



737 NON-DESTRUCTIVE TEST MANUAL

PART 6 - EDDY CURRENT

FORWARD AND AFT ENGINE MOUNTS (HFEC)

1. Purpose

- A. Use this procedure to do an inspection for surface cracks on the cone bolt lugs of the forward engine mount at NAC STA 195.494 and the hanger fittings and link assemblies of the aft engine mount at NAC STA 254.525.
- B. See Figure 1 thru Figure 3 for the location of the inspection areas.
- C. This procedure uses an instrument with an impedance plane display and a 90 degree pencil probe.
- D. Do a fluorescent dye penetrant inspection of the thread runout area of the forward and aft cone bolts. Refer to the Standard Overhaul Practices Manual 20-20-02, General Penetrant Inspection Procedure. See flagnote 2 in Figure 2 of this procedure for the location of the inspection area.

2. Equipment

A. General

- (1) Use inspection equipment that can be calibrated on the reference standard as specified in Paragraph 4.
- (2) Refer to Part 1, 51-01-00, for data about the equipment manufacturers.

B. Instrument

- (1) Use an eddy current instrument that:
 - (a) Has an impedance plane display.
 - (b) Operates at a frequency of 500 kHz.
- (2) The instruments specified below were used to prepare this procedure.
 - (a) Phasec 1.1; Hocking/Krautkramer.
 - (b) NDT-19, NDT-19E; Nortec/Staveley, Inc.
 - (c) MIZ-20A, MIZ-22; Zetec, Inc.
 - (d) Elotest B1; Rohman GmbH

C. Probes

- (1) Use a probe that:
 - (a) Has a 90 degree angle at the tip.
 - (b) Operates at a frequency of 500 kHz.
 - (c) Has a maximum external diameter of 0.13 inch (3.3 mm).
 - (d) Has a maximum length of 6.0 inch (152 mm).
 - (e) Has a maximum drop of 0.1 inch (2.5 mm).
 - (f) Is shielded.
 - (g) Operates as specified in Part 6, 51-00-00, Procedure 24.
- (2) The probes specified below were used to prepare this procedure. Only one probe is necessary to do the inspection. Specify the instrument type when you order a probe.
 - (a) VM202RA-6X.1; VM Products.
 - (b) MP901-60; NDT Engineering Corp.



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(c) MTF901-60; NDT Engineering Corp.

D. Reference Standards

- (1) Use reference standard 367. See Figure 4 for data about the reference standard.

NOTE: If you have reference standard 344, used in a previous revision of this procedure, make sure that it agrees with the specifications of reference standard 367.

3. Prepare for the Inspection

- A. Get access to the inspection areas after the forward cone bolts and aft link assemblies are removed.
- B. Clean the inspection surfaces.

4. Instrument Calibration

NOTE: It is necessary to do three calibrations to do an inspection of the areas identified in Figure 2 and Figure 3.

- A. Calibration for the cone bolt of the forward engine mount.
 - (1) Set the instrument frequency to 500 kHz.
 - (2) Set the vertical to horizontal gain to 2:1.
 - (3) Put the probe on reference standard 367 at probe Position 1 as shown in Figure 5.
 - (4) Balance the instrument.
 - (5) Adjust the balance point to 30 percent of the display as shown in Detail I in Figure 6.
 - (6) Adjust the phase control so that the lift-off signal moves horizontally to the left.
 - (7) Move the probe to Position 2 on the reference standard as shown in Figure 5.
 - (8) Move the probe, at Position 2, to get a maximum signal from the notch on the reference standard.
 - (9) Adjust the gain to get a signal that is approximately 70 percent of the display as shown in Detail I in Figure 6.

NOTE: It may be necessary to lower the instrument low pass filter if the dot is not stable. Use a scan speed across the reference standard notch that will not decrease the signal height.

- B. Calibration for the hanger fitting and link assemblies of the aft engine mount.
 - (1) Calibrate the equipment for the inspection around the bolt holes of the hanger fittings and link assemblies that do not have bushings or that have bushings without flanges.
 - (a) Set the instrument frequency to 500 kHz.
 - (b) Set the vertical to horizontal gain to 2:1.
 - (c) Put the probe on reference standard 367 at probe Position 3 as shown in Figure 5.
 - (d) Balance the instrument.
 - (e) Adjust the balance point to 30 percent of the display as shown in Detail II in Figure 6.
 - (f) Adjust the phase control so that the lift-off signal moves horizontally to the left.
 - (g) Move the probe to Position 4 on the reference standard as shown in Figure 5.
 - (h) Move the probe, at Position 4, to get a maximum signal from the notch on the reference standard.



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- (i) Adjust the gain to get a signal that is approximately 60 percent of the display as shown in Detail II in Figure 6.

NOTE: It may be necessary to lower the instrument low pass filter if the dot is not stable. Use a scan speed across the reference standard notch that will not decrease the signal height.

- (2) Calibrate the equipment for the inspection around the bolt holes of the hanger fittings that have flanged bushings.
 - (a) Set the instrument frequency to 500 kHz.
 - (b) Set the vertical to horizontal gain to 2:1.
 - (c) Put the probe on reference standard 367 at probe Position 5 as shown in Figure 5.
 - (d) Balance the instrument.
 - (e) Adjust the balance point to 30 percent of the display as shown in Detail III in Figure 6.
 - (f) Adjust the phase control so that the lift-off signal moves horizontally to the left.
 - (g) Move the probe to Position 6 on the reference standard as shown in Figure 5.
 - (h) Move the probe, at Position 6, to get a maximum signal from the notch on the reference standard.
 - (i) Adjust the gain to get a signal that is approximately 60 percent of the display as shown in Detail III in Figure 6.

NOTE: It may be necessary to lower the instrument low pass filter if the dot is not stable. Use a scan speed across the reference standard notch that will not decrease the signal height.

5. Inspection Procedure

A. Inspection of the cone bolt of the forward engine mount.

- (1) Make sure the instrument is calibrated as specified in Paragraph 4.A.
- (2) Put the probe on the cone bolt surface in the inspection area identified in Figure 2. Make sure the probe coil is away from the edge of the hole by at least half or more of the probe's external diameter.
- (3) Balance the instrument.
- (4) Slowly make a scan of the inspection area and monitor the instrument display. During the scan:
 - (a) Keep the probe coil adjacent to the edge of the hole.

