PART 6 - EDDY CURRENT

MAIN LANDING GEAR OUTER CYLINDER - MIDDLE OF THE CROSSBOLT HOLES

1. **Purpose**

   A. Use this procedure to do a subsurface eddy current inspection for cracks at the crossbolt hole in the aft trunnion area of the outer cylinder that is used in the main landing gear. This procedure looks for the cracks that can occur from corrosion pits in the middle of the crossbolt hole in the outer cylinder. See Figure 1, Flagnote 1.

   NOTE: The installed bushing wall thickness has to be identified as specified in Part 4, 32-10-03 before you can do this procedure. If the bushing wall thickness is more than 0.090 inch (2.28 mm), refer to Service Bulletin 767-32A0151.

   NOTE: This inspection is best done by an NDT person that has some experience with eddy current subsurface inspections through Al-Ni Bronze bushings and can make an analysis of the results.

   B. Service Bulletin reference: 767-32A0151

2. **Equipment**

   NOTE: Refer to Part 1, 51-01-00 for data about the equipment manufacturers.

   A. All eddy current equipment that can be calibrated as specified in this procedure can be used.

   NOTE: An impedance plane display type of eddy current instrument is recommended to use during this inspection to help make the analysis of the inspection results the easiest.

   B. Instrument - Use an eddy current instrument that can operate at 700 Hz to 1 kHz. The eddy current instruments specified below were used to prepare this procedure:

   (1) NDT 19e - Staveley Instruments

   (2) PHASEC 1.1 - Hocking Krautkramer Branson

   (3) MINIPHASEC - Hocking Krautkramer Branson

   C. Probe - This procedure uses a reflection (driver pickup) type bolthole probe. Use a bolthole probe with 1.5-inch (38.1 mm) diameter, 2.5-inch (63.5 mm) overall length, that operates at 700 Hz to 1 kHz. The probe specified below was used and found to be satisfactory.

   (1) NEC 1017 - NDT Engineering Corp.

   D. Reference Standard - Make reference standard NDT636 as specified in Figure 2.

   (1) Reference standard NDT636 uses a bushing, part number 161T1210-10, that can be ordered from Boeing.

   (2) Before the bushing is installed in reference standard NDT636, find out if the bushing has a high noise area as follows:

   (a) For an impedance plane display instrument:

   1) Set the instrument frequency to 800 Hz.

   2) Adjust the collar on the probe to position the probe coil in the center of the bushing.

   3) Balance the instrument and adjust for lift-off as specified in Paragraph 4.A.(4) thru Paragraph 4.A.(6).

   4) Adjust the instrument sensitivity control for medium sensitivity.

5) Turn the probe in the bushing. As you turn the probe, monitor the screen display for a high noise area.

NOTE: A high noise area is shown by an increase or a decrease in the screen height position of the flying dot when compared with the other areas as the probe is turned in the bushing.

6) If applicable, make a mark on the bushing to identify the high noise area(s).

(3) Install the bushing into the reference standard. If the bushing has a high noise area, install the bushing as follows:

(a) Put the high noise area of the bushing away from the reference standard 0.25 x 0.40-inch (6.35 x 10.1 mm) notch and the area of the bushing where the probe coil will be to balance the instrument.

(b) Make a mark on the reference standard to identify the location of the high noise area of the bushing.

3. Preparation for Inspection

A. Get access to the crossbolt holes in the aft trunnion area of the outer cylinder as follows (Figure 1):

(1) To do the inspection from below, open the lower access door 651TB on the outboard side of the aft trunnion.

(2) To do the inspection from the wing upper surface, remove the upper wing access panel 651MT.

(3) Refer to Service Bulletin 767-32A0151 to prepare the airplane for inspection and to remove the crossbolt.

(4) Remove all dirt and grease from inside the crossbolt hole.

4. Instrument Calibration

A. Calibrate the equipment to examine the aft trunnion area of the outer cylinder at the middle of the crossbolt hole as follows:

NOTE: Before you calibrate the instrument, find the bushing wall thickness as specified in Part 4, 32-10-03.

(1) Set the instrument frequency at 800 Hz.

(2) Adjust the collar on the probe so that the probe coil is approximately in the center of the bushing hole. See Figure 3, flagnote 1.

(3) Put the probe in the reference standard hole so that the probe coil is opposite the 0.25 x 0.40-inch (6.35 x 10.1 mm) notch as shown in Figure 3.

(4) Balance the instrument as specified in the manufacturer's instruction.

(5) Adjust the instrument vertical and horizontal display control to put the flying dot (balance point) in the center of the screen as shown in Figure 3, screen display A.

(6) Adjust the instrument for lift-off as specified in the manufacturer's instruction so that when the probe is lifted off the hole surface, the flying dot moves horizontally to the left side of the screen (see Figure 3, screen display A). You can use one of the alternative lift-off procedures that follow to get the correct probe lift-off:

(a) Alternative lift-off procedure number 1:

1) Put the probe in the reference standard hole so that the probe coil is opposite the 0.25 x 0.40-inch (6.35 x 10.1 mm) notch.

2) Move the probe at an angle in the direction of the coil so that the probe coil moves away from the inside surface of the hole.

3) Do Paragraph 4.A.(6)(a)2) again while you adjust the phase control to get the lift-off signal to move horizontally to the left.

(b) Alternative lift-off procedure number 2:

1) Put a piece of paper or tape that is 0.002 to 0.003 inch (0.05 to 0.07 mm) thick on the inside surface of the reference standard hole, opposite the 0.25 x 0.40-inch (6.35 x 10.1 mm) notch.

2) Put the probe in the hole.

3) Put the probe adjacent to the paper/tape and turn the probe until the coil is on the paper/tape.

4) Do Paragraph 4.A.(6)(b)3) again while you adjust the phase control to get the lift-off signal to move horizontally to the left.

(7) Slowly turn the probe in the reference standard hole and adjust the instrument sensitivity to get a 40% signal from the 0.25 x 0.40-inch (6.35 x 10.1 mm) notch. See Figure 3, screen display B.

NOTE: Notch signals move up and down the screen display fast and occur when the probe is turned a short scan distance. A noise signal from the bushing will move up and down the screen display slowly and occur when the probe is turned a longer scan distance (Figure 3).

NOTE: During the scan, bushing noise will cause the flying dot to move from the balance point position on the screen display. This flying dot movement makes it possible for the notch signal to be above or below the balance point. The location of the notch signal depends on where the bushing noise has caused the flying dot to move immediately before the probe is moved across the notch.

