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NONDESTRUCTIVE TEST MANUAL

PART 4 - ULTRASONIC

OUTER CHORD OF THE CANTED BULKHEAD OF THE NOSE LANDING GEAR WHEEL WELL

1. Purpose

- A. Use this procedure to examine the outer chord in the canted bulkhead of the nose landing gear wheel well for cracks. Cracks can start at the fastener holes in the outer chord and grow in a forward and aft direction.
- B. The fastener locations to be examined are those fasteners that are covered by structures at BL 10.6 and BL 25.0. The fastener hole locations are shown in Figure 1.
- C. MPD Appendix B DTR Check Form Reference:
 - (1) ITEM 53-10-I18B

2. Equipment

- A. General
 - (1) All ultrasonic equipment that can be calibrated as specified in Paragraph 4. can be used for this inspection.
 - (2) Refer to Part 1, 51-01-00, for data about the equipment manufacturers.
- B. Instrument
 - (1) Use an ultrasonic instrument that:
 - (a) Operates between 4 and 6 MHz.
 - (b) Can find a simulated crack in the reference standard as specified in the calibration instructions of this procedure.
 - (2) The instruments specified below were used to help prepare this procedure:
 - (a) USN 50; Krautkramer Branson
 - (b) Sonic 1200; Staveley Instruments, Inc.
- C. Transducer
 - (1) Use a shear wave transducer that:
 - (a) Operates at a frequency of approximately 5 MHz.
 - (b) Causes a 60 (\pm 2) degree shear wave to occur in aluminum.
 - (c) Has a maximum length of 0.75 inch (19 mm).
 - (d) Has a maximum width of 0.38 inch (9.5 mm).
 - (2) The transducers specified below were used to help prepare this procedure:
 - (a) 57A3065, Type SMZ; Staveley Sensors
 - (b) 389-020-490, KBA; Krautkramer Branson
 - (c) AP-HP-3/16-5.00-70; Xactex Corp.
- D. Reference Standard
 - (1) Make reference standard NDT658 as shown in Figure 2.
- E. Couplant
 - (1) Use an ultrasonic couplant that will not cause corrosion or other damage to the airplane.

3. Preparation for Inspection

- A. Get access to the inspection area through the access door that is immediately forward of the nose landing gear wheel well.

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- B. Remove the insulation blankets, leveling compound and sealant, as necessary, to do the inspection.
- C. Identify the inspection location.

4. Instrument Calibration

- A. Set the instrument frequency in the 4 to 6 MHz range.
- B. Put couplant on the reference standard at the transducer position (TP) 1 and 2 areas as shown in Figure 3, Detail C.
- C. Put the transducer at TP1 (Figure 3, Detail C) and get a maximum signal from the fastener hole.
- D. Adjust the instrument delay and range controls so that the initial pulse signal is at 0 percent of full screen width (FSW) and the signal from the fastener hole is at approximately 60 percent of FSW (Figure 3, Detail A).
- E. Put the transducer at transducer position 2 (Figure 3, Detail C).
- F. Slowly turn the transducer to get a maximum signal from the reference standard notch. The signal will occur at approximately 65 percent of full screen width.
- G. Adjust the gain control so the maximum signal from the notch is at 80 percent of full screen height (FSH). See Figure 3, Detail B.
- H. Turn the transducer at TP2 (Figure 3, Detail C) so the signals from the hole and the notch are on the screen. Identify the differences between these signals.
- I. Increase the gain by 6 dB.

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

5. Inspection Procedure

- A. Calibrate the instrument as specified in Paragraph 4.
- B. Put couplant on the forward side of the outer chord at the inspection areas identified in Figure 4.
- C. Put the transducer on the outer chord (Figure 4) as near as possible to the inspection fastener hole at RBL 25.0.
- D. Move the transducer to get a maximum signal from the inspection fastener hole.

NOTE: The FSW location of the hole signals will be different when the transducer to fastener distance changes.

- E. Slowly turn the transducer to point the sound away from the hole to examine the hole for cracks.
- F. Do Paragraph 5.C. thru Paragraph 5.E. again to examine the opposite side of the hole.
- G. Do Paragraph 5.C. thru Paragraph 5.F. at all fastener locations identified in Figure 4.
- H. Do Paragraph 5.B. thru Paragraph 5.G. on the left side of the airplane.