NOTE: It may be necessary to use a nonconductive circle template to keep the probe-to-edge distance equal during the scan inspection. Use a circle diameter that is equal to the outer diameter of the bearing plus the external diameter of the probe.

- (b) Make a mark at the locations that cause signals that are 50 percent or more of the height of the signal you got from the reference standard notch.
- (5) After the inspection, do a calibration test of the instrument/probe, as follows:

NOTE: Do not adjust the gain.

- (a) Put the probe on the reference standard to get the maximum signal from the notch.
- (b) Compare the signal with the signal you got from the notch during the calibration.
- (c) If the signal from the notch in the reference standard has changed 10 percent or more from the signal you got during calibration, do the calibration and inspection again.



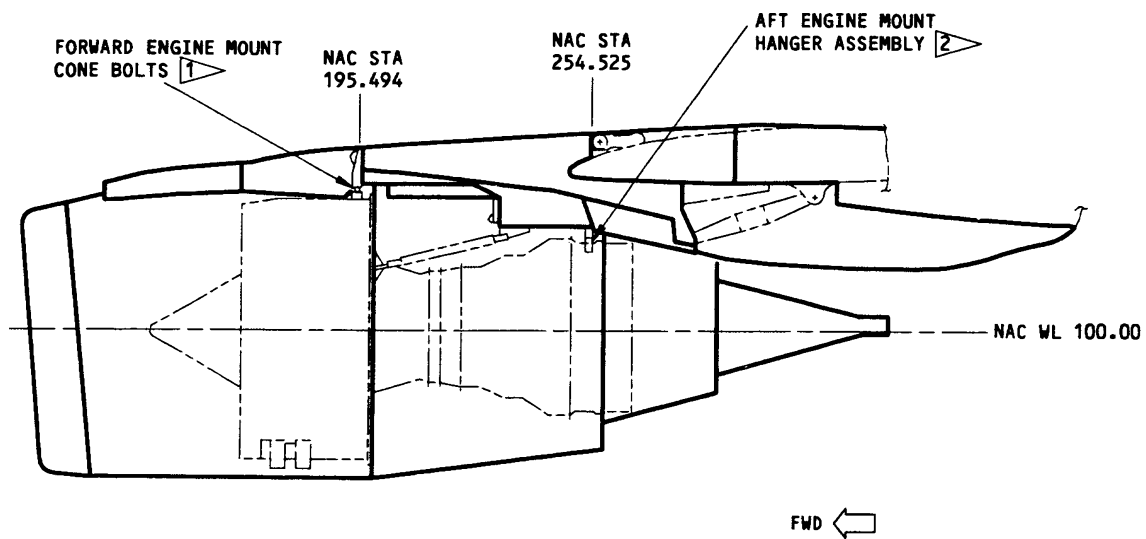
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- B. Inspection of the hanger fitting and link assemblies of the aft engine mount.
- (1) Inspection around the bolt holes of the hanger fitting and link assemblies that do not have bushings or that have bushings without flanges.
 - (a) Make sure the instrument is calibrated as specified in Paragraph 4.B.(1).
 - (b) Put the probe on the surface of the part to be examined and in the inspection area. See flagnote 1 in Figure 3, Sheet 2 for the inspection areas for the hanger fitting and Figure 3, Sheet 3 for the inspection area of the link assemblies. Make sure the probe coil is away from the edge of the hole by at least half or more of the probe's external diameter.
 - (c) Do Paragraph 5.A.(3) thru Paragraph 5.A.(5) again.
 - (2) Inspection around the bolt holes of hanger fittings that have flanged bushings.
 - (a) Make sure the instrument is calibrated as specified in Paragraph 4.B.(2).
 - (b) Put the probe on the surface of the hanger fitting and in the inspection area. Make sure the probe is adjacent to the bushing flange.
 - (c) Balance the instrument.
 - (d) Slowly do a scan of the inspection area and monitor the instrument display. During the scan:
 - 1) Keep the probe coil adjacent to the flange of the bushing during the scan inspection.
 - 2) Do Paragraph 5.A.(4)(b) and Paragraph 5.A.(5) again.

6. Inspection Results

- A. Signals that are 50 percent or more of the signal height from the reference standard notch are signs of possible cracks.
- B. Compare the signal on the airplane to the signal from the notch in the reference standard.
- C. Ferromagnetic particles can be attached to the surface of the hanger fittings and link assemblies and can cause a signal to look as a crack. Ferromagnetic particles on the surface will show as straight up and down signals but a crack will show as a curve to the left. See Details I and II of Figure 7 for an example of a crack signal and a signal from the ferromagnetic particles.
- D. If indications are found, do more analysis as follows:
 - (1) If the signal is almost the same as the signal from ferromagnetic particles, as shown in Figure 7, do a light buff to remove discoloration of the area and do an inspection of the area again. If the signal has changed in height then the indication is not a crack. If the signal does not change, do a fluorescent dye penetrant inspection to make sure of the results.
 - (2) If the signal is almost the same as the signal from a crack, as shown in Figure 7, do a fluorescent dye penetrant inspection to make sure of the results.

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LEFT SIDE VIEW OF CFM56-3 ENGINE

NOTES

- THE ENGINE MUST BE REMOVED FROM THE AIRPLANE FOR INSPECTION

1 REFER TO FIG. 2

2 REFER TO FIG. 3

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Forward and Aft Engine Mounts
Figure 1