(a) The width of the notch signal on the instrument display can be large. Do Paragraph 4.A.(8) while you adjust the instrument sensitivity.

(8) Adjust the instrument vertical/horizontal ratio so that the flying dot will remain on the screen display during the scan. See Figure 3, screen display B.

(9) Do the steps that follow if the vertical/horizontal ratio is at the instrument maximum and the flying dot does not remain on the instrument screen for the full 360-degree probe scan.

(a) Turn the probe in the reference standard hole and stop when the flying dot is half the distance between the balance point and the instrument screen edge where the dot goes off the screen. Balance the instrument again at this location. Refer to Paragraph 4.A.(4).

(b) Turn the probe 360 degrees in the reference standard hole and make sure the full scan is on the instrument screen display. If the flying dot continues to go off the screen when the probe is turned in the hole the full 360 degrees, do Paragraph 4.A.(9) again.

(10) Do Paragraph 2.D. again at the new instrument sensitivity adjustment.

(11) Do Paragraph 4.A.(8) again if the bushing position has been changed in the reference standard.

5. Inspection Procedure

A. Examine the aft trunnion area of the outer cylinder at the middle of the crossbolt holes as follows:

(1) Prepare for the inspection as specified in Paragraph 3.

(2) Do the calibration as specified in Paragraph 4.

(3) Adjust the probe collar so that the probe coil is 0.30 inch (7.6 mm) from the bottom of the probe collar.

(4) Put the probe in the inboard crossbolt hole of the outer cylinder as shown in Figure 4, flagnote 1.

(5) Adjust the instrument to put the flying dot in the center of screen.

NOTE: Do not adjust the instrument sensitivity.

NOTE: Make sure that the probe fits tightly in the hole. See Figure 3, flagnote 3.

(6) Slowly turn the probe in the crossbolt hole the full 360 degrees and monitor the screen display. See Figure 5 for the screen display examples that follow:

(a) Figure 5 shows an example of a screen display that can occur when the vertical/horizontal ratio of the equipment is adjusted correctly. With the vertical/horizontal ratio set correctly, the full 360-degree scan of the hole is shown on the screen display.

(b) Figure 5 shows an example of a screen display that can occur when the vertical/horizontal ratio of the equipment is not adjusted correctly. When the vertical/horizontal ratio is not set correctly, the flying dot will go off of the screen display during part of the 360-degree scan of the hole.

(c) Figure 5 shows an example of a screen display that can occur when there is not a crack indication.

(7) Do the steps that follow if the vertical/horizontal ratio is at the instrument maximum and the flying dot does not remain on the instrument screen for the full 360-degree probe scan.

(a) Turn the probe in the crossbolt hole and stop when the flying dot is half the distance between the balance point and the instrument screen edge where the dot goes off the screen. Balance the instrument again at this location. Refer to Paragraph 4.A.(4).

(b) Turn the probe 360 degrees in the crossbolt hole and make sure the full scan is on the instrument screen display. If the flying dot continues to go off the screen when the probe is turned in the hole the full 360 degrees, do Paragraph 5.A.(7) again.

(8) Move the probe collar along the probe so that the probe will extend into the hole an increment of 0.2 inch (5.0 mm).

(9) Do Paragraph 5.A.(4) thru Paragraph 5.A.(6) again.

(10) Move the probe collar along the probe so that the probe will extend into the hole an increment of 0.2 inch (5.0 mm) again and do Paragraph 5.A.(4) thru Paragraph 5.A.(6) again.

(11) Do Paragraph 5.A.(3) thru Paragraph 5.A.(10) on the outboard crossbolt hole of the outer cylinder.

(12) Do Paragraph 5.A.(3) thru Paragraph 5.A.(10) on the opposite main landing gear.

(13) Make a record of the inspection areas that cause eddy current signals that are more than 30% of full screen height to occur.

6. Inspection Results

A. Compare all subsurface eddy current indications that occur during the inspection of the outer cylinder with the indications that occurred during calibration from the reference standard.

B. An inspection around the crossbolt hole in the outer cylinder that does not result in crack indications is an indication that the outer cylinder is acceptable.

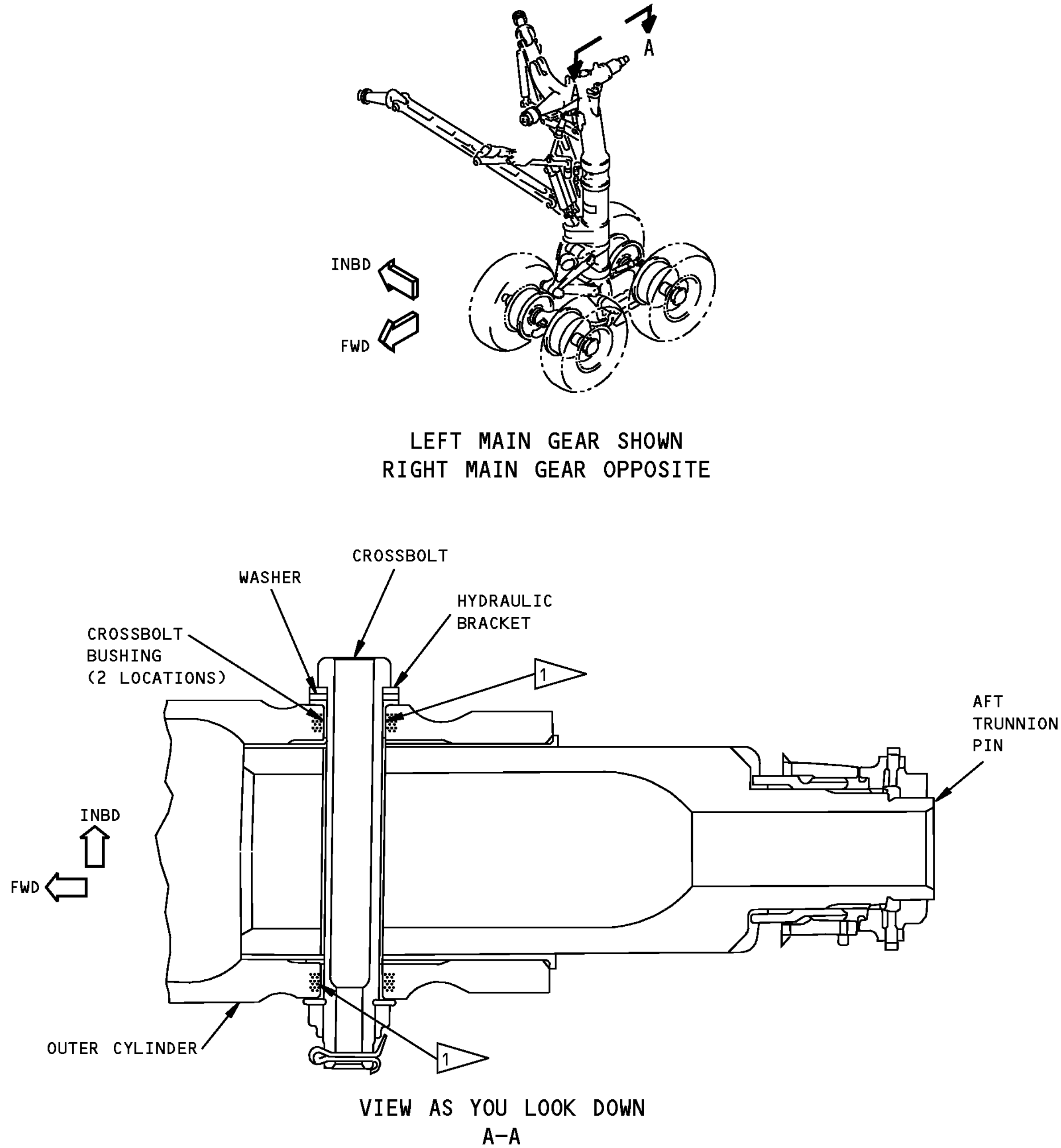
C. A signal that has a fast upscale and downscale movement and that is 30% (or more) of full screen height when the probe is moved a short scan distance is a possible crack. Areas that give these types of signals must be examined more carefully with the bushing removed as follows:

