LARGE FORWARD CARGO DOOR LIFT DRIVE TORQUE SHAFT

1. Purpose

A. To detect cracks in large forward cargo door lift drive torque shaft, initiating from root of drive dogs at shaft driven end.

B. Service Bulletin reference: 767-52-0019.

2. Equipment

A. Any ultrasonic equipment which will satisfy requirements of this procedure may be used. The following equipment was used during development of this procedure and found acceptable.

(1) Instrument - Pulse/echo ultrasonic instrument capable of operating at a frequency of 5 MHz.

(2) Transducer - 5 MHz longitudinal wave transducer with a case diameter of 0.37 inch, P/N 57A4268, Automation Industries, Inc.

(3) Transducer Positioning Fixtures - Fabricate transducer positioners per Figure 2.

(4) Reference Standard - Fabricate reference standard per Figure 3.

(5) Couplant - Grease or light oil.

3. Preparation for Inspection

A. Open cargo door as required to gain access to actuator shafts. See Figure 1.

B. Wipe surface clean.

4. Instrument Calibration

A. Connect transducer to instrument and turn instrument on.

B. Apply couplant to surface of reference standard.

C. Apply couplant to transducer and place in transducer positioner marked "Aft Shoe.''

D. Place transducer/positioner assembly on reference standard at Position A, as shown in Figure 4. Manipulate transducer assembly to obtain a maximum signal from the radius at root of drive dog. See Figure 4.

E. Adjust instrument controls so that initial pulse appears at left edge of screen, with signal from root of drive dog appearing at 50% of screen width. See Figure 4.

F. Adjust instrument sensitivity to obtain 80% of full screen height response from root of drive dog. See Figure 4.

G. Move transducer/positioner assembly to obtain a maximum indication from sawcut at the inner diameter of the standard and note location on instrument screen. See Figure 4, Position B.

H. If indication from sawcut does not appear within 10% of screen width of indication from root of drive dog, repeat Paragraph 4.D., Paragraph 4.E. and Paragraph 4.F. to ensure instrument is adjusted properly.

I. Scan around reference standard with transducer assembly and note that indications from radius at root of drive dog and corner at end of dog can be found at two locations on opposite sides of standard.

NOTE: Indications from cracks will appear 90 degrees of rotation away from these characteristic indications. See Figure 4 and Figure 5.

5. Inspection Procedure

A. Apply couplant to transducer and place transducer in positioner marked "Aft Shoe."

B. Apply couplant to aft torque shaft and place transducer/positioner assembly on actuator shaft with arrow on positioner pointing forward.

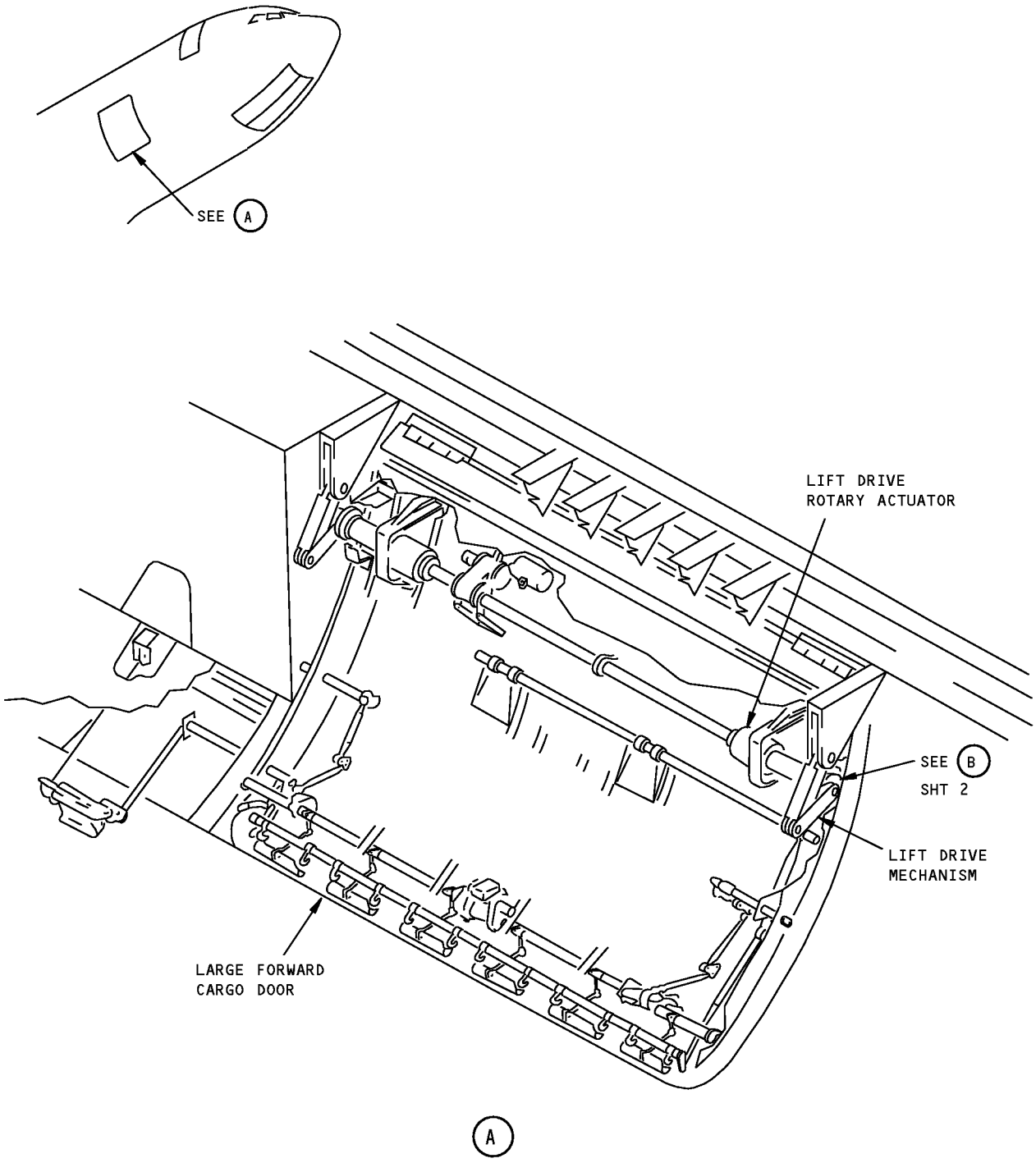
C. Scan around shaft and locate characteristic signals from root and end of a drive dog per Figure 4 and Figure 5. Manipulate transducer to obtain a maximum signal from root.

D. Adjust instrument sensitivity to obtain 80% of full screen height response from root of drive dog. Then, increase sensitivity of instrument by 12 dB.