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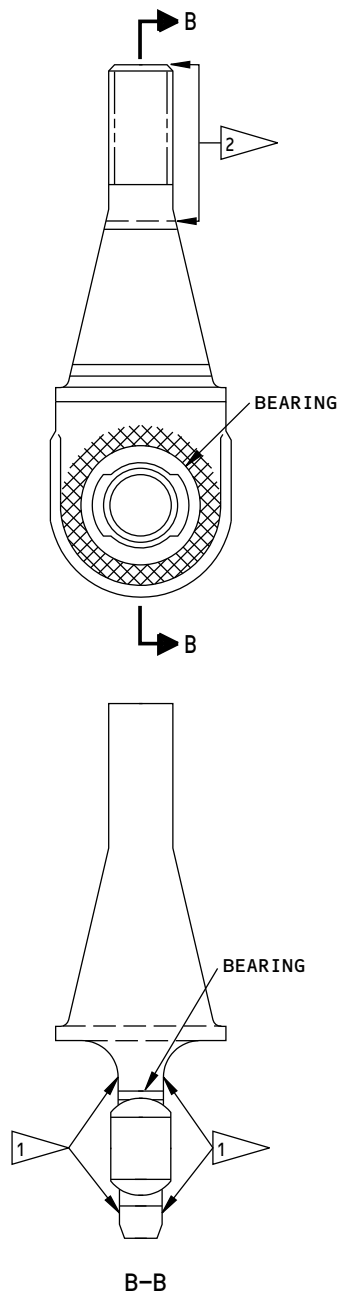
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NOTES

XXXX INSPECTION AREA

- OUTBOARD SIDE SHOWN, INBOARD SIDE SIMILAR

1 PUT THE PROBE ON THE CONE BOLT LUG ADJACENT TO THE BEARING. CALIBRATE THE EQUIPMENT AS SPECIFIED IN PARA. 4.A.

2 DO A FLUORESCENT PENETRANT INSPECTION AS SPECIFIED IN SOPM 20-20-02 OF THE FORWARD AND AFT CONE BOLT THREAD RUNOUT AREAS.

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**Forward Engine Mount Cone Bolt
Figure 2**

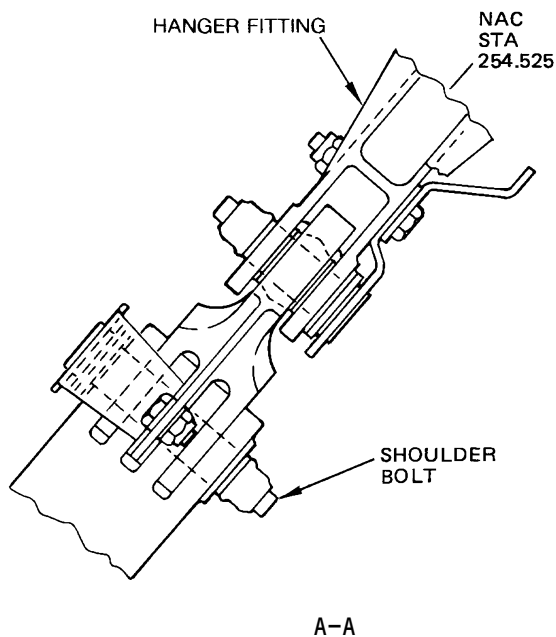
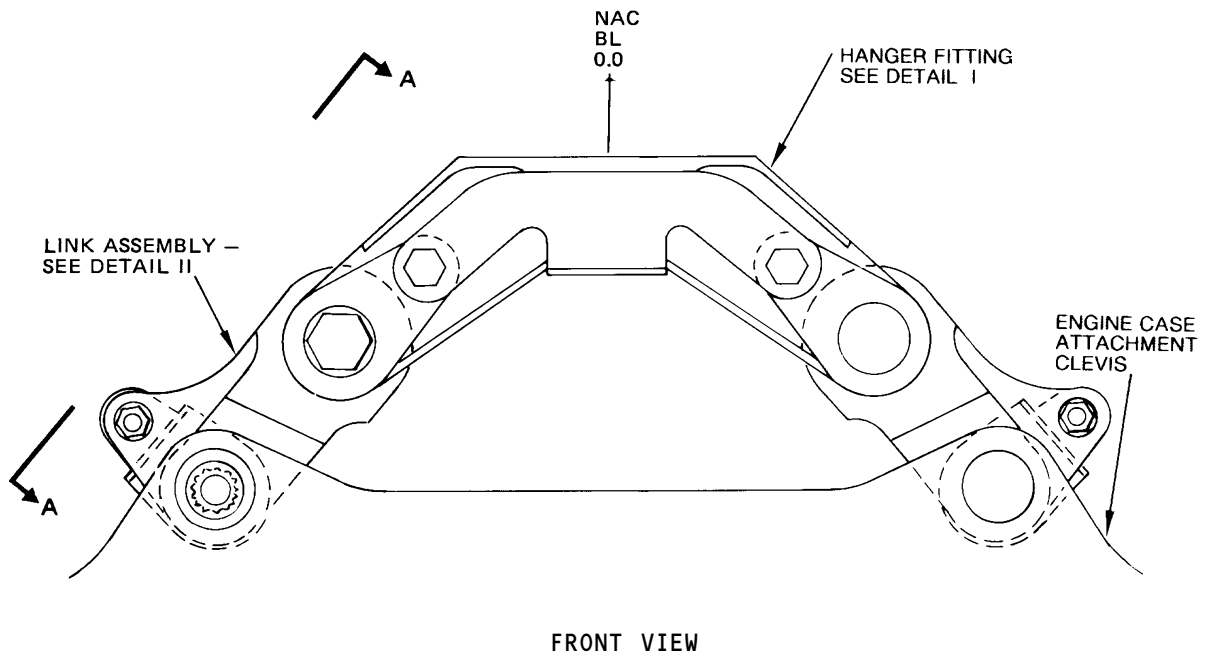
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**Aft Engine Mount Hanger Assembly
Figure 3 (Sheet 1 of 3)**