(1) Do a visual inspection of the crossbolt hole at the location that caused the crack indication.

(2) Examine the possible crack location in the crossbolt hole as specified in Part 6, 32-10-02. Part 6, 32-10-02 is a surface eddy current inspection procedure.

(3) If a crack indication is identified, remove all the cadmium from the possible crack location and do inspection procedure Part 6, 32-10-02 again.

NOTE: Refer to Service Bulletin 767-32A0151 for instructions on how to remove the cadmium and how to refinish the crossbolt hole.

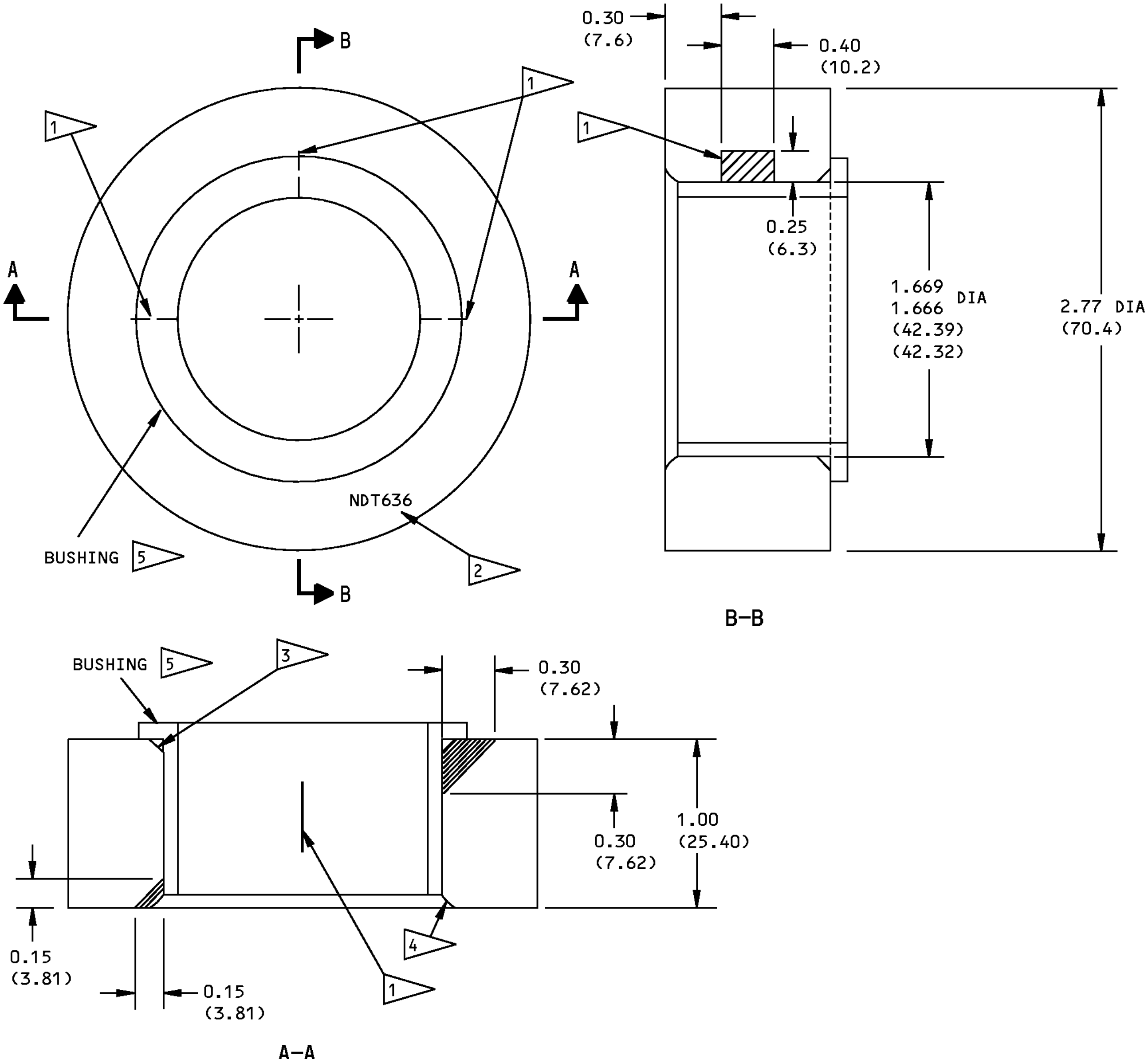


NOTES

- TO GET ACCESS TO THE INSIDE DIAMETER OF THE CROSSBOLT HOLE BUSHING, REMOVE THE CROSSBOLT, WASHERS AND THE INBOARD HYDRAULIC BRACKET.

1 INSPECTION AREA - THE PURPOSE OF THIS PROCEDURE IS TO EXAMINE THE OUTER CYLINDER FOR CRACKS IN THE MIDDLE OF THE CROSSBOLT HOLE.

