning materials and solvents should be used to make sure the part is clean before inspection.

(l) Teflon tape: maximum thickness 0.0035 inch (0.089 mm) 3M Company, number 5490, 0.25 in (6.35 mm) wide.

(6) Pre-inspection - Part Preparation.

(a) Clean the holes using approved cleaning materials. Refer to TASK 70-22-06-110-043, Special Cleaning Procedure No. 6, Bolthole Cleaning for Eddy Current Inspection.

(b) Number the holes for reference. The reference location for numbering is the "/" in the designation "S/N" where the part serial number is located. Hole number 1 is the first hole clockwise from the "/", aft looking forward (ALF). If the "S/N" mark does not exist, the number 1 hole will be the first hole clockwise from the initial digit of the serial number. All remaining holes are then numbered in sequence moving clockwise, aft looking forward.

(c) Visually inspect the holes under white light. Clean the holes again, as required, to remove any remaining dirt or foreign material. Refer to TASK 70-22-06-110-043, Special Cleaning Procedure No. 6, Bolthole Cleaning for Eddy Current Inspection. Note on the appropriate inspection data sheet any significant physical conditions in the holes such as evidence of fretting or rubbing.

(7) Equipment Set-up.

(a) Set the instrument control settings in accordance with Table 4.
(b) Set the Gould model No. 220 to the settings in accordance with Table 4, or alternate recorder in accordance with Figure 13.
(c) Adjust the rotational speed of the scanner so that it corresponds to the value noted in Table 3 for that diameter of bolt hole probe being used.

Initial Instrument Control Settings - Table 4

Control Description	Initial Settings
Elotest B1:	
Frequency	2.0 MHz
Gain	40 dB
Y Axis Gain	0 dB
X Axis Gain	0 dB
Preamplifier	12 dB
Bandwidth	HF
Phase	0 degrees
Dot Position Y/X	0/0
NDT-16:	
Filter	Lowpass 100 Hz
Gate	Off
Alarm	Off
Power switch	On
Rotation Control	0.0
Gain Control	2.00
Frequency Selector	2 MHz
X Control	Mid Range
R Control	Mid Range
Display Sensitivity	1V (H & V)
Null Button	-
Memory Control Features	Storage
CRT Adjustment Controls (at GRD)	Center Spot
Display Selector	Filter
Filter Out Switch	In
20 Hz Filter Switch	Out
10 Hz Filter Switch	Out
5 Hz Filter Switch	Out
Filter FS16-1 or 2 Modules:	
Sweep Mode Switch	HV
Sweep Range Switch	Any
Sweep Speed Switch	Any
Sweep Trigger	Free Run
Erase Mode Switch	Manual
Record Mode Switch	Manual
Record Control Connector	-
Ext. Trigger Connector	-
Filter Out Switch	In
20 Hz Filter Switch	Out
10 Hz Filter Switch	Out
5 Hz Filter Switch	Out
NDT-19/19E:	
Power	On
Control Lock	Off
Tape In	Off
Display	Frequency 1
Sweep	Off
Program	01
Memory 2	Off
Alarm	Off

Latch	Off
Frequency KHz	2000
Gain (Horizontal & Vertical)	51.0
Position (Horizontal & Vertical)	128
Angle (Rotation)	00
Filter - High Pass	0
Filter - Low Pass	100
SP 01, 03, 04, 05	Off
SP 02 (Probe Drive)	2 or High
Continues Null	Off
F1/F2 (Frequency)	Frequency 1
NDT 25L:	
Power	On
Status Lights	On
Alarm	Optional
Display:	
H/T	Off/NA
V/T	Off/NA
H/V	On
Non Store	Off
Alarm Size	NA
Alarm Pos	NA
Man X	As Needed
Man R	As Needed
Functions:	
V Read	Off
H Read	Off
V Sens	1
H Sens	1
Frequency	2000 kHz
Angle	As Needed
Gain	50 dB
Prog Store	As Needed
Call Prog	As Needed
Filters:	
High Pass	0 Hz
Low Pass (special function)	100 Hz
Gould 220 Recorder:	
Vertical Pen Position	Centered
Horizontal Pen Position	Centered
Horizontal Fine Sensitivity	Full CW
Vertical Fine Sensitivity	Full CW
Horizontal Coarse Sensitivity	50mv/div
Vertical Coarse Sensitivity	20mv/div
Horizontal/Vertical Markers	Off
Recorder Power Button	On
Chart Stop Button	In
Chart Speed Selectors	Out

(d) Figure 13 provides equivalent settings for times when alternate recorders are used instead of the Gould 220. To use this table, refer to the Gould 220 initial settings in Table 4, find that setting in Figure 13 for the 220 then read across the table for the appropriate setting for the selected recorder.