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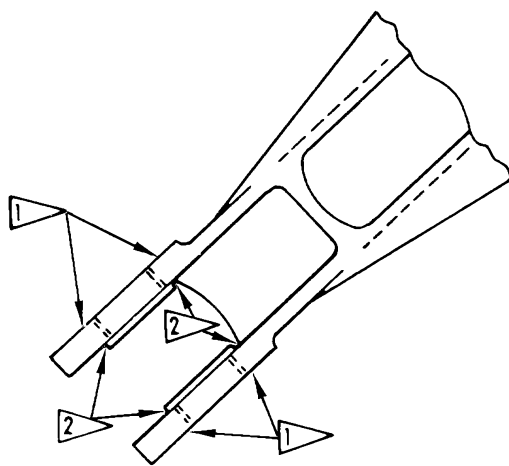
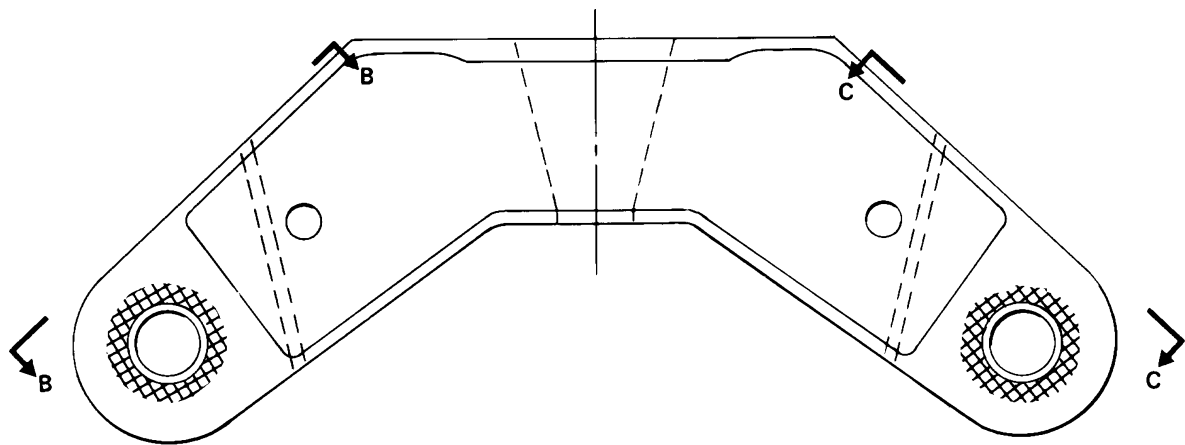
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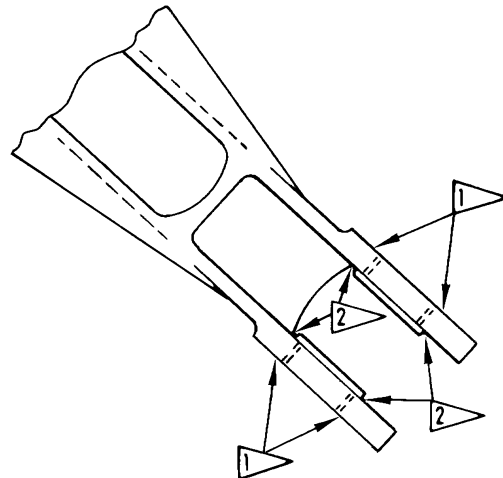
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B-B



C-C

NOTES

 INSPECTION AREA

1 PUT THE PROBE ON THE HANGER FITTING CLEVIS ADJACENT TO THE BUSHING. CALIBRATE THE EQUIPMENT AS SPECIFIED IN PARA. 4.B.1.

2 PUT THE PROBE ON THE HANGER FITTING CLEVIS ADJACENT TO THE BUSHING FLANGE. CALIBRATE AS SPECIFIED IN PARA. 4.B.2.

**HANGER FITTING
DETAIL I**

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**Aft Engine Mount Hanger Assembly
Figure 3 (Sheet 2 of 3)**

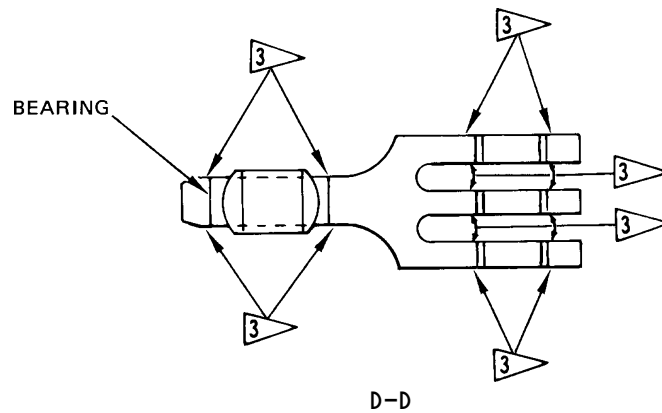
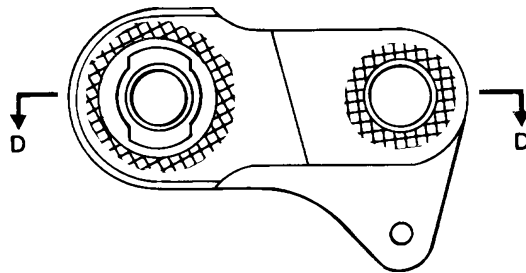
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NOTES

XXXXXX INSPECTION AREA

3 PUT THE PROBE ON THE LINK ASSEMBLY
ADJACENT TO THE BUSHING. CALIBRATE THE
EQUIPMENT AS SPECIFIED IN PARA. 4.B.1.

LINK ASSEMBLY DETAIL II

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Aft Engine Mount Hanger Assembly
Figure 3 (Sheet 3 of 3)