Outer Cylinder Inspection Area
Figure 1



NOTES

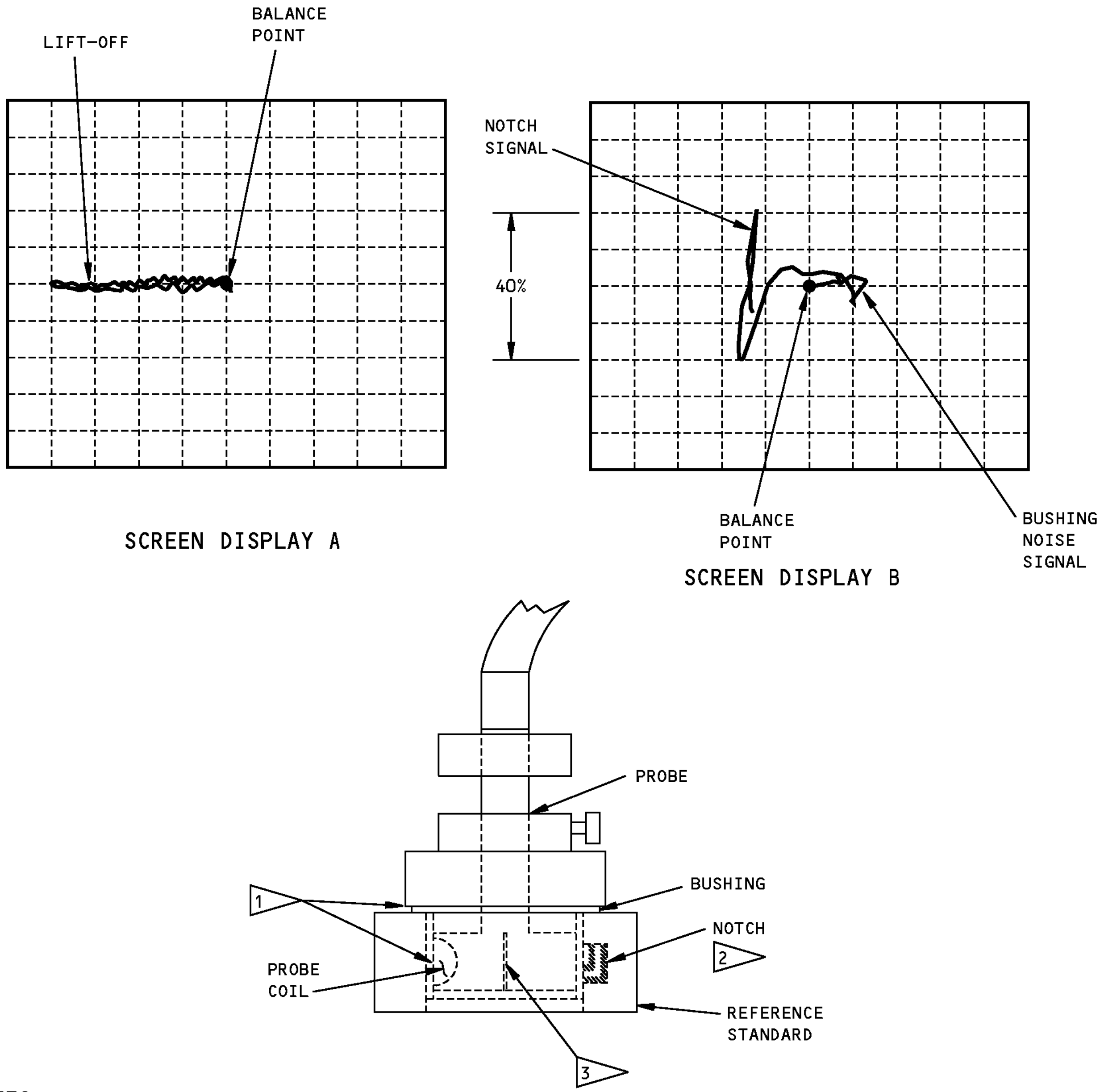
- ALL DIMENSIONS ARE IN INCHES (MILLIMETERS ARE IN PARENTHESES)
- TOLERANCE (UNLESS SPECIFIED DIFFERENTLY):

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

- MATERIAL: 4140, 4330, 4340, 4330M, 4340M STEEL

1. EDM NOTCH; MAXIMUM WIDTH 0.015 (0.38)
2. ETCH OR STEEL STAMP THE REFERENCE STANDARD WITH NDT636
3. CHAMFER - 0.030 (0.76)
4. RADIUS - 0.060 TO 0.090 (1.52 TO 2.29)
5. INSTALL BUSHING 161T1210-10 AS SHOWN AND AS SPECIFIED IN PARAGRAPH 2.D.