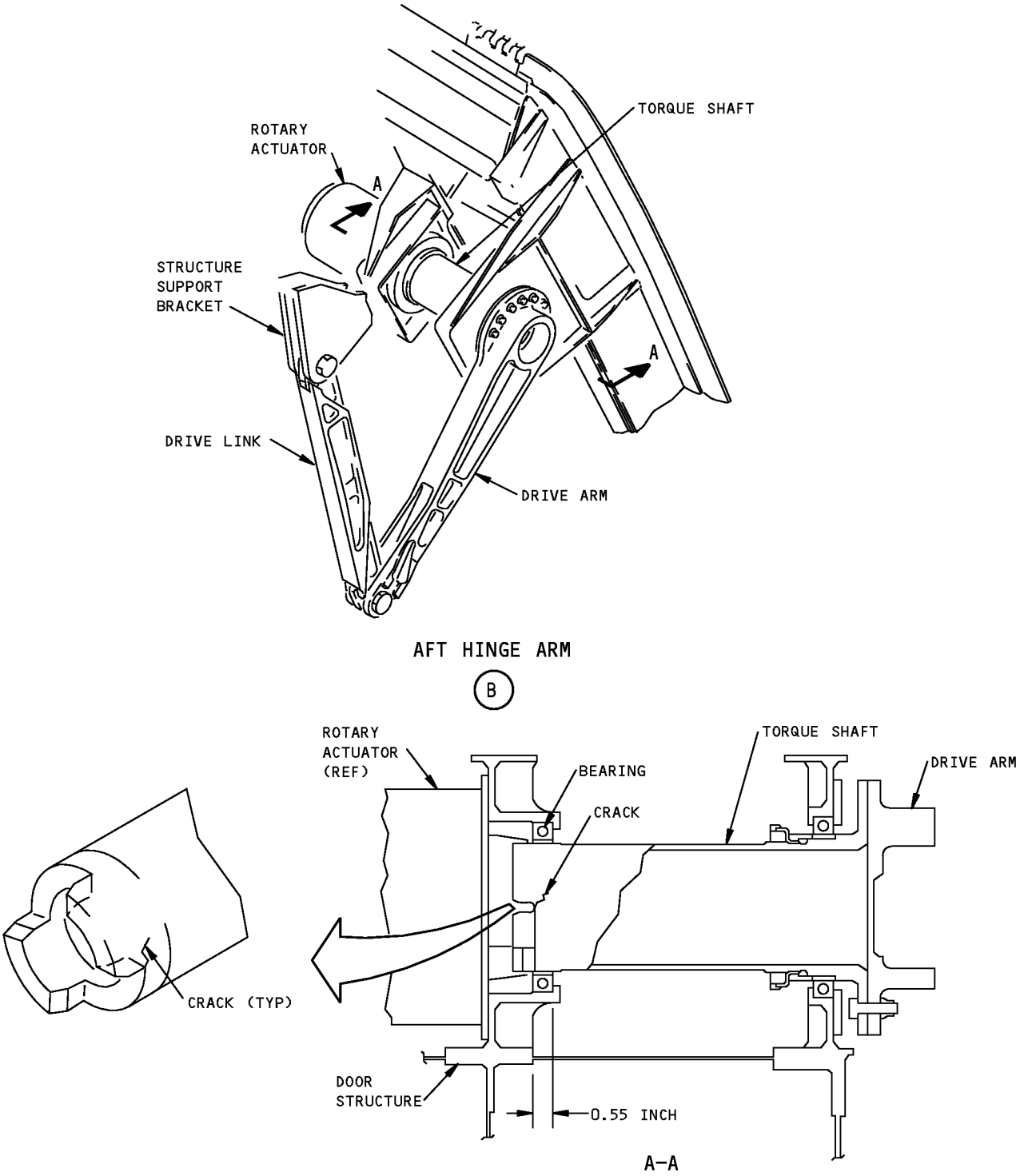
E. Carefully scan around shaft with transducer/positioner assembly. Note that characteristic indications will appear at two locations on shaft approximately 180° apart. These characteristic indications will appear as those shown in Figure 4, Position A.

F. Any indications, other than the characteristic ones which appear at from 40% to 60% of screen width and rise to 40% of screen height or greater, indicate the presence of cracks.

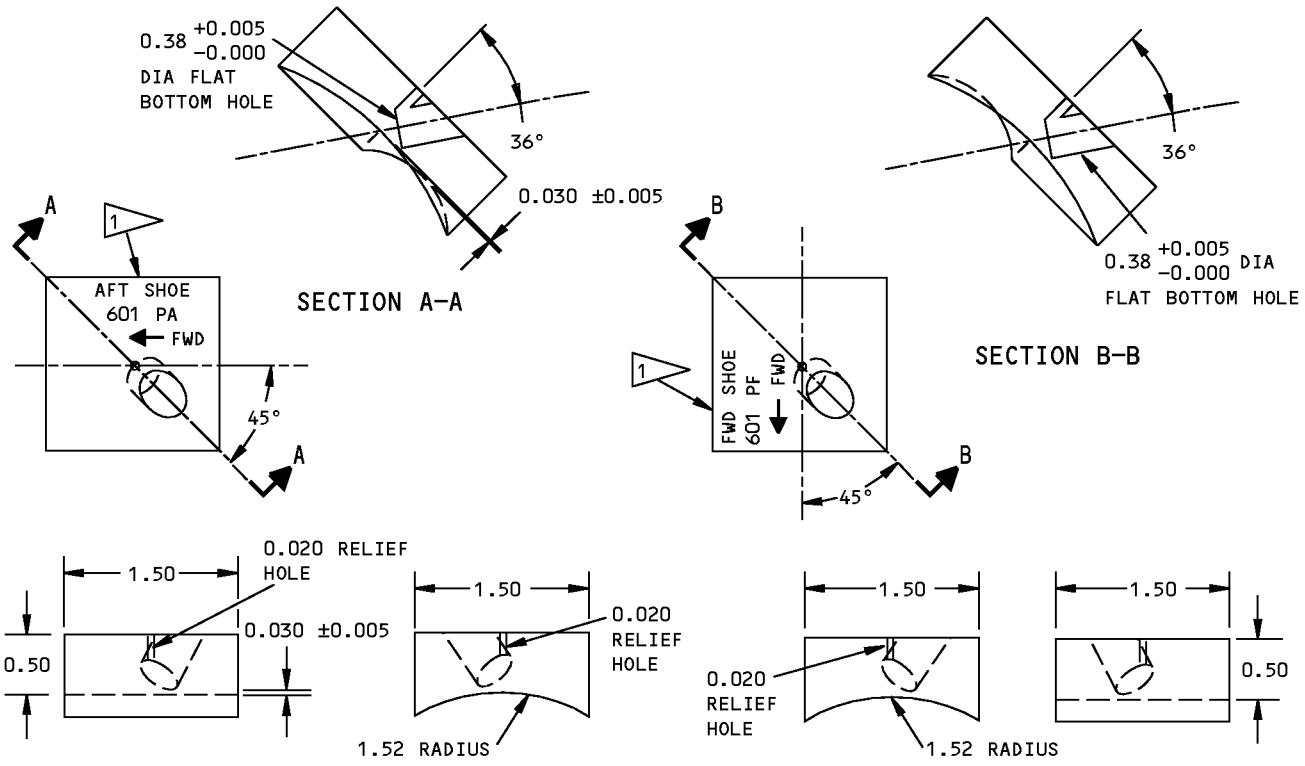
G. Repeat Paragraph 5.A. thru Paragraph 5.F. for forward torque shaft using positioner marked "Fwd Shoe."

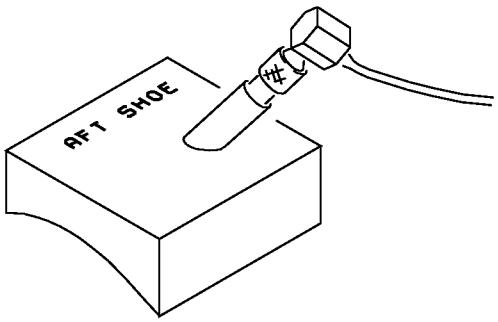


Large Forward Cargo Door Lift Drive Torque Shaft
Figure 1 (Sheet 1 of 2)



Large Forward Cargo Door Lift Drive Torque Shaft
Figure 1 (Sheet 2 of 2)





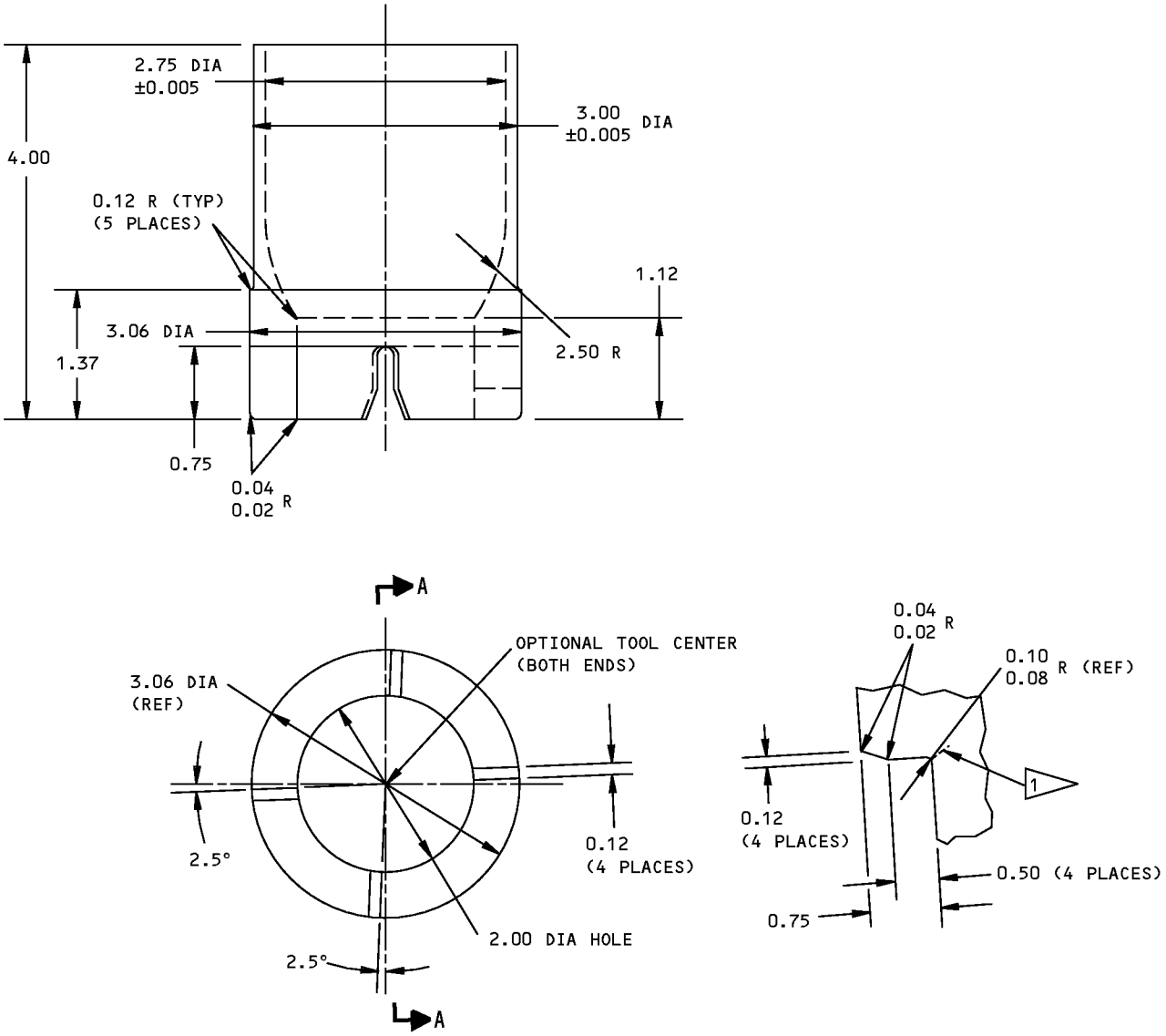
TRANSDUCER/POSITIONER ASSEMBLY (TYPICAL)