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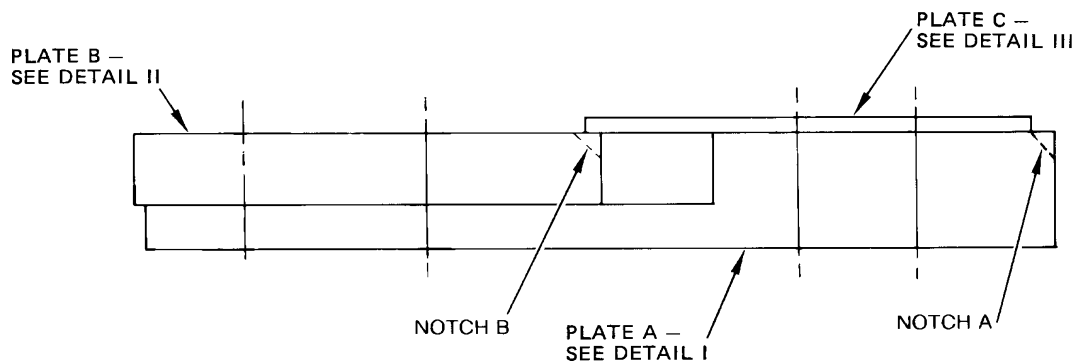
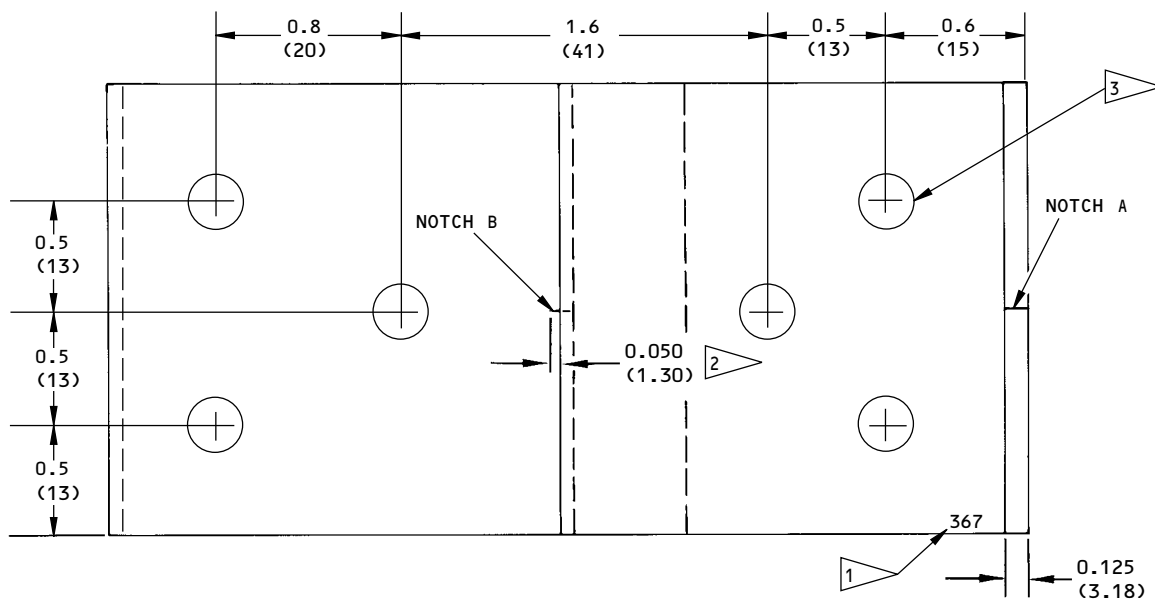
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NOTES

- ALL DIMENSIONS ARE IN INCHES (MILLIMETERS ARE IN PARENTHESES).

- TOLERANCES (UNLESS SPECIFIED DIFFERENTLY):

INCHES	MILLIMETERS
X.XXX = ± 0.005	X.XX = ± 0.10
X.XX = ± 0.025	X.X = ± 0.5
X.X = ± 0.050	X = ± 1

- THE DRAWING ABOVE, IS THE ASSEMBLED REFERENCE STANDARD. SEE DETAILS I, II, AND III (FIGURE 4, SHEETS 2 & 3) TO MAKE EACH PIECE

- 1 ETCH OR STEEL STAMP THE REFERENCE STANDARD NUMBER
- 2 ADJUST PLATE B TO GET NOTCH B TO THE DIMENSIONS SHOWN.
- 3 FASTENER TO HOLD ALL PLATES TOGETHER (6 LOCATIONS).

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Reference Standard 367
Figure 4 (Sheet 1 of 3)

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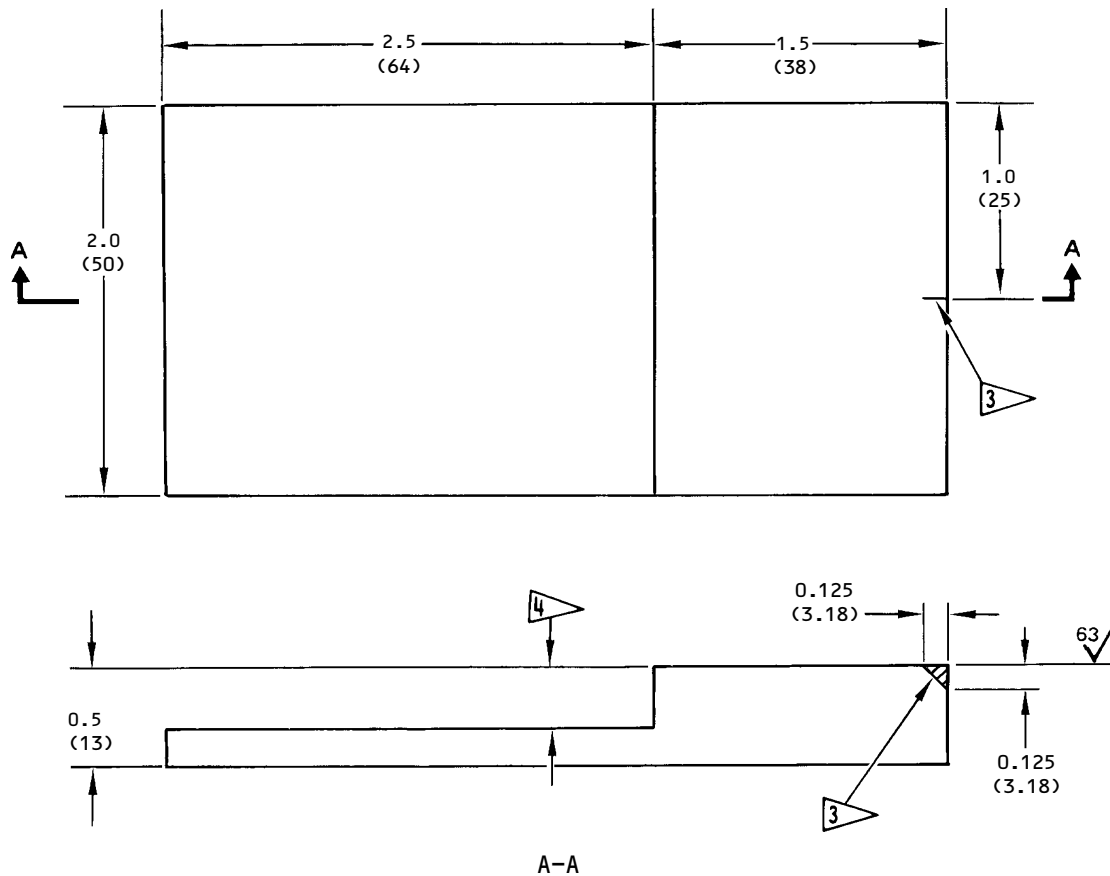