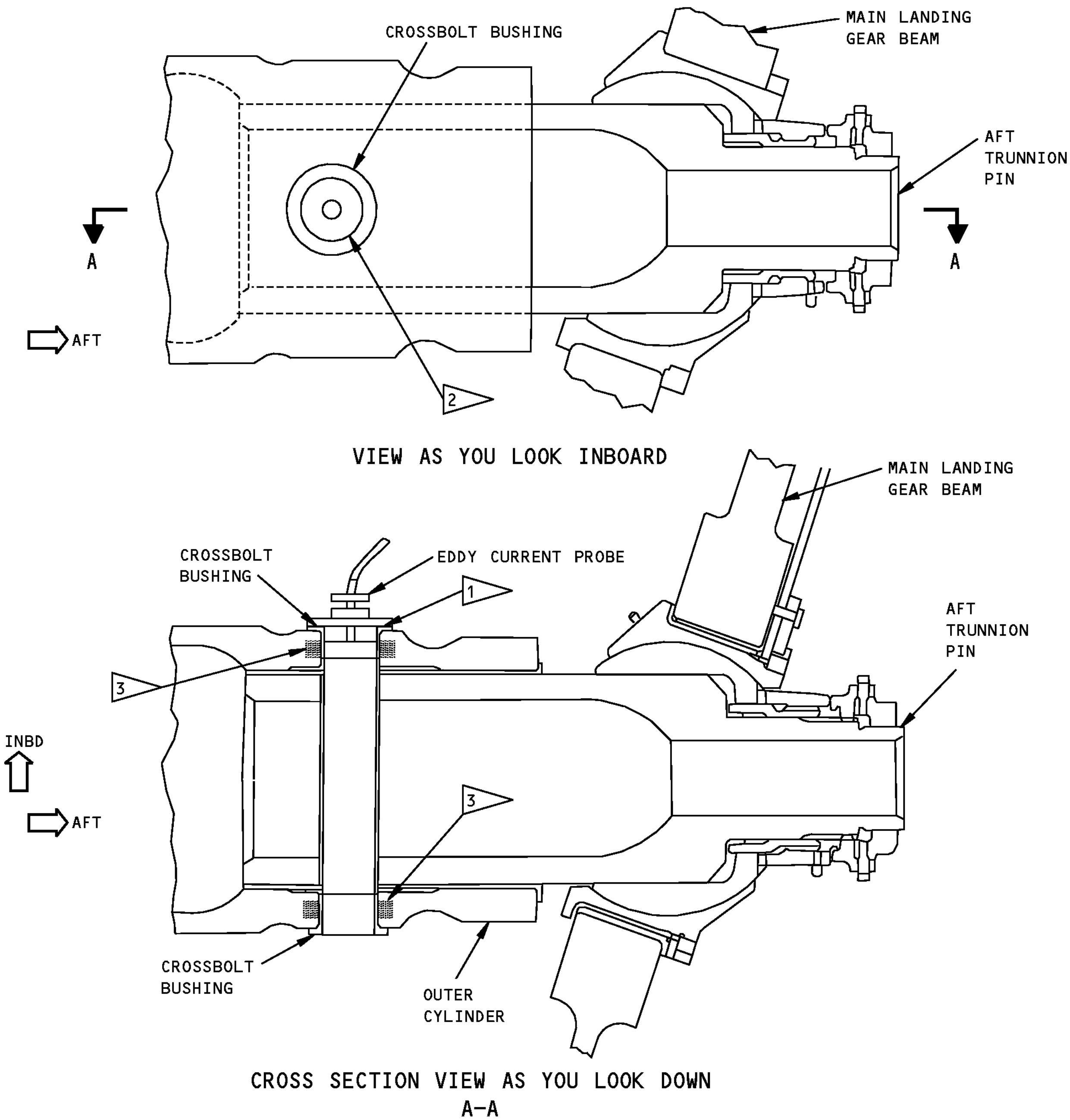
Reference Standard NDT636
Figure 2



NOTES

1. ADJUST THE PROBE COLLAR TO PUT THE CENTER OF THE COIL APPROXIMATELY 0.5 INCH (12.7 MM) FROM THE COLLAR.
2. NOTCH - 0.25 X 0.4 INCH (6.35 X 10.1 MM)
3. PUT A NONCONDUCTIVE SHIM IN THE PROBE SLOT TO GET A TIGHT FIT. THE PROBE TIGHT FIT MUST BE SUFFICIENT TO PREVENT PROBE WOBBLE, BUT NOT SO TIGHT AS TO CAUSE MORE THAN THE USUAL WEAR OF THE PROBE COIL.

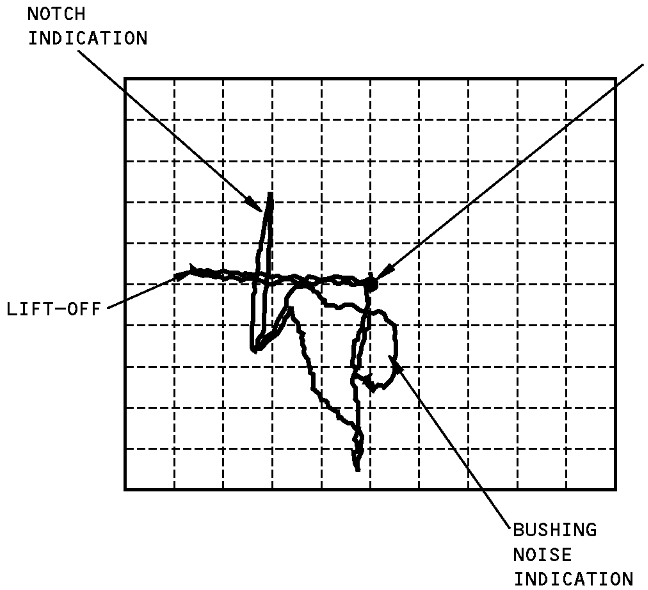
Instrument Calibration
Figure 3



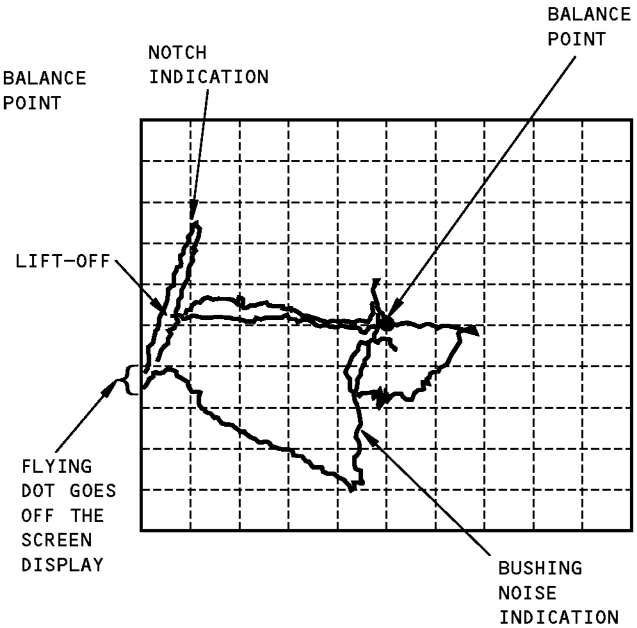
NOTES

- THE AFT TRUNNION OF THE LEFT MAIN LANDING GEAR IS SHOWN; THE AFT TRUNNION OF THE RIGHT MAIN LANDING GEAR IS OPPOSITE.
- ▒ INSPECTION AREA
- 1 PUT THE PROBE IN THE BOLT HOLE ON TOP OF THE CROSSBOLT BUSHING.
- 2 DO A SCAN 360 DEGREES AROUND THE CROSSBOLT HOLE.
- 3 THIS PROCEDURE EXAMINES THE INBOARD AND OUTBOARD CROSSBOLT HOLES IN THE AFT TRUNNION AREA OF THE OUTER CYLINDER FOR CRACKS.