NOTE: Some inspection procedures require long term storage of strip chart recordings in excess of five (5) years. In these cases, the Gould 220 must be used and not the alternates, since the alternates listed in this document use thermal recording paper with a recorded shelf life limited to five (5) years.

NOTE: It is the user's responsibility to assure that the recording medium complies with the appropriate regulation.

(e) For inspections being accomplished with a Nortec PS-3TR scanner, adjust the speed of translation on the PS-3T controller so that it has the value noted in Table 3 for the diameter of hole under inspection.

NOTE: For smaller diameter bolt hole probes, adjust the rotational speed of the scanner to the maximum if the speed noted on Table 3 can not be achieved.

(f) Connect the vertical output of the eddy current instrument to Channel No. 1 of the strip chart recorder and the horizontal output of the eddy current instrument to Channel No. 2.

(8) Probe Preparation.

(a) Select the appropriate size probe for the hole to be inspected as specified in the applicable service bulletin or shop manual procedure. Refer to Table 3.

(b) Apply teflon tape to completely cover coil face. See Figure 12.

NOTE: There must be no wrinkles in the tape edges or they will snag on entering the hole. If the tape is wrinkled, it is too wide or was improperly applied. Remove it, cut a narrower piece, and apply the new piece.

(c) Manually insert the probe into the calibration hole to determine fit. Proper fit is achieved when the probe tip is snug enough that it will stand alone and supports it's own weight. On inserting or withdrawing the probe there should be a light drag.

(d) For probes with saw slots, proper fit is obtained by cutting a piece of wedge rubber, at a slight wedge shape. Gross wedge shapes will work themselves out of the probe slot. Insert the rubber wedge into the probe slot and adjust for fit as described in paragraph 3.A.(7)(c). See Figure 11.

(e) For probes without saw slots, proper fit is obtained by applying teflon tape as required to the probe body opposite the coil.

(f) Insert probe into scanner.

(9) Equipment Calibration.

CAUTION: BEFORE REMOVING ANY MODULE IN A NDT-16, TURN OFF THE INSTRUMENT POWER. MODULE DAMAGE MAY RESULT IF THE POWER IS NOT TURNED OFF.

(a) Connect the equipment and set the initial control settings per paragraph 3.A.(6) of this document.

1 Set up the NDT-16 as follows:

a Remove the No. F16-1 filter module during set up of the equipment and carefully snap off the left side cover of the module.

b Move the small slide switch inside the module near the front panel to position X1.

c Replace the cover and reinsert the filter module.

2 Set up the Elotest B1 as follows:

a Determine the maximum possible preamplifier gain by increasing the preamplifier gain until the "PREAMP OVERLOAD" indication appears.

NOTE: To minimize instrument produced noise, the preamplifier gain should be increased to the maximum possible value without producing a preamplifier overload condition.

b Reduce the preamplifier gain just enough to eliminate the overload indication.

CAUTION: DO NOT PRESS THE COMPENSATION BUTTON AFTER SWITCHING BACK TO THE LOW-PASS FILTER.

c To operate at higher preamplifier gain levels, tune the impedance bridge circuitry. Set the filter to 100 Hz high-pass and press the compensation (null) button. Change the filter back to 100 Hz low-pass.

d Place the probe on a test piece or calibration standard.

e Adjust the two small potentiometers on the adapter to move the dot as close as possible to the null point on the display.

NOTE: If the dot position function is set to 0/0 then the null point will be at the center of the display.

f If necessary, reduce the gain to bring the dot on screen so that this adjustment may be made.

NOTE: With proper bridge adjustment it is possible to operate at high pre-amplifier gain settings. This adjustment may be different for each probe. After completing this adjustment, the compensation button can be used as needed to null the instrument.

3 No special preparation is necessary for the Nortec NDT 19, NDT 19E, or NDT 25L.

(b) Prepare the probe as stated in paragraph 3.A.(7) of this document.

(c) Align the probe and scanner for correct entry into the hole with the calibration notch. Refer to 3.A(4)(h) calibration standard.

(d) Turn on the PS-2M or PS-3T and 3R probe scanner and drive the probe down into the calibration hole until the probe coil is completely within the hole.

(e) Stop the scanner when the white epoxy line on the probe stem faces away from the EDM slot location.

(f) Null the instrument. For NDT-16, null for 5 to 10 seconds or until the spot stabilizes in the center of screen.

(g) With the probe still in the calibration hole, turn on the PS-2M (FWD) and put the transmission in R for rotate only. For PS-3T and 3R systems, turn on the PS-3R for probe rotation only.

(h) Change the filter on the eddy current instruments:

1 On the NDT 16, set the filter to 5 Hz (high pass).

2 On the NDT 19 and 19E, leave the low pass filter at100 Hz, and set the high pass filter to 4 Hz or 5 Hz.
3 On the Elotel B1, change the filter from the low pass100 Hz to high pass 5 Hz.
4 On the NDT 25L, leave the low pass filter (SP-02) at 100 Hz, and set the high pass filter to 5 Hz.