PLATE A
DETAIL I

NOTES

- ALL DIMENSIONS ARE IN INCHES (MILLIMETERS ARE IN PARENTHESES)

TOLERANCE:

INCHES	MILLIMETERS
X.XXX = ± 0.005	X.XX = ± 0.10
X.XX = ± 0.025	X.X = ± 0.5
X.X = ± 0.050	X = ± 1

- MATERIAL: 15-5 PH CRES, HEAT TREAT
CONDITION 180-200 KSI

3 EDM NOTCH 0.004 ± 0.001 (0.10 ± 0.03) WIDE

4 DIMENSION EQUAL TO PLATE B THICKNESS ± 0.002 (0.06)

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Reference Standard 367
Figure 4 (Sheet 2 of 3)

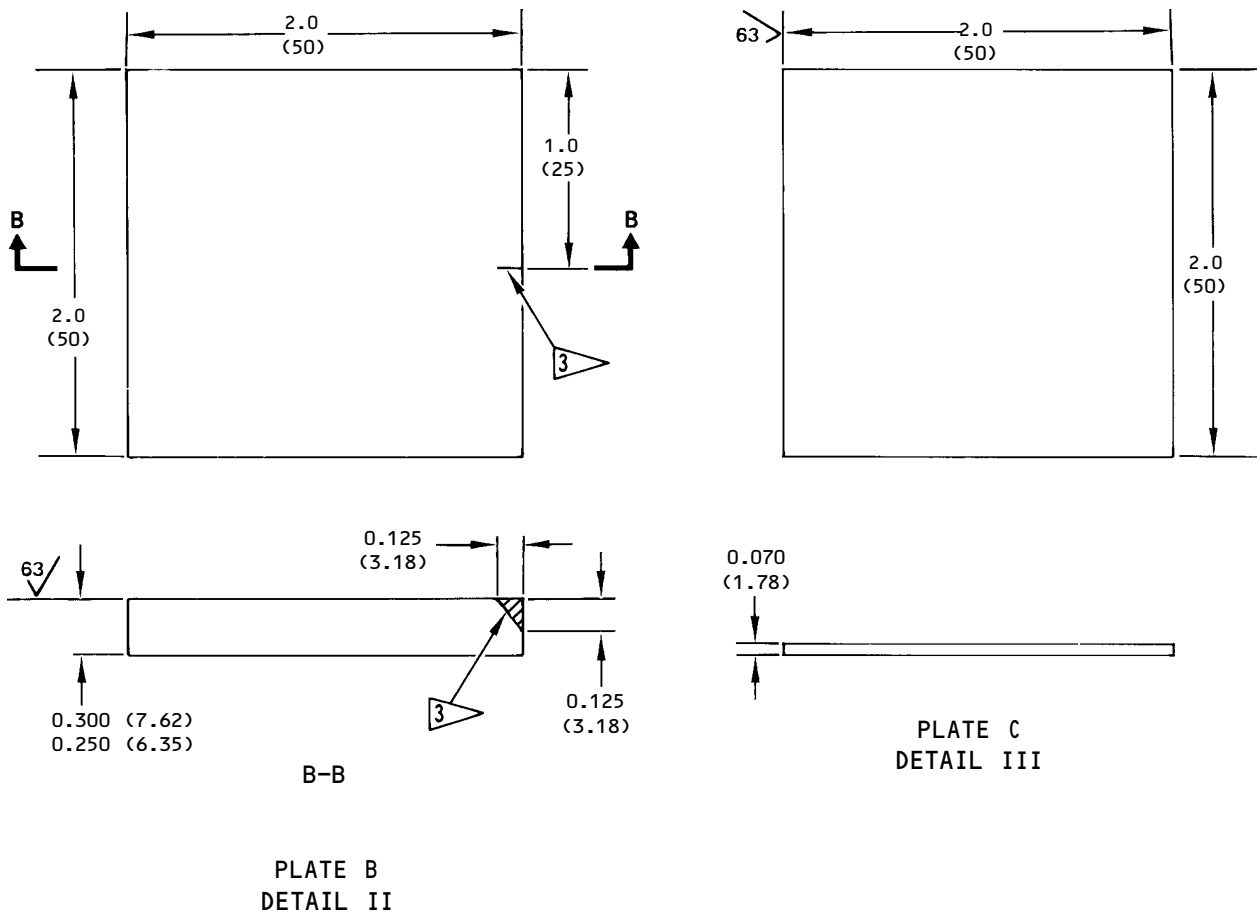
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NOTES

- ALL DIMENSIONS ARE IN INCHES (MILLIMETERS ARE IN PARENTHESES)

TOLERANCE:

INCHES	MILLIMETERS
X.XXX = ± 0.005	X.XX = ± 0.10
X.XX = ± 0.025	X.X = ± 0.5
X.X = ± 0.050	X = ± 1

- MATERIAL: INCONEL 718

3/ EDM NOTCH 0.004 \pm 0.001 (0.10 \pm 0.03) WIDE

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Reference Standard 367
Figure 4 (Sheet 3 of 3)