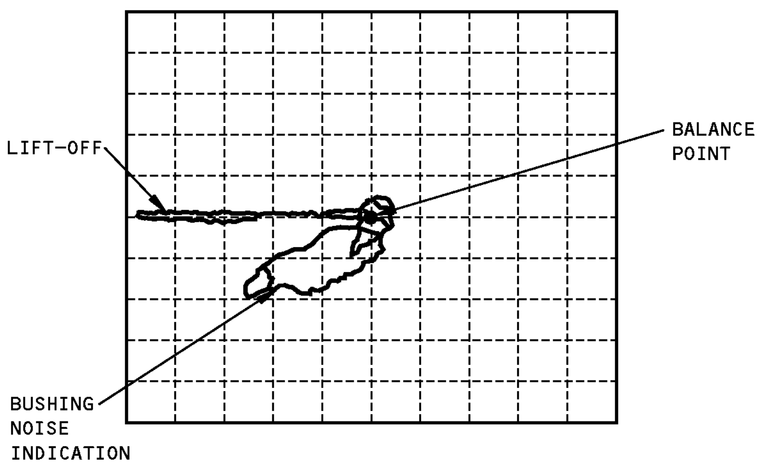
Inspection of the Middle of the Crossbolt Hole in the Aft Trunnion Area of the Outer Cylinder
Figure 4



VERTICAL/HORIZONTAL RATIO CORRECTLY SET
WHEN THE VERTICAL/HORIZONTAL RATIO IS CORRECTLY SET THE FULL 360 DEGREE SCAN OF THE HOLE WILL SHOW ON THE SCREEN DISPLAY



VERTICAL/HORIZONTAL RATIO INCORRECTLY SET
WHEN THE VERTICAL/HORIZONTAL RATIO IS INCORRECTLY SET THE FLYING DOT WILL GO OFF THE SCREEN DISPLAY DURING THE SCAN



POSSIBLE SCREEN DISPLAY FROM A FULL 360 DEGREE SCAN WITH NO CRACK INDICATION

Instrument Screen Display Examples
Figure 5

PART 6 - EDDY CURRENT

MAIN LANDING GEAR OUTER CYLINDER - AFT END FACE AND CROSSBOLT HOLE INSPECTION

1. **Purpose**
   A. This surface eddy current inspection will examine the aft trunnion area of the outer cylinder of the main landing gear for cracks.
   B. The inspection areas are the end face of the outer cylinder, adjacent to the bushing flange, and the area around the crossbolt hole bushings. See Figure 1.
   C. This procedure can also be used to examine crack indications found in the bore of the crossbolt hole as specified in Part 4, 32-10-02.
   D. Service Bulletin reference: 767-32A0151
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) will operate at a frequency of between 20 and 25 kHz
      (2) The instrument that was used to prepare this procedure was a Hocking Phasec 1.1.

      NOTE: If you want to use a meter instrument, refer to Part 6, 51-00-12 and calibrate the equipment on reference standard NDT636 at 25 kHz.
   C. Probe
      (1) It is necessary to use a reflection, right angle, surface probe that can operate at 20 to 25 kHz.
      (2) An NDT Engineering Probe, Part No. RS902-50/20K/2D, was used to make this procedure.
   D. Reference Standard
      (1) Use reference standard NDT636. See Figure 2 for data about the reference standard.
         (a) Reference standard NDT636 uses a bushing, part number 161T1210-10, that can be ordered from Boeing.
3. **Preparation for Inspection**
   A. Open the access door, 651TB, on the upper wing above the aft trunnion.
   B. Get access to the inboard side of the aft trunnion from the wheel well area that is inboard of the landing gear.
   C. Remove the crossbolt. Refer to SB 767-32A0151.
   D. Clean all grease and dirt from the inspection areas.
   E. Remove the sealant that is around the aft trunnion and crossbolt bushings. See Figure 1.
4. **Instrument Calibration**
   A. Set the frequency between 20 and 25 kHz.
   B. Put the probe on the reference standard at probe position 1. See Figure 3.
   C. Balance the instrument.

D. Set the balance point as shown in Figure 4.

E. Adjust the equipment so the lift-off signal moves horizontally to the left. See Figure 4.

F. Move the probe around the reference standard and across the notch at position 2 (Figure 3). Make sure the probe touches the bushing flange during the scan.

G. Adjust the instrument sensitivity to get a 40-percent signal from the notch as shown in Figure 4.

5. Inspection Procedure

A. Put the probe on the aft trunnion inspection area adjacent to the bushing flange and balance the instrument.

NOTE: The balance point can change locations because of the cadmium plate and the paint thickness on the aft trunnion.

B. Do a scan of the aft trunnion inspection area as follows:

(1) Use the bushing flange as a guide and move the probe 360 degrees around the inspection surface. During the scan:

(a) Look for a crack signal as shown in Figure 4. The crack indication will be almost the same as the signal you got during calibration from the reference standard notch.