NOTES

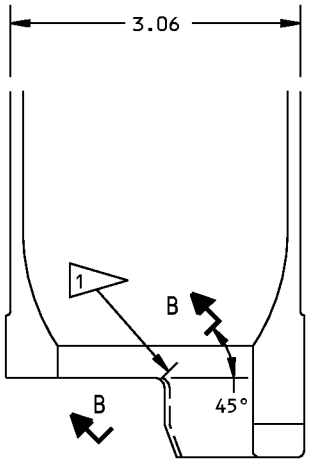
- ALL DIMENSIONS ARE IN INCHES
- MATERIAL: LUCITE
- TOLERANCE: ±0.01 EXCEPT AS NOTED

1 ENGRAVE OR STAMP INTO PART AS SHOWN

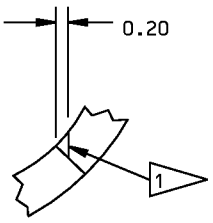
Transducer Positioning Fixtures
Figure 2



Reference Standard 601
Figure 3 (Sheet 1 of 2)



SECTION A–A
(ROTATED 95° CW)



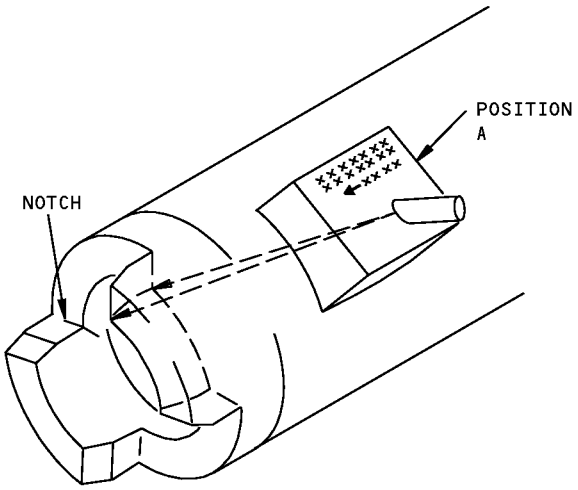
SECTION B–B

NOTES

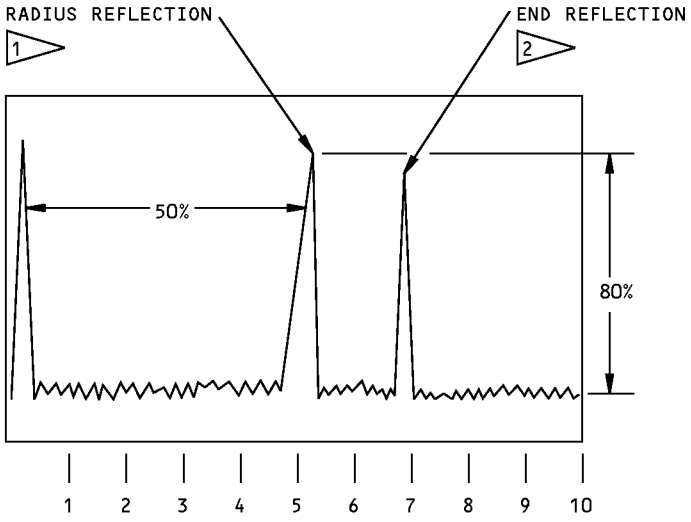
- ALL DIMENSIONS ARE IN INCHES EXCEPT AS NOTED
- MATERIAL: 4340 STEEL
- TOLERANCE: ±0.01 EXCEPT AS NOTED

1 JEWELER'S SAWCUT 0.030 MAX WIDTH X 0.20 DEEP AT RADIUS AT ROOT OF TANG

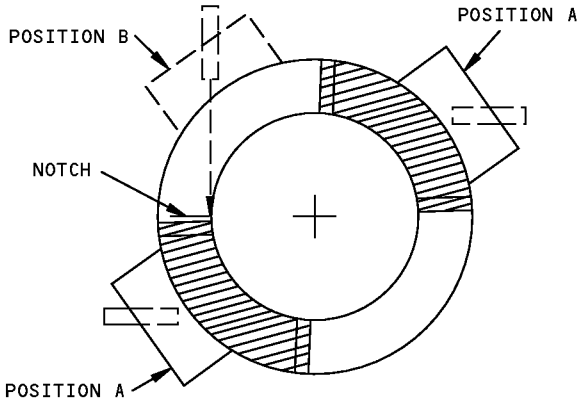
Reference Standard 601
Figure 3 (Sheet 2 of 2)



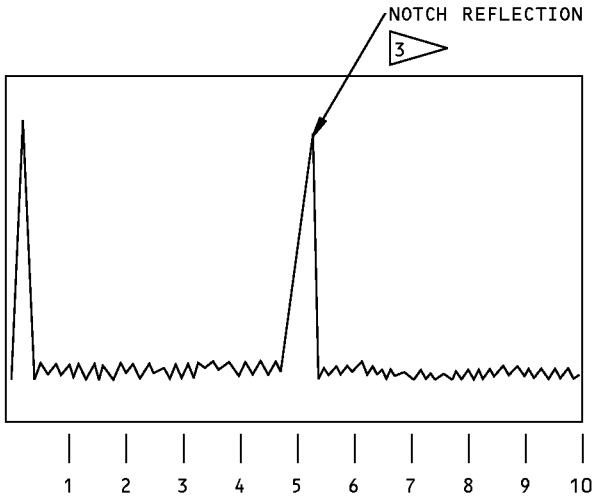
TRANSDUCER POSITION A



OSCILLOSCOPE RESPONSE PATTERN WITH TRANSDUCER/POSITIONER AT POSITION A



END VIEW



OSCILLOSCOPE RESPONSE PATTERN WITH TRANSDUCER/POSITIONER AT POSITION B (STANDARD ROTATED APPROX 90°)