6. Inspection Results

- A. Signals that are 40 percent or more of FSH and occur after the hole signal are crack indications. Compare the crack signal to the signal you get from the notch in the reference standard to be sure it is a crack signal.
- 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.

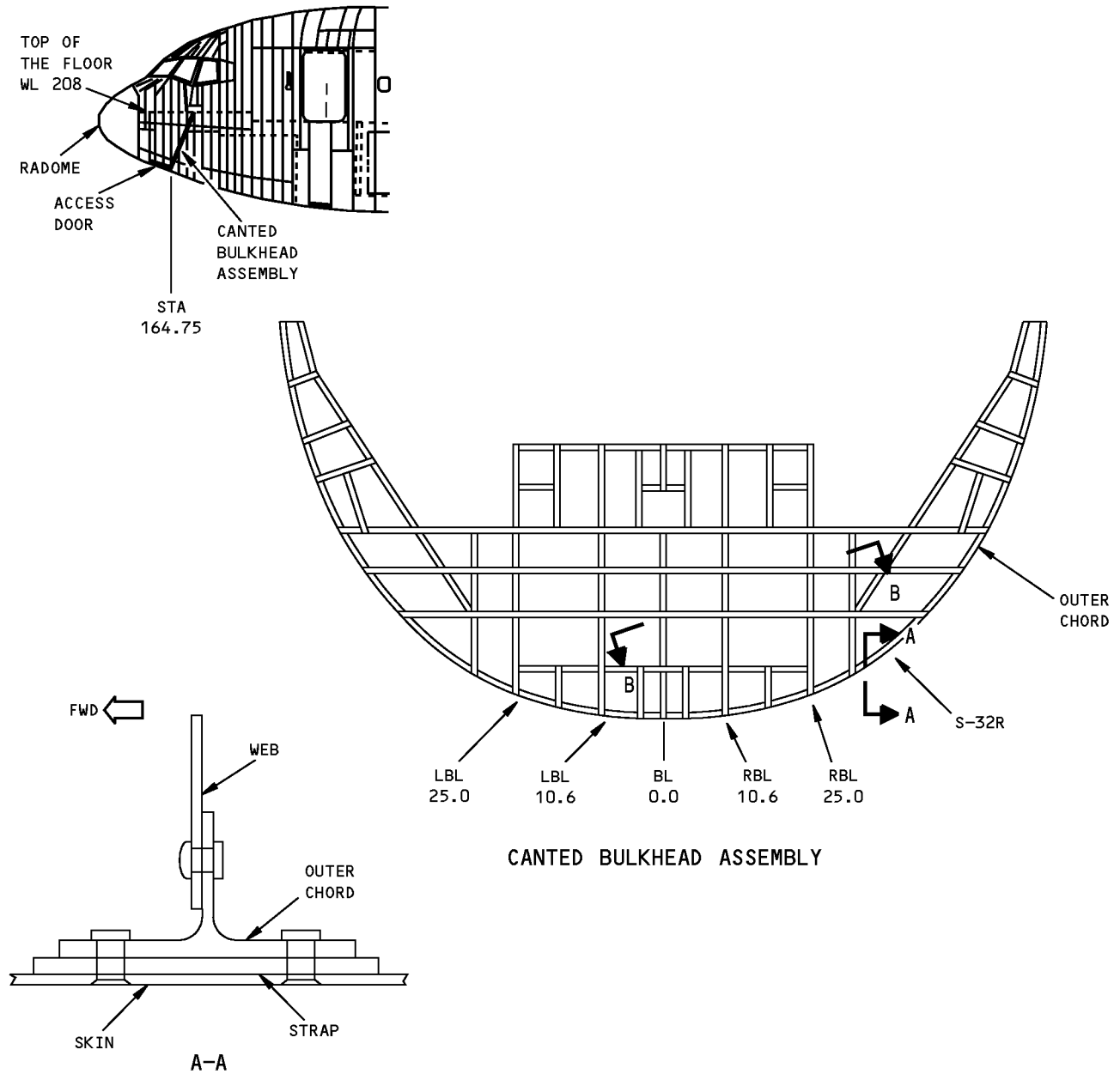
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NOTES