(i) Turn on the strip chart recorder and check that Channel No. 1 is on 20 mV/Div. and Channel No. 2 is on 50 mV/Div.

(j) Translate the probe within the calibration hole until the EDM notch is detected.

(k) Manually translate the rotating probe across the entire EDM notch 0.003 in. (0.08 mm) at a time to determine where the maximum amplitudes are achieved on Channel No. 1 and No. 2.

(l) Observe the EDM notch response on the eddyscope. Adjust the rotation or phase control to obtain an EDM notch response pointing(longest leg) into the upper left quadrant of the CRT for Inconel or into the lower left quadrant of the CRT for Titanium. See Figure 10 and Figure 9. In both instances the phase angle established by this step should be set to approximately 45 degrees from horizontal.

(m) Examine the recorder tracings on Channels No. 1 and No. 2. Alternately adjust the rotation (Phase) and gain controls to achieve calibration amplitudes of 40 percent (400 mV) full scale on Channel No. 1 and 35 percent (875 mV) full scale amplitude in Channel No. 2 (plus or minus 1 percent full scale). Renull is required after any gain adjustment. Assure that the EDM notch response remains in the correct quadrant on the eddyscope.

NOTE: For renulling, it is required that the coils face the side of the hole away from the EDM notch.

NOTE: For calibration standards with correction factors applied to them, calibrate the equipment to those factors (plus or minus1 percent full scale).

NOTE: Calibration standard correction factors - As a result of differences in notch response resulting from possible variations in the fabrication process, calibration standards may have amplitude correction factors (equivalent responses) applied to them. The GE quality technology laboratory will establish these equivalent responses by comparing the responses from the GE master standard to the response from the subordinate standard. In cases where an equivalent response is required, this equivalent response applies only to the calibration and does not alter the amplitudes specified for indication rejection or evaluation limits.

(n) When these amplitudes have been achieved, translate the probe very slowly across the entire notch to assure that the calibration has been performed at the point of maximum response from the notch. If a greater amplitude is obtained on the strip chart Channel No. 1 (vertical), repeat paragraphs 3.A.(8)(m) and (n).

(o) If excessive noise is experienced on Channel No. 1 at the calibration settings, check for the following:
1 Teflon tape on probe face worn or damaged.
2 Probe not aligned with calibration hole.
3 Probe not wedged properly.
4 Calibration hole dirty.
5 Equipment malfunction (high gain).

(p) Record all calibration data onto the strip chart recording and onto an appropriate inspection data sheet. See Figure 8.

(10) Part Inspection

(a) Assure the teflon tape is still covering the coil. Replace if it is worn or wrinkled, and recheck calibration.

(b) Examine the probe fit in several holes and make whatever adjustments are necessary to ensure a fit which is equivalent to that obtained for calibration. Holes may be over or undersize and it may be desirable to inspect all the holes of one size before changing the diameter of the probe if it is required.

(c) Scan all holes in the upward direction (translation) unless otherwise specified.

NOTE: Check the teflon tape on the probe frequently and replace it if it becomes worn or wrinkled.

(d) If any indications exceeding the requirements of paragraph3.A.(11) of this document are found, mark the hole for evaluation.

(e) After all holes have been inspected, evaluate the indications from paragraph 3.A.(9)(d) per paragraph 3.A.(12) of this document.

(f) Complete the post-inspection check per paragraph 3.A.(10) of this document.

(11) Post-inspection Calibration Check.

(a) After completion of the part inspection, or after intervals not to exceed four hours, check the calibration on the calibration standard.

(b) If the calibration repeats within ±5 percent of full scale at channel No.1 of the strip chart recorder the test is acceptable.

(c) If the amplitude of the response on Channel No. 1 has decreased by 5 percent of full scale amplitude, repeat the calibration procedure and reinspect all parts inspected since the previous calibration.

(d) If the amplitude of the response on Channel No. 1 has increased by more than 5 percent, only parts previously found to be rejected to paragraph 3.A.(11) need to be reinspected, repeat the calibration procedure prior to additional inspection.

(12) Inspection Requirements.

(a) Any indication equal to or greater than the criteria specified in the service bulletin or Engine/Shop Manual procedure for the part being inspected must be evaluated according to the requirements of paragraph 3.A.(12).

(b) If, after completion of the evaluation procedure, the amplitude of any indication is still equal to or greater than the requirements of the service bulletin or Engine/Shop Manual procedure, the part must be considered unserviceable.

(13) Indication Evaluation.

NOTE: The optimum time to perform these evaluations is either at the time the indication is found, or immediately after the completion of the inspection of a specific area.

(a) Examine the traces on Channel No. 1 of the strip chart for each hole. For each hole with an indication(s) meeting the requirements of paragraph 3.A.(11), reclean the hole with a cotton swab moistened with cleaning fluid, and reinspect the hole. If the indication remains, it is considered repeatable, and should be evaluated as stated below. If not, proceed to next indication.