NOTES

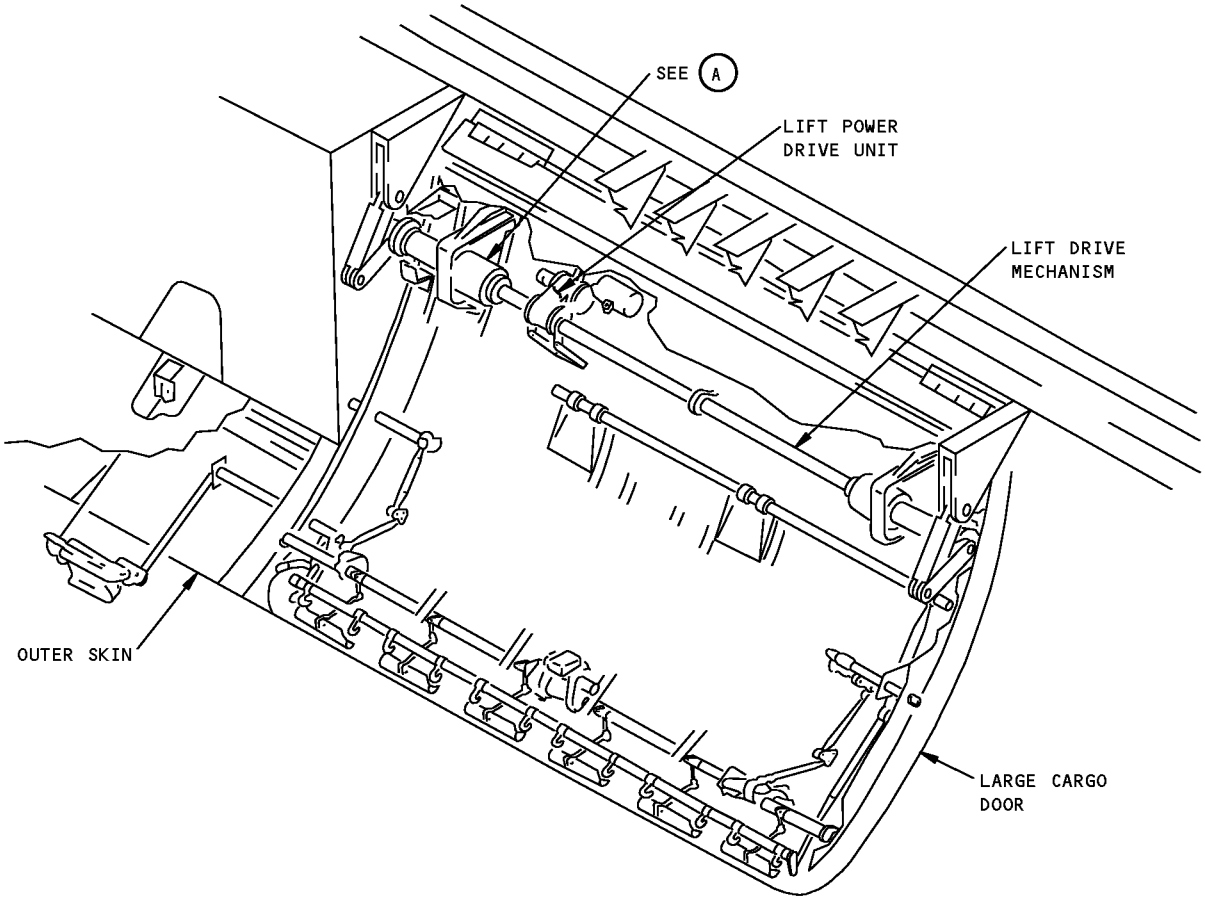
- ONE TRANSDUCER POSITION WILL NOT PRODUCE MAXIMUM RESPONSE FROM BOTH REFLECTORS

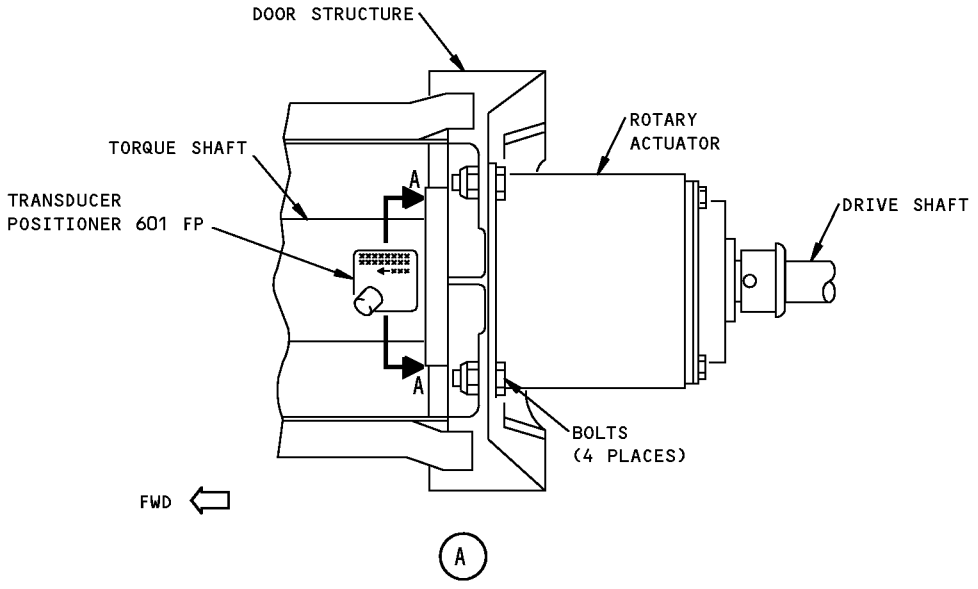
1 INDICATION FROM RADIUS AT ROOT OF DOG

2 INDICATION FROM CORNER AT END OF DOG

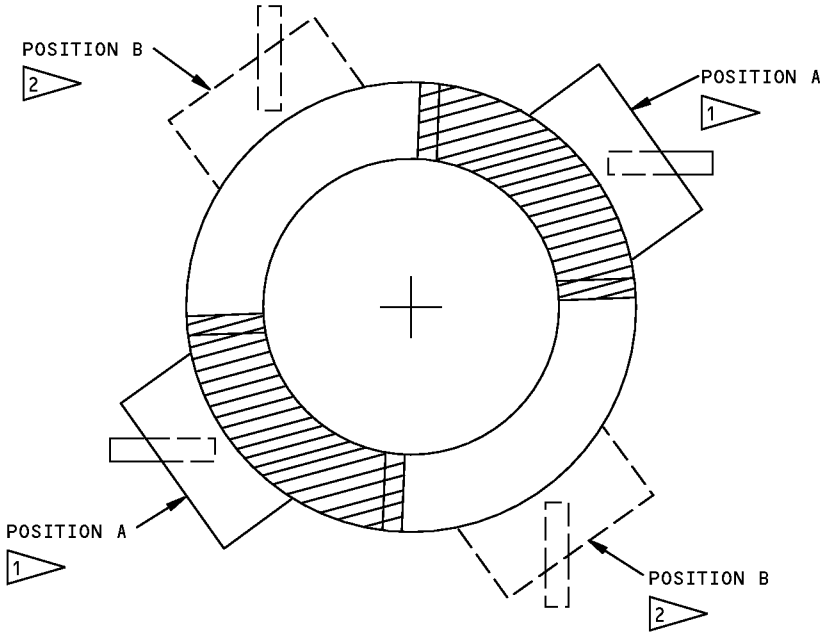
3 INDICATION FROM NOTCH AT ROOT OF DOG

Transducer Calibration Positions on Reference Standard
Figure 4





Large Cargo Door Lift Drive Torque Shaft Inspection
Figure 5 (Sheet 1 of 2)



SECTION A-A (TYPICAL)

NOTES

- SHADED AREAS INDICATE DOG ENDS
- FORWARD TORQUE SHAFT INSPECTION SHOWN, AFT INSPECTION IS REVERSED

1 TRANSDUCER PLACEMENT AT POSITION A WILL RESULT IN CHARACTERISTIC SIGNALS PER FIG.4

2 TRANSDUCER PLACEMENT AT POSITION B WILL SHOW INDICATIONS ONLY IF DEFECTS ARE PRESENT, PER FIG. 4 (NOTCH INDICATION)

Large Cargo Door Lift Drive Torque Shaft Inspection
Figure 5 (Sheet 2 of 2)

FORWARD AND AFT LARGE CARGO DOORS - INNER CHORD OF THE LATCH FRAMES

1. Purpose

A. Use this procedure to examine the latch frames of the forward and aft large cargo doors for cracks. The inspection is done at the fasteners that attach the inner chord of the latch frames to the inner strap or skin. See Figure 1.

B. MPD DTR Check Form Reference:

(1) Item 52-30-I05B and I09B

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, 51-04-00, for data about ultrasonic inspections.

B. Instrument

(1) Use an ultrasonic instrument that can:

(a) Do pulse echo inspection.

(b) Operate at a frequency of 5 MHz.

(2) The instruments that follow were used to help prepare this procedure.

(a) USN 52; Krautkramer, Inc.

(b) Sonic 1200; Staveley, Inc.

C. Ultrasonic Transducer

(1) It is necessary to use a transducer that can operate at 5 MHz and can put a 70 degree shear wave in aluminum. The maximum case dimensions are 0.75 x 0.375 inch (20 x 10 mm). A top mounted connector is recommended.

(2) The shear wave transducers that follow were used to help prepare this procedure.