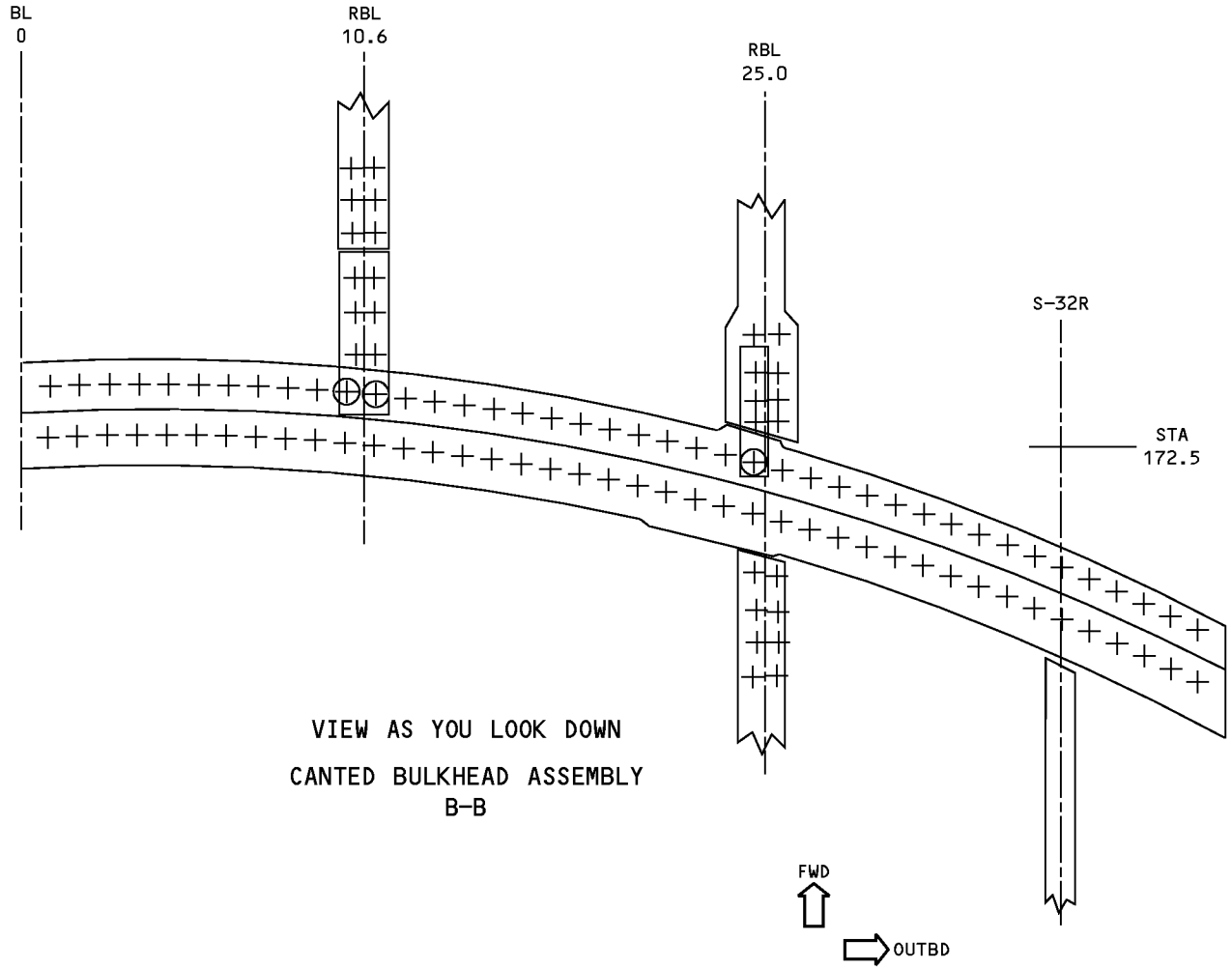
- EXAMINE THE OUTER CHORD AT RBL 25.0, RBL 10.6, LBL 10.6 AND LBL 25.0.

**Inspection Location
Figure 1 (Sheet 1 of 2)**

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VIEW AS YOU LOOK DOWN
CANTED BULKHEAD ASSEMBLY
B-B

NOTES

- THE RIGHT SIDE OF THE AIRPLANE IS SHOWN;
THE LEFT SIDE IS ALMOST THE SAME.