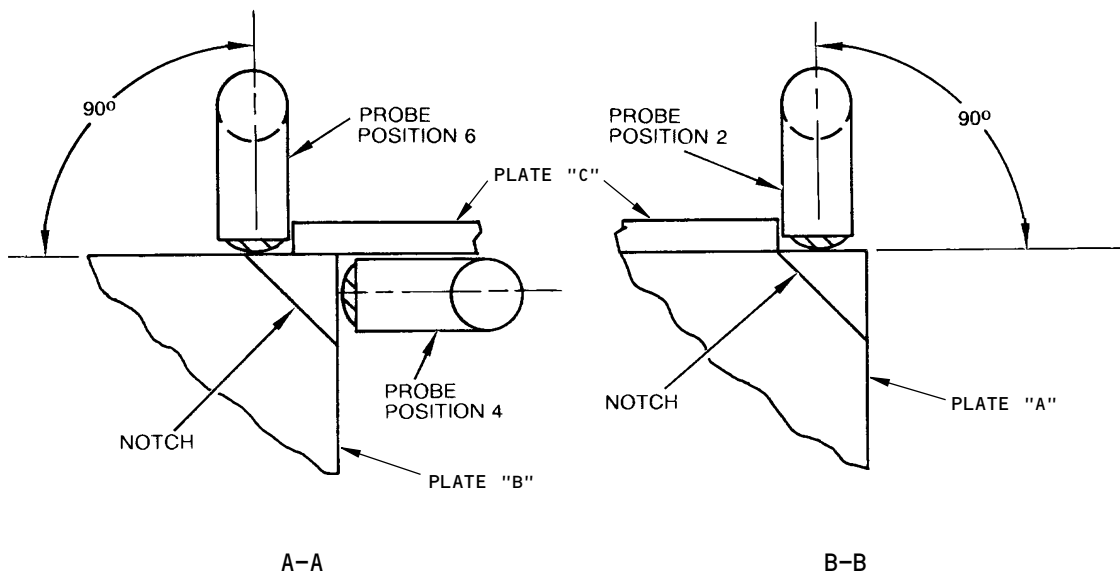
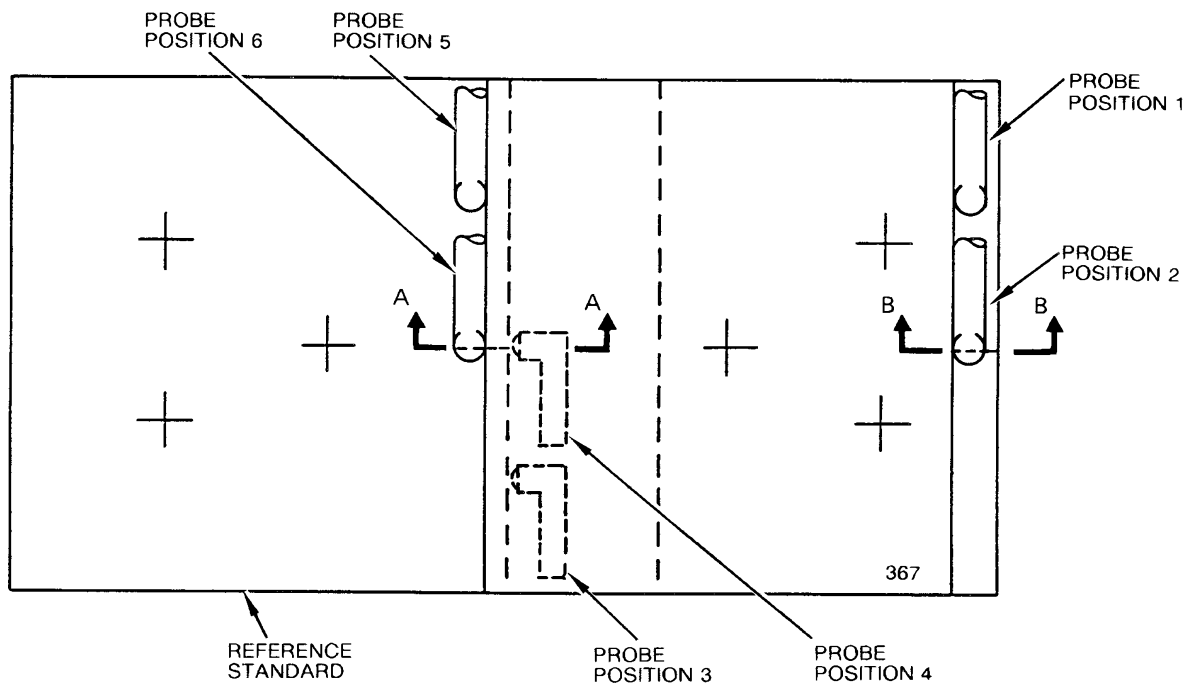
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NOTES:

- KEEP THE PROBE ADJACENT TO THE EDGE OF PLATE "C" FOR PROBE POSITIONS 1, 2, 5 AND 6. FOR PROBE POSITIONS 3 AND 4, KEEP THE PROBE ADJACENT TO THE BOTTOM SURFACE OF PLATE "C".

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**Probe Calibration Positions
Figure 5**