(a) SUSM 570A, 5 MHz, 70°; NDT Engineering

(b) PAB 0503 70° AI; Harisonic

D. Reference Standard – Make reference standard NDT6010 as specified in Figure 2.

E. Ultrasonic Couplant – Use a couplant that will not damage the airplane structure.

3. Preparation for Inspection

A. Remove all sealant, dirt and grease from the inspection areas.

B. Make sure the areas the transducer will touch are clean and smooth.

4. Instrument Calibration

A. Connect the transducer to the instrument and set the instrument frequency to 5 MHz or to a range that includes 5 MHz.

B. Apply couplant to reference standard NDT6010 at Positions 1 and 2 and put the transducer at Position 1 as shown in Figure 3.

C. Set the initial pulse signal at 0% of full-screen width (FSW).

D. Put the transducer on the reference standard so that it points at the fastener hole. Make sure the front edge of the transducer does not move across the scribe line.

NOTE: The scribe lines on the reference standard identify the edges of the inner strap. The holes are not centered on the width of the strap. Line A identifies the edge of the strap that is farther from the holes and Line B the edge that is nearer to the holes. The transducer must be calibrated at the same distance that it will be when it is used to examine the inner chord of the latch frame on the airplane.

E. Move the transducer to get the maximum signal from the fastener hole. See Figure 3, Detail I.

F. Adjust the gain so that the signal from the fastener hole is at 80% of full screen height (FSH).

G. Adjust the range and delay controls so that the maximum signal from the fastener hole is at 80% of FSW. Make sure the initial pulse stays at 0% of FSW. See Figure 3, Detail I.

H. Apply couplant to the reference standard at Position 2 as shown in Figure 3.

I. Put the transducer at Position 2 as shown in Figure 3 and identify the signal from the fastener hole.

J. Slowly turn the transducer to point at the notch. The signal from the notch will occur at approximately 85 to 95% of FSW as shown in Figure 3, Detail II.

K. Move and turn the transducer to identify the differences between the signals from the fastener hole and the notch.

L. Increase the gain by 6 dB and record this gain level.

NOTE: Do not remove the 6 dB of gain during the inspection.

5. Inspection Procedure

A. Examine the two fastener holes at the intersections of the inner chord of the latch frame and the inner strap for cracks on the forward and aft large cargo doors. See Figure 1.

NOTE: Each door has 12 inspection locations.

(1) Calibrate the instrument as specified in Paragraph 4.

(2) Apply sufficient couplant to the inspection surfaces that the transducer will touch.

(3) Put the transducer on the inner chord of the large cargo door at one of the inspection locations.

(4) Point the transducer at a fastener. Adjust the transducer-to-fastener distance so the maximum signal from the fastener hole is at approximately 80% of FSW. See Figure 3, Detail I.

NOTE: The signal from the hole in the reference standard can occur at a different location (by a small quantity) on the screen display than the signal from the hole on the airplane. This can occur because of larger holes in the parts and/or a different distance between the transducer and the hole.

(5) Slowly turn the transducer to get the maximum signal from the fastener hole.

(a) It is possible to get a very small or no signal at all from the fastener hole if most of the sound transfers into the fastener. If this occurs, add more gain as necessary to set the signal from the fastener hole between 40 and 80% of FSH. Remove the additional gain and set the gain level to the level recorded in Paragraph 4.L. before you examine a different fastener hole.

(6) Slowly turn the transducer away from the fastener hole to examine the inner chord for cracks. Monitor the screen display for crack-type signals as you examine each side of the fastener hole.

(7) Do Paragraph 5.A.(2) thru Paragraph 5.A.(6) again to examine the two fastener holes at each inspection area.

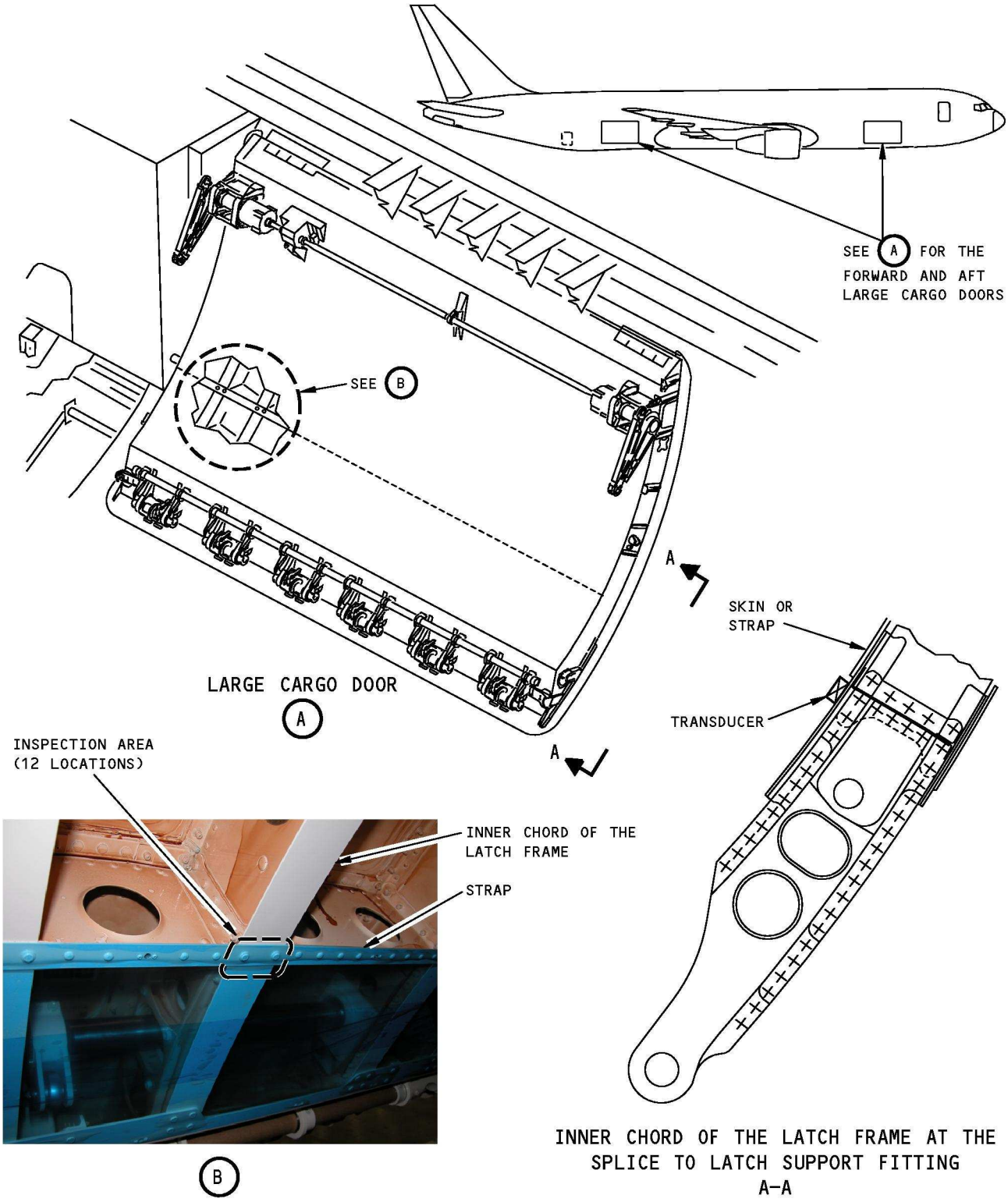
6. Inspection Results

A. Signals that are 40% or more of FSH and are also between 70 and 90% of FSW are crack indications. Make sure the fastener hole is not the cause of the crack indication (see the note in Paragraph 5.A.(4)).