C. Do Paragraph 5.A. and Paragraph 5.B. again around each of the crossbolt hole bushings.

D. Do Paragraph 5.A. thru Paragraph 5.C. again on the opposite landing gear.

6. Inspection Results

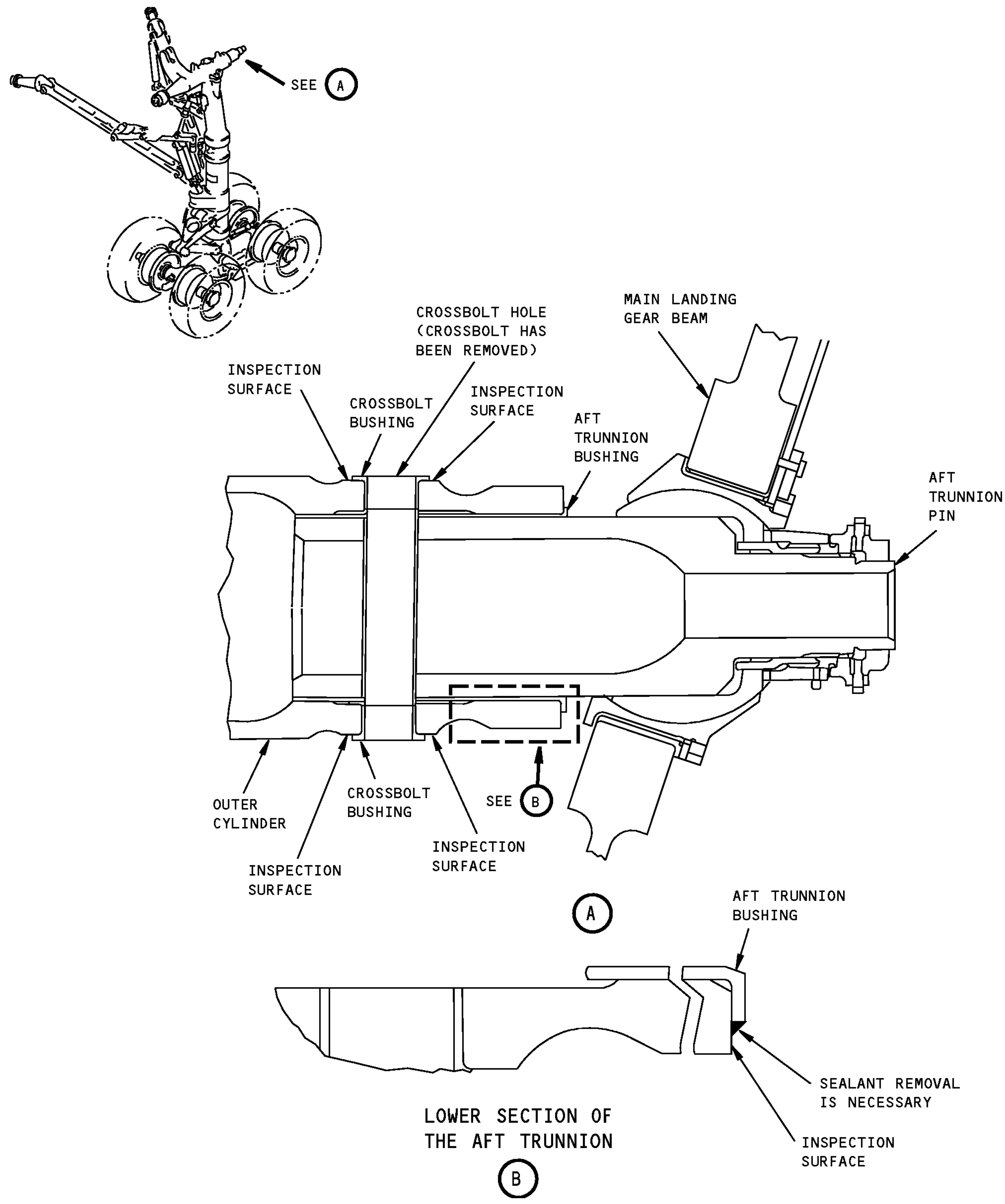
A. A fast signal that is 20 percent (or more) of the display higher than the balance point can be a crack indication.

B. If the crack signal is not almost vertical as shown in Figure 4 it can be a false indication.

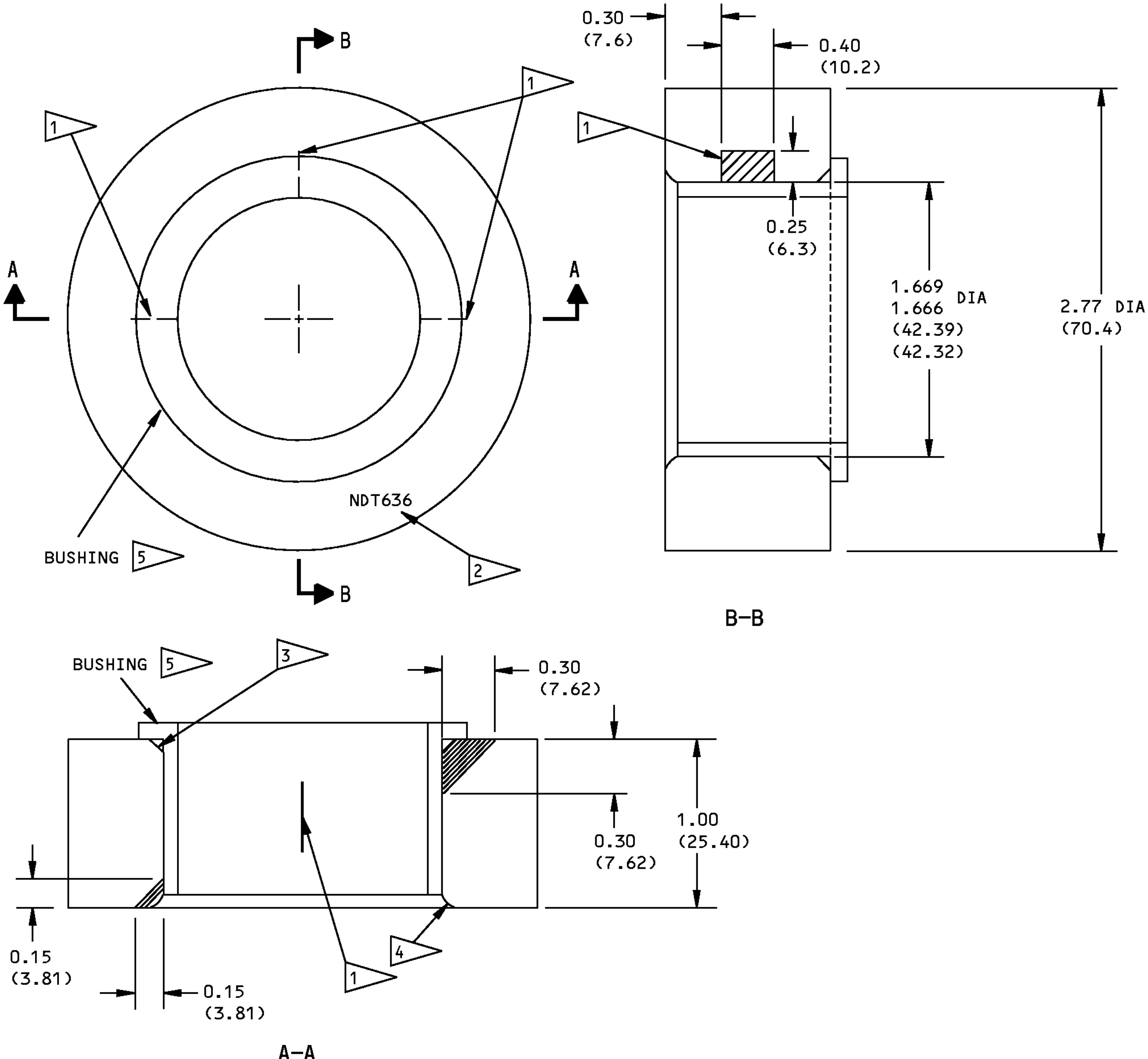
NOTE: Because of the high conductivity of the cadmium plating, a scratch on the cadmium can cause a signal to occur that is almost the same as a crack indication. Also, changes in the thickness of the cadmium can cause small, slow changes in the location of the balance point.