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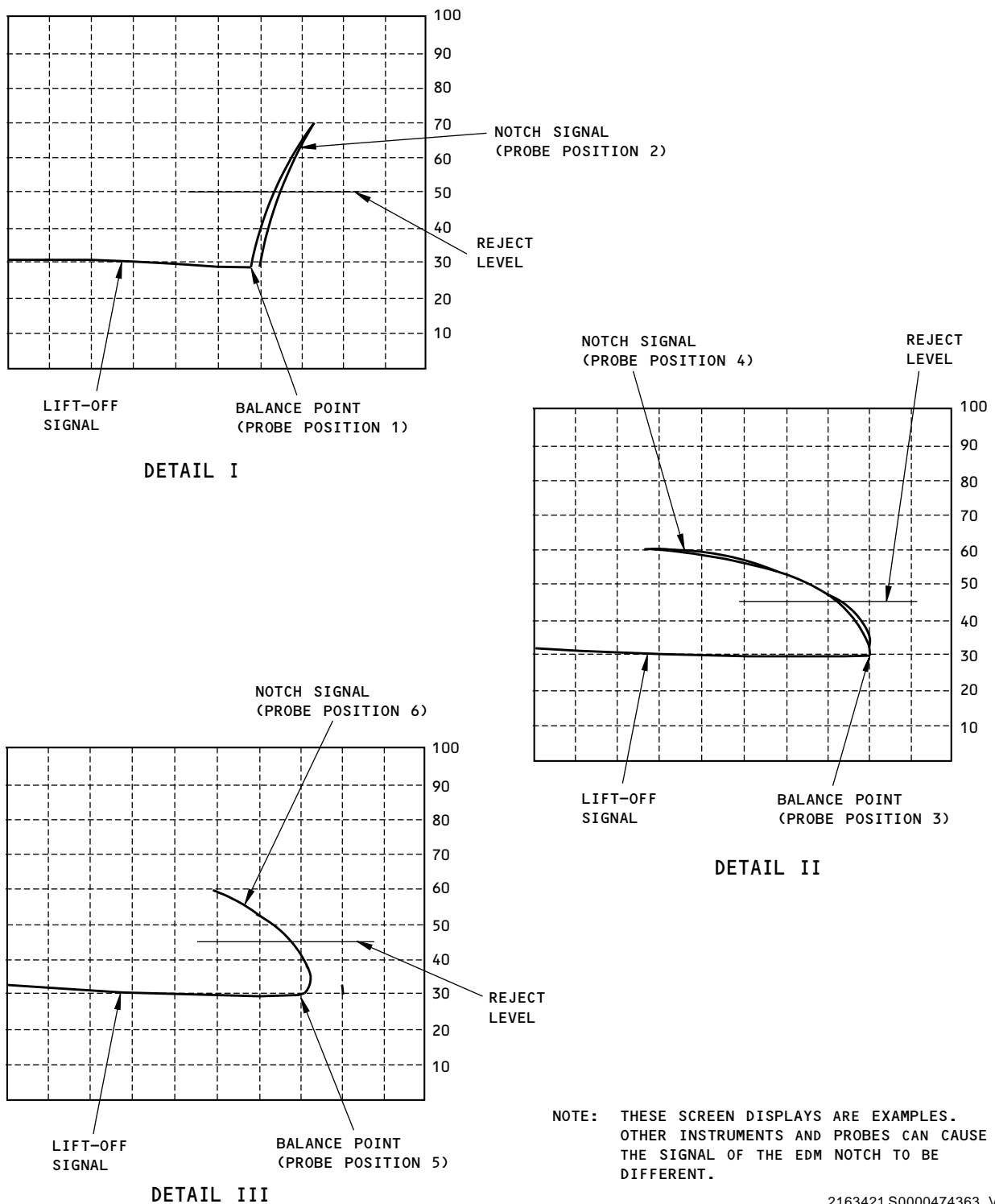
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Calibration Screen Displays
Figure 6

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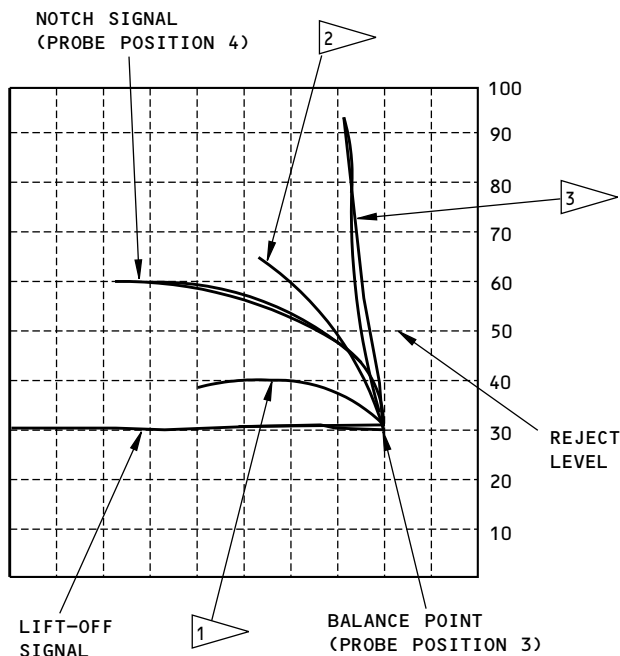
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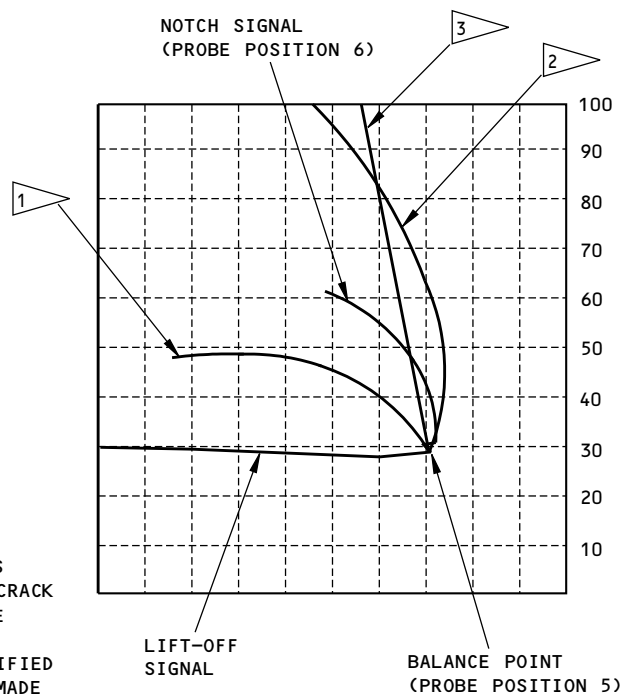
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DETAIL I



DETAIL II

NOTES:

THE SCREEN DISPLAYS ABOVE ARE EXAMPLES OF SIGNALS FROM THE EDM NOTCH IN THE REFERENCE STANDARD, A CRACK IN A TEST PART AND FERROMAGNETIC PARTICLES ON THE SURFACE OF A TEST PART. THE SIGNALS IN DETAIL I WERE MADE WITH THE INSTRUMENT CALIBRATED AS SPECIFIED IN PAR. 4.B.(1). THE SIGNALS IN DETAIL II WERE MADE WITH THE INSTRUMENT CALIBRATED AS SPECIFIED IN PAR. 4.B.(2). OTHER INSTRUMENTS AND PROBES CAN CAUSE THE SIGNALS IN THE ABOVE DISPLAYS TO BE DIFFERENT.

- 1 SIGNAL FROM A FATIGUE CRACK THAT IS APPROXIMATELY 0.020 INCH (0.50 mm) DEEP
- 2 SIGNAL FROM A FATIGUE CRACK THAT IS APPROXIMATELY 0.063 INCH (1.60 mm) DEEP
- 3 SIGNAL FROM A PART WITH FERROMAGNETIC PARTICLES ON THE SURFACE

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Examples of Screen Displays
Figure 7

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