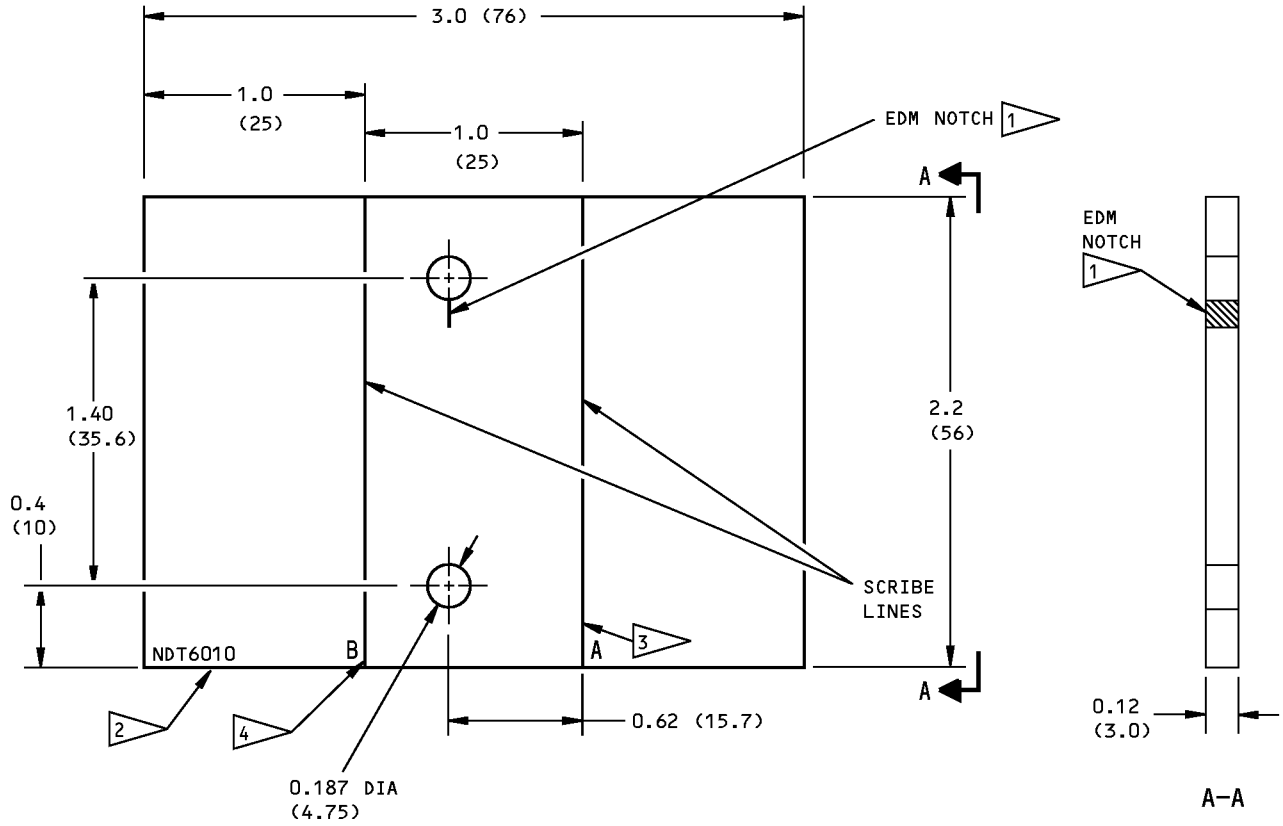
(1) If a crack indication occurs, remove the paint from the surface that the transducer touches. Adjust the gain to the value identified in Paragraph 4.L. and do the inspection again.

(2) If the signal is more than 40% of FSH, then do Paragraph 6.B.

B. To make sure that a signal is from a crack, remove the fastener and do an open hole eddy current inspection as specified in Part 6, 51-00-04, Part 6, 51-00-11, or Part 6, 51-00-16.



Inspection Area for the Inner Chords
Figure 1



NOTES

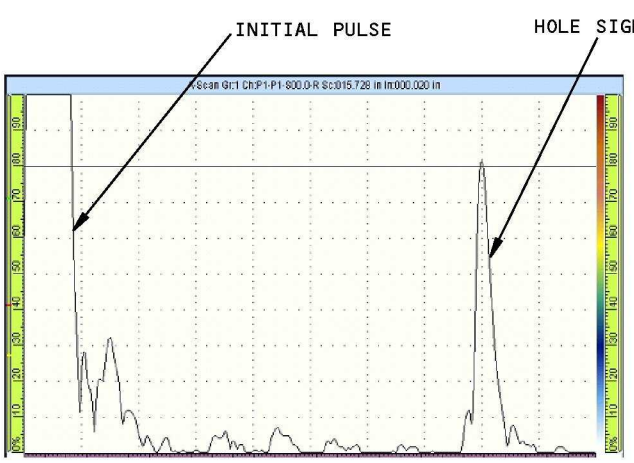
- ALL DIMENSIONS ARE IN INCHES (MILLIMETERS ARE IN PARENTHESES)
- TOLERANCE (UNLESS SPECIFIED DIFFERENTLY):

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

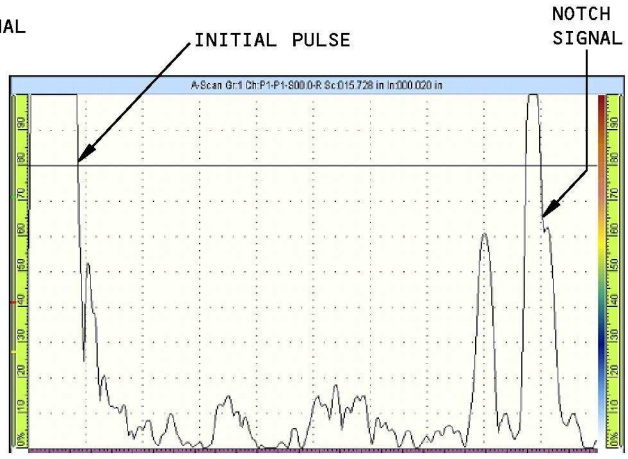
- MATERIAL: ALUMINUM 7075-T6
- SURFACE ROUGHNESS: 125 Ra OR BETTER

1. EDM NOTCH:
   WIDTH: 0.007 (0.18) MAXIMUM
   LENGTH: 0.20 (5.1)
   DEPTH: FULL PART THICKNESS
2. ETCH OR STEEL STAMP THE REFERENCE STANDARD NUMBER NDT6010 AT APPROXIMATELY THIS LOCATION
3. SCRIBE LINE A
4. SCRIBE LINE B

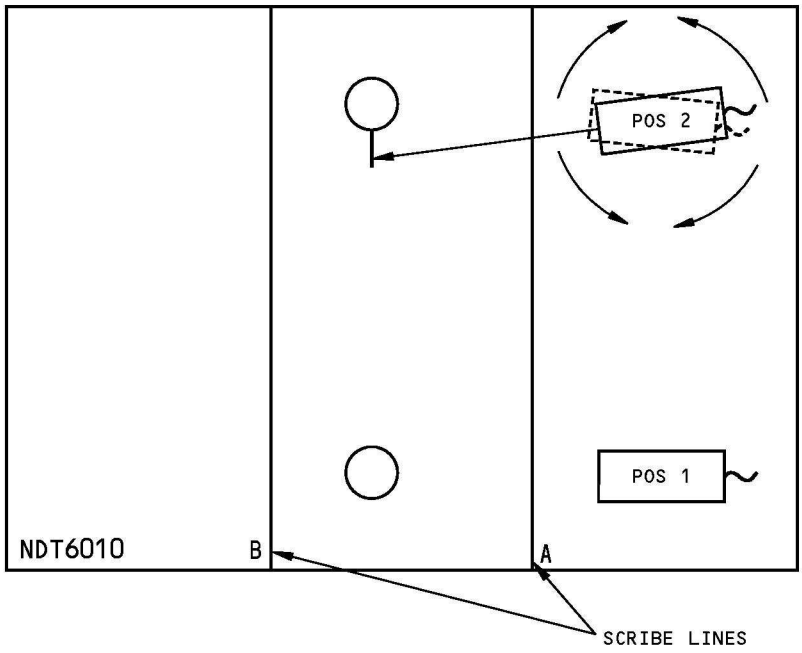
Reference Standard NDT6010
Figure 2



HOLE SIGNAL
DETAIL I



NOTCH SIGNAL
DETAIL II



NOTES:

- MAKE SURE THAT THE TRANSDUCER IS BEHIND SCRIBE LINES A AND B.
- TURN THE TRANSDUCER AS NECESSARY TO GET THE MAXIMUM SIGNAL.

Instrument Calibration
Figure 3

FORWARD AND AFT LARGE CARGO DOORS - OUTER SKIN AT THE MAIN HINGES

1. Purpose

A. Use this procedure to examine the outer skin of the forward and aft large cargo doors under the main hinges for cracks. The inspection is done from the external surface of the airplane. See Figure 1.

B. MPD DTR Check Form Reference:

(1) Item 52-30-I05C, and I09C

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, 51-04-00 for data about ultrasonic inspection.

B. Instrument

(1) Use ultrasonic instrument that can:

(a) Do pulse echo inspection.

(b) Operate at a frequency of 5 MHz.

(2) The instruments that follow were used to help prepare this procedure.

(a) USN 52; Krautkramer, Inc.

(b) Sonic 1200; Staveley, Inc.

C. Ultrasonic Transducers

(1) It is necessary to use a transducer that can operate at 5 MHz and can put a 70 degree shear wave in aluminum. A top mounted connector is recommended. The maximum case dimensions are 0.55 inches (14.0 mm) long and 0.25 inch (6.4 mm) in diameter. A small transducer is necessary to fit between and around fasteners that can block access to the inspection area

(2) The shear wave transducer that follows was used to help prepare this procedure.