(b) For all repeatable indications record the hole number, Channel No. 1 amplitude on the recorder and the location within the hole on the appropriate inspection data sheet.

(c) Carefully examine the area under evaluation with a bright white light, using a glass of 2 to 10 power. Note any unusual conditions, such as discoloration, scratches, score marks, sharp edges, uneven surfaces, etc. Record these conditions on the appropriate inspection data sheet.

(d) Carefully reclean the area containing the indication per paragraph 3.A.(5) of this document. Assure that no protruding material exists in the area.

(e) Check that the probe fits snugly in the hole, and that the hole has not become elliptical.

(f) Assure that the calibration amplitude is 40 percent full scale on Channel No. 1 and 35 percent full scale amplitude on Channel No. 2. Assure that the EDM notch is in the correct quadrant on the eddyscope.

(g) Repeat the inspection of the hole. If the indication amplitude has reduced, repeat the cleaning process as necessary until the indication is removed or the amplitude of the eddy current indication is reduced below the evaluation limit.

(h) If the indication cannot be reduced in amplitude to an acceptable level, or increases in amplitude, as a result of the cleaning, refer to paragraph 3.A.(11) and the appropriate service bulletin or shop manual procedure for information regarding the disposition of the part.

(14) Records

(a) As a minimum, the following information must be permanently written on each strip chart recording and an appropriate inspection data sheet.

Item	Data To Be Recorded
1 Eddyscope:	Manufacturer Model No. Serial No. Gain level Frequency setting Rotation control setting Filter switch position
2 Recorder:	Manufacturer Serial No. Horizontal channel coarse sensitivity Vertical channel coarse sensitivity Chart speed
3 Probe:	Model number, frequency designation, and serial number
4 Indications:	Evaluation of all reportable indications and results
5 Part:	Part Name Part Number Part Serial Number Engine Serial Number Type of Inspection and area. Example: Inner Bolt Holes Cycles Since New/Time Since New (CSN/TSN) if available

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SLOW SPEED EDDY CURRENT INSPECTION DATA SHEET

INSPECTOR: _____
DATE: _____ AIRLINE: _____

INSPECTED PART:

PART NAME: _____ DISPOSITION: _____
PART NUMBER: _____ AREA INSPECTED: _____
PART SERIAL NUMBER: _____ ENGINE SERIAL NUMBER: _____
TIME SINCE NEW: _____ CYCLES SINCE NEW: _____

EDDY CURRENT INSTRUMENT:

MANUFACTURER: _____ MODEL: _____
SERIAL NUMBER: _____ FREQUENCY: _____
GAIN: _____ X-AXIS GAIN: _____
Y-AXIS GAIN: _____ PREAMPLIFIER: _____
BANDWIDTH: _____ PHASE: _____
FILTER TYPE: _____ FILTER FREQUENCY: _____

STRIP CHART RECORDER:

MANUFACTURER: _____ SERIAL NUMBER: _____

PROBE ROTOR:

MANUFACTURER: _____ TYPE: _____
SERIAL NUMBER: _____

PROBE:

MANUFACTURER: _____ PART NUMBER: _____
SERIAL NUMBER: _____ DIAMETER:

CALIBRATION STANDARD:

MATERIAL: _____ SERIAL NUMBER: _____
HOLE SIZE: _____ NOTCH SIZE: _____

INDICATIONS:

HOLE NO.	DEPTH	CLOCK POSITION	AMPLITUDE	COMMENTS

1098755-01-A

Figure 8 Slow Speed Eddy Current Inspection Data Sheet

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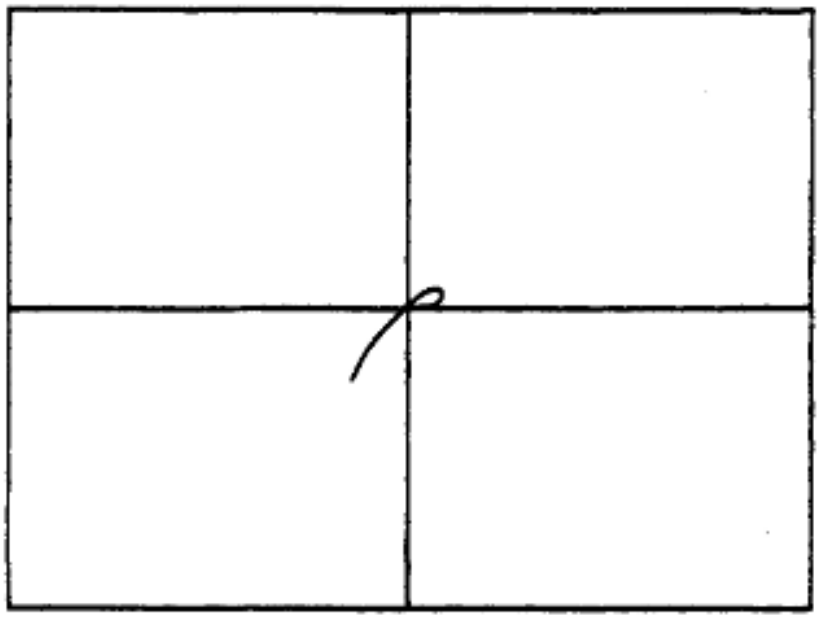
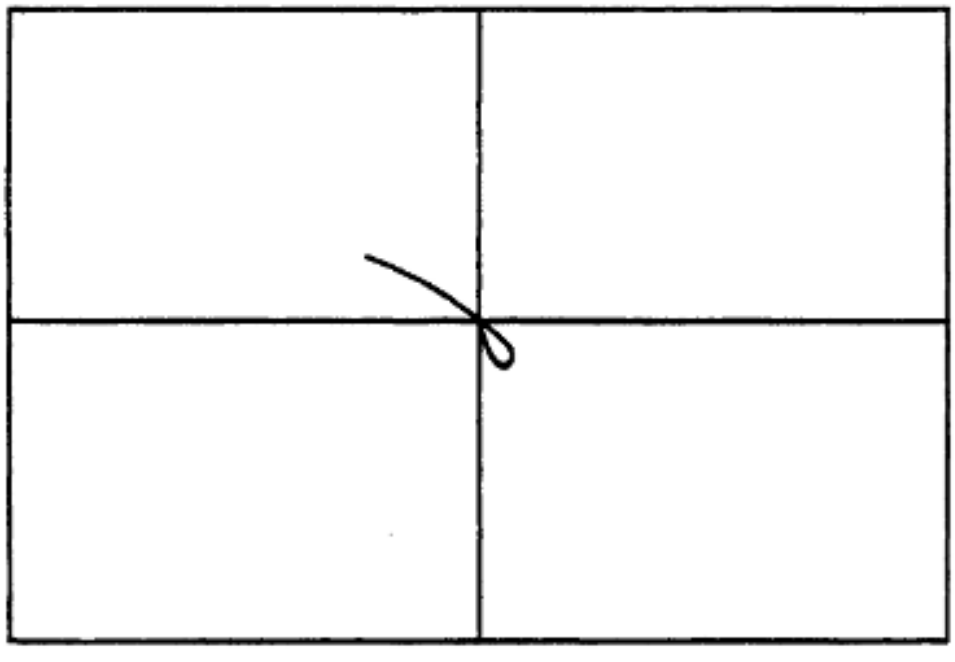


1151241-00-C

Figure 9 Titanium Notch Response

*** * * FOR ALL**



1151242-00-C

Figure 10 Inconel Notch Response

*** * * FOR ALL**

1151240-00-C

Figure 11 Rubber Wedging for Sizing

*** * * FOR ALL**

1151239-00-C

Figure 12 Application of Teflon Tape to Probe

*** * * FOR ALL**

SETTING	GOULD 220	GOULD TA240 (EASY GRAF) WITH 13-6615-10A SIGNAL CONDITIONERS	GOULD WINDOWGRAF WITH 13-6615-10A SIGNAL CONDITIONERS
POWER	ON	ON	ON
CHART SPEED	(MM/SEC BUTTON DEPRESSED) 1 MM/SEC 5 MM/SEC 25 MM/SEC 125 MM/SEC	 1 MM/SEC 5 MM/SEC 25 MM/SEC 125 MM/SEC	 1 MM/SEC 5 MM/SEC 25 MM/SEC 125 MM/SEC
CHANNEL POSITION	CHANNEL 1 & 2 CENTERED	CHANNEL 1 & 2 CENTERED	CHANNEL 1 & 2 CENTERED CHAN. 3 & 4 PULLED OUT (OFF)
CHANNEL SENSITIVITY	 1 (mV/DIV) 2 5 10 20 50 100 200 500 1 (V/DIV) 2 5 10	(x1/x100 BUTTON OUT) .05 VOLTS FULL SCALE .10 .25 .5 1.0 2.5 5.0 (x1/x100 BUTTON IN) .10 VOLTS FULL SCALE .25 .5 1.0 2.5 5.0	(x1/x100 BUTTON OUT) .05 VOLTS FULL SCALE .10 .25 .5 1.0 2.5 5.0 (x1/x100 BUTTON IN) .10 VOLTS FULL SCALE .25 .5 1.0 2.5 5.0
VARIABLE SENSITIVITY (GAIN)	SENSITIVITY x1 KNOB FULL CLOCKWISE	VARIABLE GAIN BUTTON DEPRESSED	VARIABLE GAIN BUTTON DEPRESSED
VARIABLE OFFSET	N/A	BUTTON DEPRESSED	BUTTON DEPRESSED
FLT	N/A	BUTTON OUT (NO LP FILT.)	BUTTON OUT (NO LP FILT.)
ON/OFF (ON SIGNAL CONDITIONER)	N/A	CHANNEL 1&2 ON (IN)	CHANNEL 1 & 2 ON (IN) CHANNEL 3 & 4 OFF (OUT)
AC/DC	N/A	DC (BUTTON IN)	DC (BUTTON IN)
CURSER	N/A	OFF	OFF
PRINTER	N/A	ON/OFF (AS DESIRED)	ON/OFF (AS DESIRED)
EVENT MARKER	N/A	ON/OFF (AS DESIRED)	ON/OFF (AS DESIRED)
MENU SETTINGS	N/A	N/A	MENU 1: GRID TYPE: 2 CHANNEL STRIP DISK: SAVE CONTINUOUS FIT SCR. MODE: XY,X=CH1