C. If you get a crack indication, remove the cadmium from the inspection area and examine the area again to make sure it is a crack.

D. If you have questions about a signal, you can make a copy of the signal and give it to the Boeing field service representative for help in analysis.



Inspection Location
Figure 1



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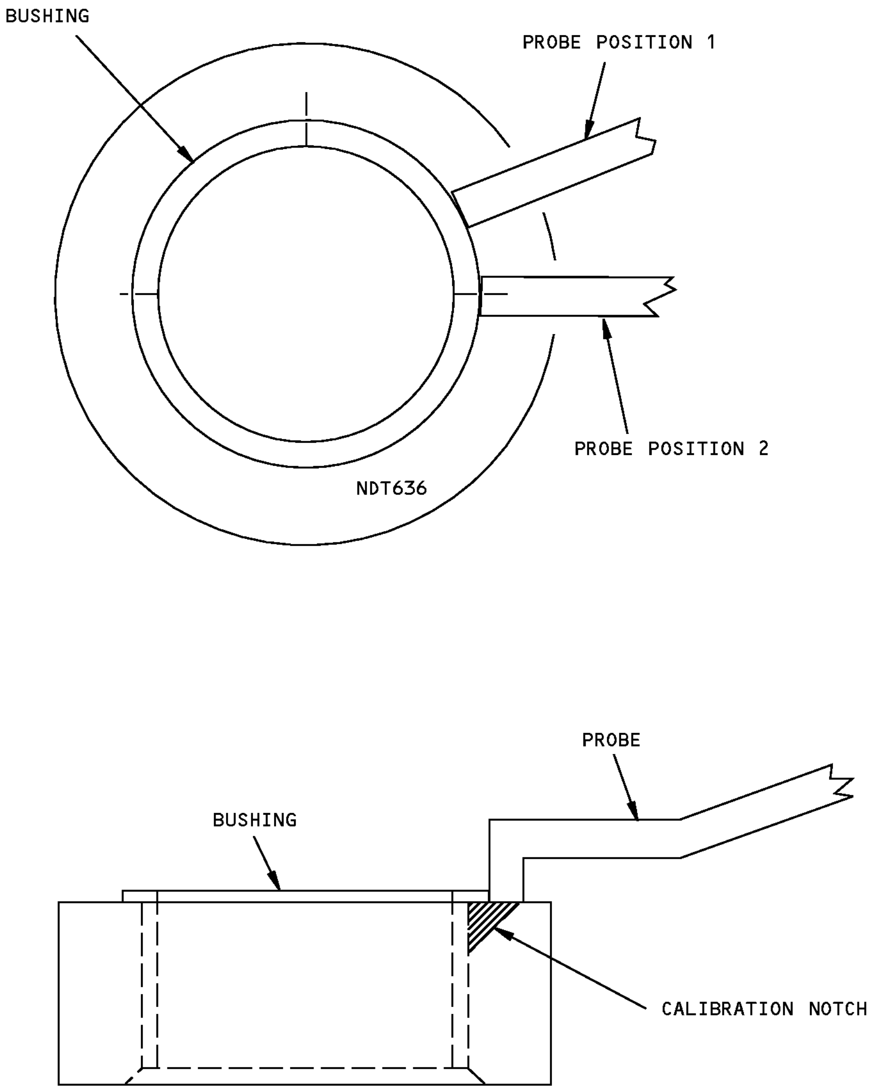
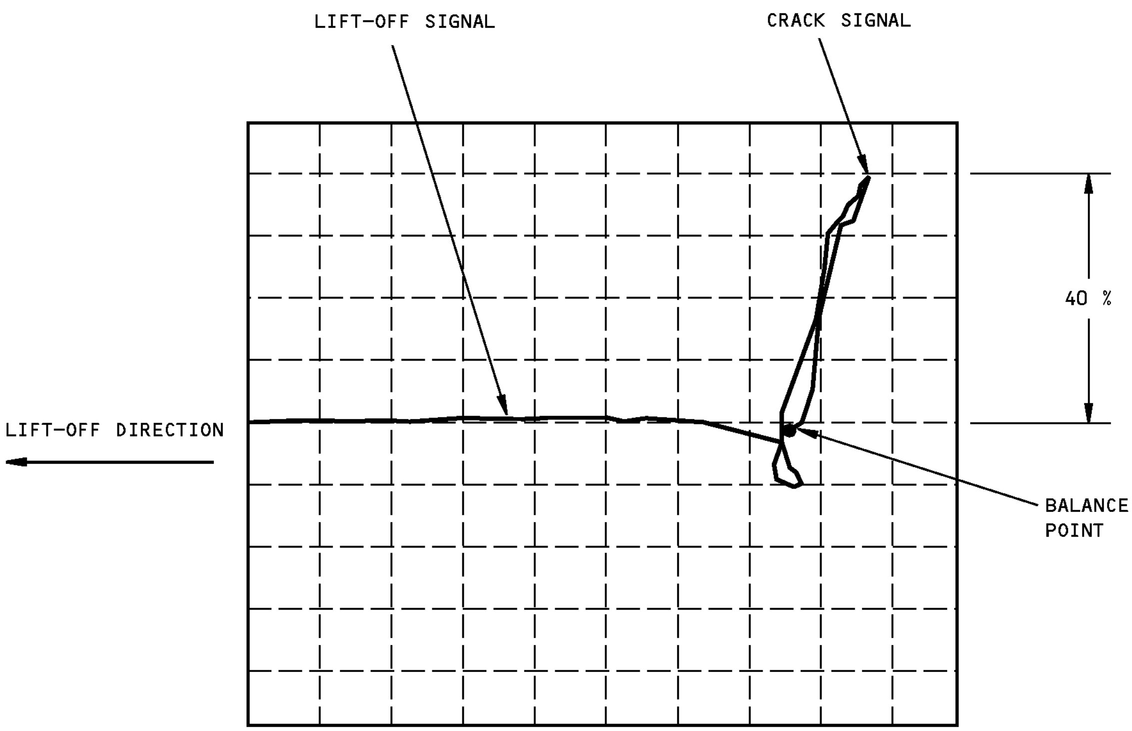
3. CHAMFER - 0.030 (0.76)
4. RADIUS - 0.060 TO 0.080 (1.52 TO 2.29)
5. INSTALL BUSHING 161T1210-10 AS SHOWN.

Reference Standard NDT636
Figure 2



Probe Calibration Positions
Figure 3



Impedance Plane Display
Figure 4