(a) SUSM 570A 5 MHz 70°; NDT Engineering

D. Reference Standard – Make reference standard NDT6009 as specified in Figure 2.

E. Ultrasonic Couplant – Use a couplant that will not damage the airplane structure.

3. Preparation for Inspection

A. Remove all sealant, dirt and grease from inspection areas.

B. Make sure that the area the transducer will touch is clean and smooth.

4. Instrument Calibration

A. Connect the transducer to the instrument and set the instrument frequency to 5 MHz or to a range that includes 5 MHz.

B. Apply couplant to reference standard NDT6009 and put the transducer at Position 1 as shown in Figure 3.

C. Set the initial pulse signal at 0% of full-screen width (FSW).

D. Put the transducer on the reference standard so that it points at the fastener hole. Make sure the front edge of the transducer does not move across the scribe line.

NOTE: This scribe line identifies the location of the hinge that is on the inspection area.

E. Move the transducer to get the maximum signal from the fastener hole.

F. Adjust the gain so that the fastener hole signal is at 80% of full screen height (FSH).

G. Adjust the range and delay controls so that the maximum signal from the fastener hole is at 80% of FSW. Make sure the initial pulse stays at 0% of FSW. See Figure 3, Detail I.

H. Apply couplant to the reference standard at Position 2 as shown in Figure 3.

I. Put the transducer at Position 2 as shown in Figure 3 and identify the signal from the fastener hole.

J. Slowly turn the transducer to point at the notch. The signal from the reference standard notch will occur at approximately 70 to 95% of FSW, as shown in Figure 3, Detail II.

K. Move and turn the transducer to identify the differences between the signals from the fastener hole and the notch.

L. Apply couplant to the reference standard at Position 3 as shown in Figure 3.

M. Put the transducer at Position 3 (Figure 3) to identify the signal from the second notch in reference standard NDT6009.

N. If the notch signal is less than 80% of FSH, adjust the gain to get an 80% of FSH signal from the notch at Position 3.

O. Record the instrument gain level.

P. Increase the gain by 6 dB.

NOTE: Do not remove the 6 dB of gain during the inspection.

5. Inspection Procedure

A. Examine the first fastener row behind the hinge for cracks. Put the transducer on the door skin below the hinge sections to examine the fastener hole that is nearest to the transducer. See Figure 1.

(1) Calibrate the instrument as specified in Paragraph 4.

(2) Apply sufficient couplant to the inspection surfaces that the transducer will touch.

(3) Put the transducer on the large cargo door skin at one of the inspection locations.

(4) Point the transducer at a fastener. Adjust the transducer-to-fastener distance so the maximum signal from the fastener hole is at approximately 80% of FSW.

NOTE: The signal from the hole in the reference standard can occur at a different location (by a small quantity) on the screen display than the signal from the hole on the airplane. This can occur because of larger holes in the parts and/or a different distance between the transducer and the hole.

(5) Slowly turn the transducer to get the maximum signal from the fastener hole.

(a) It is possible to get a very small signal or no signal at all from the fastener hole if most of the sound transfers into the fastener. If this occurs, add more gain as necessary to set the signal from the fastener hole between 40 and 80% of FSH. Put the gain back to the initial quantity before you examine a different fastener hole.

(6) Slowly turn the transducer away from the fastener hole to examine the large cargo door skin for cracks. Monitor the screen display for crack-type signals as you examine each side of the fastener hole.

(7) Do Paragraph 5.A.(2) thru Paragraph 5.A.(6) to examine each fastener hole in the inspection areas.

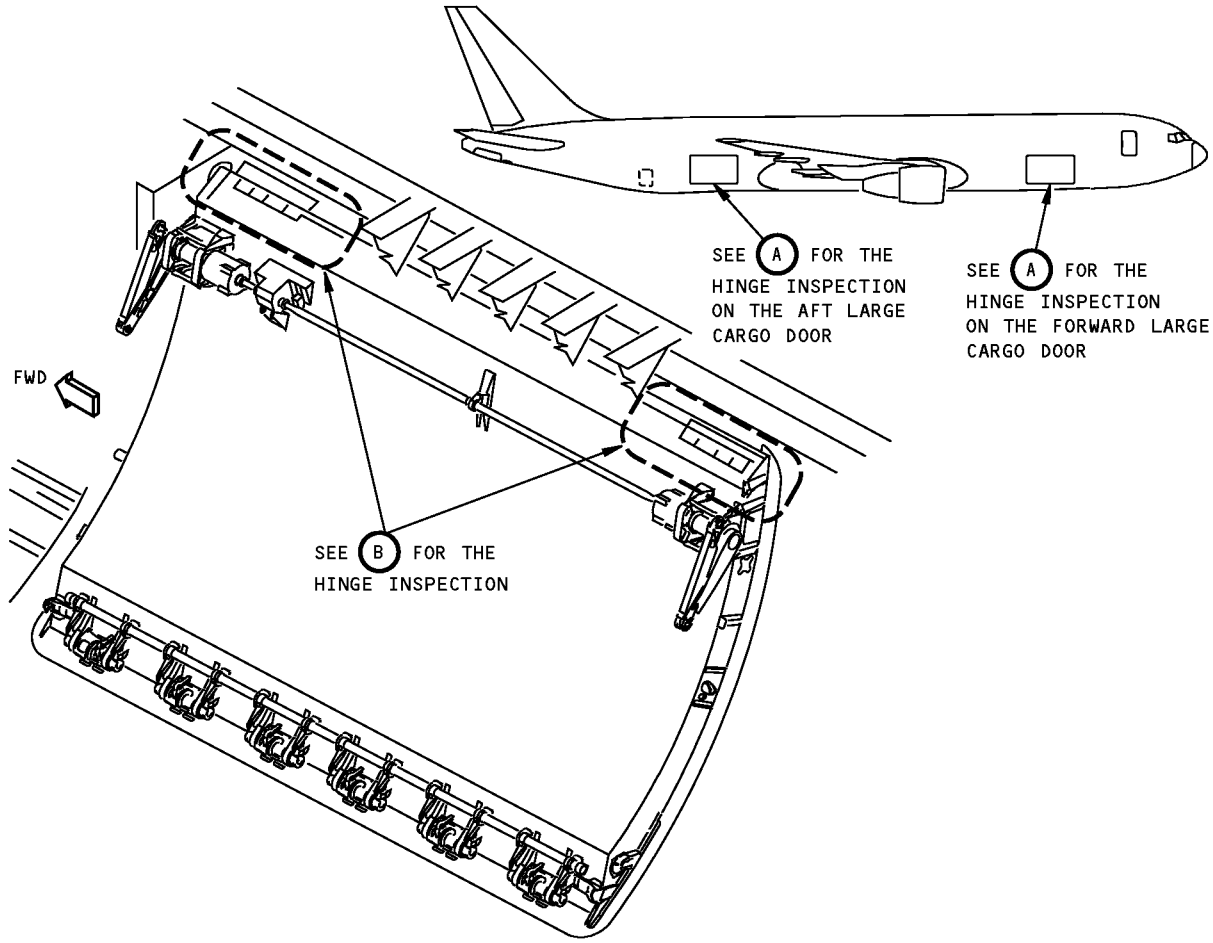
6. Inspection Results

A. Signals that are 40% or more of FSH and are also between 70 and 100% of FSW are crack indications. Make sure the fastener hole is not the cause of the crack indication (see the note in Paragraph 5.A.(4).

(1) If a crack indication occurs, remove the paint from the surface that the transducer touches. Adjust the gain to the value identified in Paragraph 4.O. and do the inspection again.

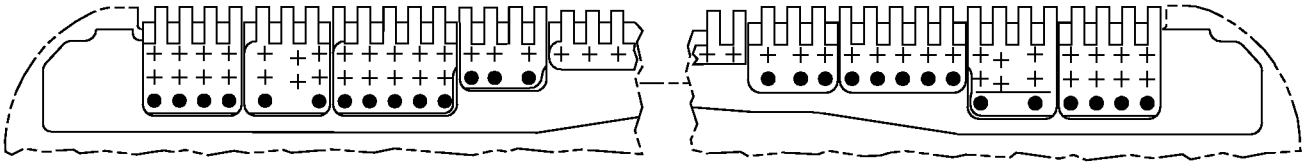
(2) If the signal is more than 40% of FSH, then do Paragraph 6.B.

B. To make sure that a signal is from a crack, remove the fastener and do an open hole eddy current inspection as specified in Part 6, 51-00-04, Part 6, 51-00-11, or Part 6, 51-00-16.