1113210-00-A

Figure 13 (Sheet 1) Alternate Strip Chart Recorder Settings

*** * * FOR ALL**

SETTING	GOULD 220	GRAPHTECH WR3310 AL 3301 SIGNAL COND. RICOH CHART PAPER # PR410-2B	GRAPHTECH WR7500 AL 3501 SIGNAL COND. GRAPHTEC CORP PAPER # PR-220
POWER	ON	ON	ON
CHART SPEED	(MM/SEC BUTTON DEPRESSED) 1 MM/SEC 5 MM/SEC 25 MM/SEC 125 MM/SEC	50 MM/SEC * (MIN/SEC BUTTON OUT) 5 MM/SEC (MIN/SEC BUTTON DEPRESSED) 25 MM/SEC " " 100 MM/SEC * " " * APPROXIMATELY EQUAL TO GOULD 220	(SEC/MIN BUTTON DEPRESSED) 1 MM/SEC 5 MM/SEC 25 MM/SEC N/A
CHANNEL POSITION	CHANNEL 1 & 2 CENTERED	CHANNEL 1 & 2 CENTERED	CHANNEL 1 & 2 CENTERED
CHANNEL SENSITIVITY	1 (mV/DIV) 2 5 10 20 50 100 200 500 1 (V/DIV) 2 5 10	RANGE KNOB (mV/x100mV) 10 mV/cm (SET AT mV) 20 50 100 200 500 1000 20 (SET AT 100mV) 50 100 200 500 1000 NOTE: FS VOLTAGE WILL DIFFER, HOWEVER V/DIV WILL BE THE SAME	RANGE KNOB (V/x100V) .05 (SET AT V) .1 .2* .5 1.0 2.0* 5.0 .1 (SET AT 100V) .2* .5 1 * 80% OF GOULD 220 2* 5
VARIABLE SENSITIVITY (GAIN)	SENSITIVITY X1 KNOB FULL CLOCKWISE	SET UPON CALIBRATING INST. WITH CAL. V SWITCH	SET UPON CALIBRATING INST. WITH CAL. V SWITCH
CHART EXT.	N/A	BUTTON OUT	BUTTON OUT
FLT	N/A	(INTERNAL) SET TO "OFF"	(INTERNAL) SET TO "OFF"
ON/OFF (ON SIGNAL CONDITIONER)	N/A	SWITCH TO MEASURE CHANNEL 1 & 2	SWITCH TO MEASURE CHANNEL 1 & 2
TIMING	N/A	N/A	AS DESIRED; EVENT/TIMING BUTTON IN/ PULSE TIMING AS DESIRED
EVENT MARKER	AS DESIRED	ON/OFF (AS DESIRED)	EVENT/TIMING BUTTON IN/ DEPRESS EVENT BUTTON AS DESIRED
HEAT ON SIG. COND.	N/A	ON (UP)	DEPRESS ALL 3 HEAT BUTTONS (ON)

1113211 00 A

Figure 13 (Sheet 2) Alternate Strip Chart Recorder Settings

4. High Speed Eddy Current Inspection Method with Electronic Data Acquisition and Storage (Method C).
Subtask 70-32-07-250-013

A. Method C: High Speed Eddy Current Inspection with Electronic Data Acquisition and Storage.

(1) Scope.

(a) This document describes the equipment, technique, and procedure necessary to perform a 2 MHz high speed eddy current inspection with electronic data acquisition of circular holes in engine hardware. A Service Bulletin or Engine/Shop Manual procedure shall provide the detailed information needed for inspection of specific parts.

(b) Perform the inspection of the hardware in accordance with Subtask 70-32-07-250-011, High Speed Eddy Current Inspection (Method A), and the following parameters.

(2) Applicable Documents.

(a) All documents listed in paragraph 2.A.(2), Applicable Documents, are to be followed. Refer to Subtask 70-32-07-250-011, High Speed Eddy Current Inspection (Method A).

(3) Personnel Requirements.

(a) Personnel performing this inspection must be certified in accordance with one of the requirements listed in paragraph 2.A.(3), Personnel Requirements. Refer to Subtask 70-32-07-250-011, High Speed Eddy Current Inspection (Method A).

(4) Pre-inspection Part Preparation.

(a) Pre-inspection part preparation is to be performed in accordance with Subtask 70-32-07-250-011, High Speed Eddy Current Inspection (Method A).

(5) Equipment Requirements.

CAUTION: THE HOLESCAN SYSTEM IS A HIGH PERFORMANCE, PC-BASED EDDY CURRENT ELECTRONIC DATA ACQUISITION SYSTEM. DO NOT INSTALL ANY OTHER SOFTWARE (GAMES, SCREEN SAVERS, ETC.) OR HARDWARE (NETWORK CARDS, GAME CARDS, ETC.) WITHOUT APPROVAL FROM THE SYSTEM MANUFACTURER.

(a) Holescan system: Rohmann GmbH ScanAlyzer or a GEAE-approved equivalent. The Holescan/ScanAlyzer eddy current inspection system is a universal software program to analyze, record and file data of image generating eddy current inspections. The ScanAlyzer system includes the following recommended components:

1 Computer - IBM-compatible PC, with Pentium processor > 200 MHz, main memory > 32 MB, monitor - SVGQ graphic card (256 colors > 800 x 600 pixel) 1024 x 786 recommended, operating system - Windows NT operating system with Service Pack 3 or higher, Elotest PC4 digitizing PC-card (type PC4/0, PC4/1, or PC4/2) and all associated software, or an approved equivalent.

2 Eddy current instrument - Rohmann Elotest B1/V4 or latest version with model B1-RS probe adapter.

3 Guide fixture - A GEAE-approved guide fixture, P/N SO16602, to provide mechanical control of the probe angle.

4 Probe rotor - SR1-HF Rohmann ScanAlyzer rotation scanner with analog or digital position identification, or an approved equivalent.

5 Cable - Rohmann GmbH model RK-2N cable, or an approved equivalent.

6 Probe Adapter - ARM1 for Rohmann rotor, or an approved equivalent.

(b) Probe: GE Aircraft Engines (GEAE) SPO-5000 series probe or an approved equivalent. The correct probe size will be specified in the Service Bulletin or Engine/Shop Manual procedure for the part to be inspected. Refer to Figure 4.

(c) Calibration Standard: Calibration standards must be made of the same material as the part to be inspected. Specific details will be specified in the Service Bulletin or Engine/Shop Manual procedure for the part to be inspected. Refer to Figure 6.

(d) Mineral Oil: A small amount of mineral oil or other GEAE-approved lubricant can help produce a smoother probe rotation, reduce probe wear, and reduce incorrect eddy current signals. It is important that the lubricant be a relatively inert material to avoid chemical reactions that may affect probe performance or reduce its useful life. The use of mineral oil or another lubricant is not necessary but can be used at the discretion of the inspector.

(e) Cleaning Materials: Use GEAE-approved cleaning materials and solvents to make sure the part is clean before inspection.

(f) Marking Materials: Action Marker P/N Q404, black, or a GEAE-approved equivalent, to mark parts.

(g) Flex-Hones: Flex-Hones may be used when more aggressive cleaning is required and shall be specified in the appropriate Service Bulletin or Engine/Shop Manual.

(h) Inspection Shoes: A dedicated inspection fixture (shoe) for each piece of hardware has been designed to help facilitate inspection of the boltholes. It is recommended that inspection be performed using the inspection shoes. A list of approved inspection shoes can be obtained from GEAE.

(6) Initial Equipment Setup.

(a) Make all necessary cable connections for system operation.

(b) Select the appropriate eddy current probe and calibration standard for inspection.

(c) Insert the probe into the calibration standard hole to check the fit. It is desirable to have the probe lightly touch the surface of the hole but there should be no interference or binding. The motor in the probe rotor is very low torque so any drag will slow or stop the rotor.

1 If the difference between the probe and hole diameter is too great, either too large or too small, it may be necessary to use a slightly larger or smaller probe.

(d) Insert the probe into the probe rotor.

CAUTION: TURN OFF THE POWER TO THE ROHMANN EDDY CURRENT INSTRUMENT WHEN IT IS NOT IN USE. DAMAGE TO THE CATHODE RAY TUBE (CRT) MAY OCCUR WHEN IT IS NOT USED FOR MORE THAN ONE HOUR.

(e) Adjust the Rohmann Elotest B1/V4 controls in accordance with the settings given in Table 5.

(f) Adjust the Holescan system controls:

1 Using the DEVICE SETUP menu in the APPLICATIONS MANAGER menu, adjust the ScanAlyzer controls in accordance with the settings given in Table 6, Table 7, and Table 8.