THE FORWARD LARGE CARGO DOOR IS SHOWN;
THE AFT LARGE CARGO DOOR IS ALMOST THE SAME.

A



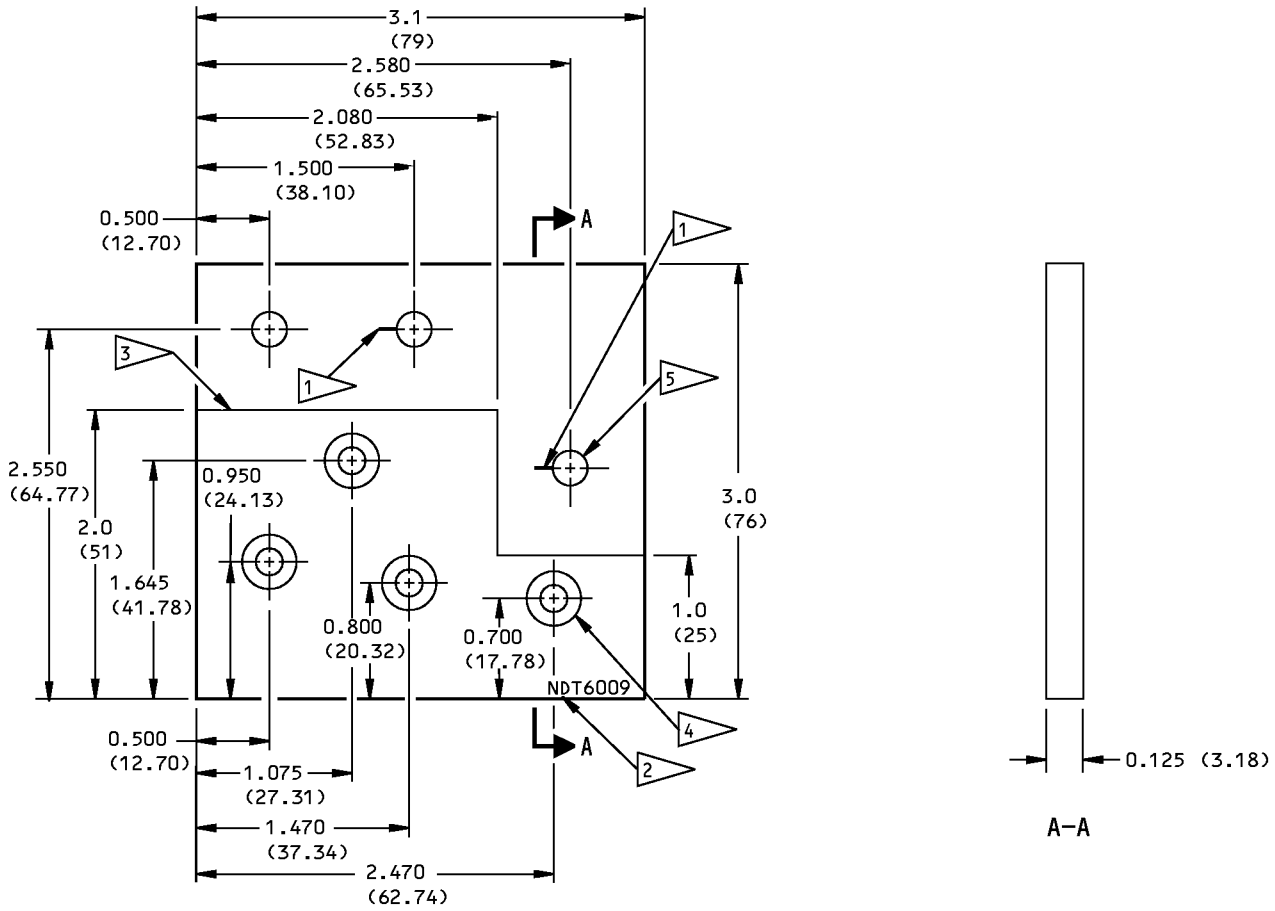
NOTE:

● INSPECTION FASTENERS

INSPECTION AREA FOR THE LARGE CARGO DOOR HINGE

B

767 Large Cargo Door Hinge
Figure 1



NOTES

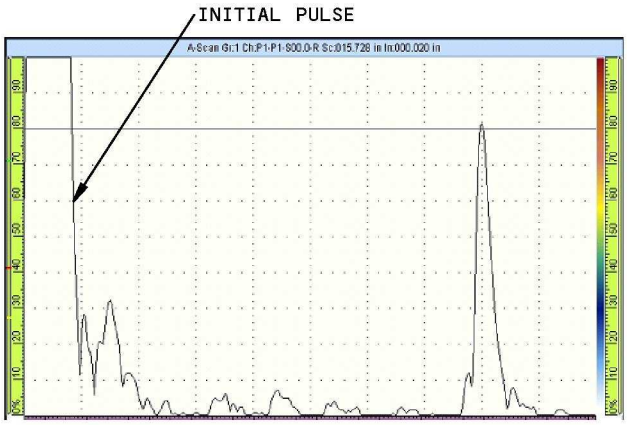
- ALL DIMENSIONS ARE IN INCHES
  (MILLIMETERS ARE IN PARENTHESES)
- TOLERANCE (UNLESS SPECIFIED DIFFERENTLY):

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

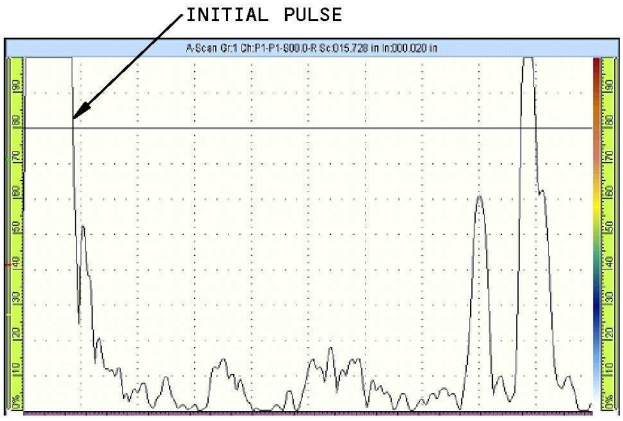
- MATERIAL: ALUMINUM 2024-T3
  0.125 (3.18) THICK
- SURFACE ROUGHNESS: 125 Ra OR BETTER

1. EDM NOTCH:
   WIDTH: 0.007 (0.18) MAXIMUM
   LENGTH: 0.15 (3.8)
   DEPTH: FULL PART THICKNESS
2. ETCH OR STEEL STAMP THE REFERENCE STANDARD NUMBER NDT6009 AT APPROXIMATELY THIS LOCATION
3. MAKE A SCRIBE LINE AS SHOWN
4. ALL COUNTERSUNK HOLES:
   0.38 (9.7) DIA X 100°
   0.19 (4.8) DIA HOLE
5. STRAIGHT HOLES:
   0.250-0.254 (6.35-6.45) DIA

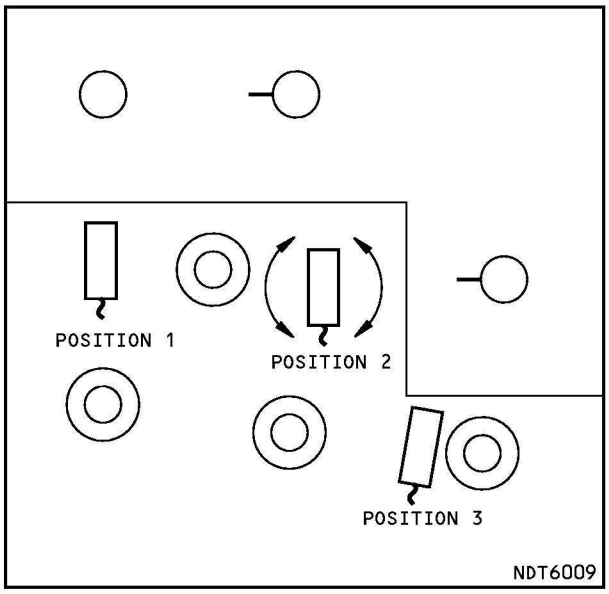
Reference Standard NDT6009
Figure 2



HOLE SIGNAL
DETAIL I



NOTCH SIGNAL
DETAIL II



NOTES:

- MAKE SURE THAT THE TRANSDUCER IS BEHIND THE SCRIBE LINE
- TURN THE TRANSDUCER AS NECESSARY TO GET THE MAXIMUM SIGNAL.

Instrument Calibration
Figure 3