(g) Recommended filter settings for certain probe diameters are given in Table 9.

NOTE: Filter settings are based upon probe diameter. The settings may change over time because of probe wear. The table below is a reference to use as a starting point for filter settings. Because of probe manufacturer, conditions, and diameter, some adjustment to these settings may be necessary to achieve equal lengths of the eddy current signal legs.

Rohmann Elotest B1/V4 Controls - Table 5

Description	Initial Setting

Frequency	2 MHz
BWL	Off
Gain	60 dB
Pre-amp	Increase until probe trouble/overload is detected by the instrument, and then reduce the pre-amp by one setting
X Axis Gain	0 dB
Y Axis Gain	0 dB
Phase	186
Disp	Y/X
Highpass Filter	See Filter Settings Table
Lowpass Filter	See Filter Settings Table
Band	Dyn (600-850 Hz band pass)
Dot Position	0/0
Timebase	SYNC - Auto
Gate	Optional
Alarm	Optional

NOTE: The initial settings of the MAIN PARAMETERS dialog box in the INSTRUMENT menu can be downloaded to and/or from the Rohmann Elotest B1/V4 instrument.

Holescan System Controls, INSTRUMENT Menu - Table 6

Description	**Setting**
DISPLAY Window:	
Threshold Type	Cross Threshold (Box)
Threshold Level X-Axis (Cross/Box)	250/250
Threshold Level Y-Axis (Cross/Box)	100/100
Alarm Mode	Short (Visible)
Timebase	Auto
X-deflection	25ms/div
Single Shot Time	0.3 sec
Roll Mode Time	8s

Holescan System Controls, SCAN DEVICE Menu - Table 7

X-Axis		**Y-Axis**		**Info**	
PC4 SCANNER PARAMETERS Window:					
Meter Mode	Rotor Double (rotor checked)	Meter Mode	Analog (fixed lines checked)	Data Source	Channel 1 (ext)
Meter Unit	Degrees	Meter Unit	(Inches)		
Start Position	0	Start Position	0		
End Position	360	End Position	2.165354		
Scan Resolution	0.5	Scan Resolution	0.015		
Physical Resolution	0.5	Physical Resolution	0.000528651		
Max Scan Speed	3600				

NOTE: AXIS dialog box in the DISPLAY menu is not used for set up of ScanAlyzer.

Holescan System Controls, DISPLAY Menu - Table 8

Standard DISPLAY Configuration Window:	
Adjust Default Volt/Div.	0.5 V/Div.
C-Scan Unit	Use Div.

Recommended Filter Settings - Table 9

Probe Diameter (Inch)	**Highpass Filter (Hz)**	**Lowpass Filter (Hz)**
0.192	200	800
0.239	200	800
0.244	200	800
0.247	200	800
0.281	400	1000
0.294	400	1000
0.299	400	1000
0.308	400	1000

0.314	400	1000
0.318	400	1250
0.328	400	1250
0.334	400	1250
0.395	500	1250
0.408	500	1250
0.435	500	1250
0.514	500	1250

(7) Equipment Calibration.

NOTE: The eddy current instrument displays the peak-to-peak eddy current signal. The ScanAlyzer system captures the peak response of the longest leg of the eddy current signal, not the peak-to-peak value. Any calibration response from the ScanAlyzer system must be doubled for the correct calibration amplitude.

(a) Equipment calibration is to be performed in accordance with Subtask 70-32-07-250-011, High Speed Eddy Current Inspection (Method A).

(8) Hardware Inspection.

(a) Attach the appropriate inspection shoe to the guide fixture for inspection of boltholes.

(b) Hardware inspection is to be performed in accordance with Subtask 70-32-07-250-011, High Speed Eddy Current Inspection (Method A).

(9) Post-inspection Calibration Check.

(a) Remove the inspection shoe from the guide fixture before post-inspection calibration check.

(b) Post-inspection calibration is to be performed in accordance with Subtask 70-32-07-250-011, High Speed Eddy Current Inspection (Method A).

(10) Indication Evaluation/Rejection Criteria.

NOTE: The eddy current instrument displays the peak-to-peak eddy current signal. The ScanAlyzer system captures the peak response of the longest leg of the eddy current signal, not the peak-to-peak value. Any evaluation performed of an eddy current response from the ScanAlyzer system must be doubled for the correct amplitude.

(a) Evaluation and rejection of hardware is to be performed in accordance with Subtask 70-32-07-250-011, High Speed Eddy Current Inspection (Method A).

(11) Cleaning Procedure.

(a) Refer to TASK 70-22-06-110-043, Special Cleaning Procedure No. 6, Bolthole Cleaning for Eddy Current Inspection.

(12) Disposition, Documentation, and Records.

(a) Disposition, documentation, and record keeping are to be performed in accordance with Subtask 70-32-07-250-011, High Speed Eddy Current Inspection (Method A).