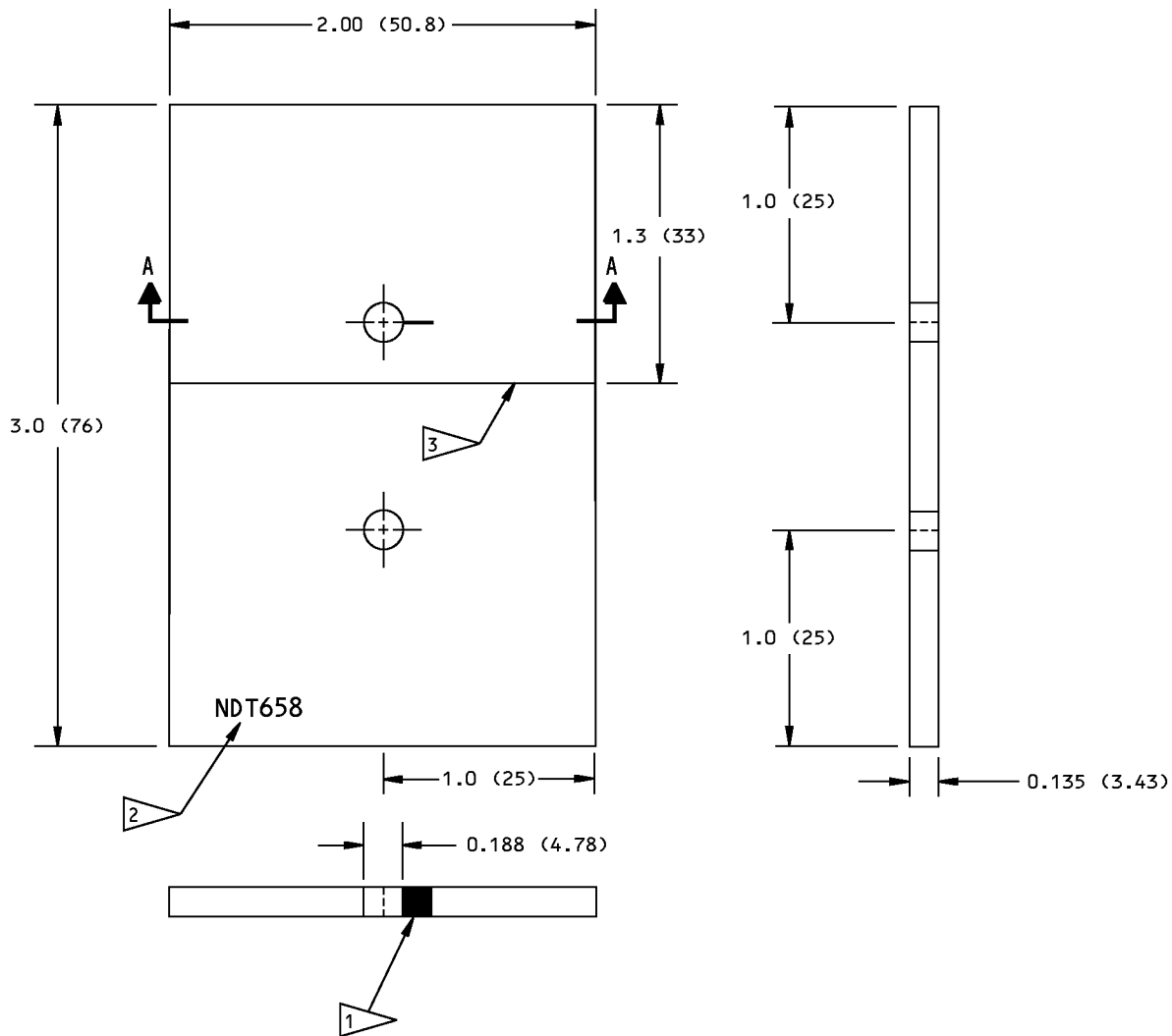
⊕ INSPECTION FASTENERS

**Inspection Location
Figure 1 (Sheet 2 of 2)**

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NOTES

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

<u>INCHES</u>	<u>MILLIMETERS</u>
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 (7075-T6 OPTIONAL)
- SURFACE ROUGHNESS: 125 Ra OR BETTER

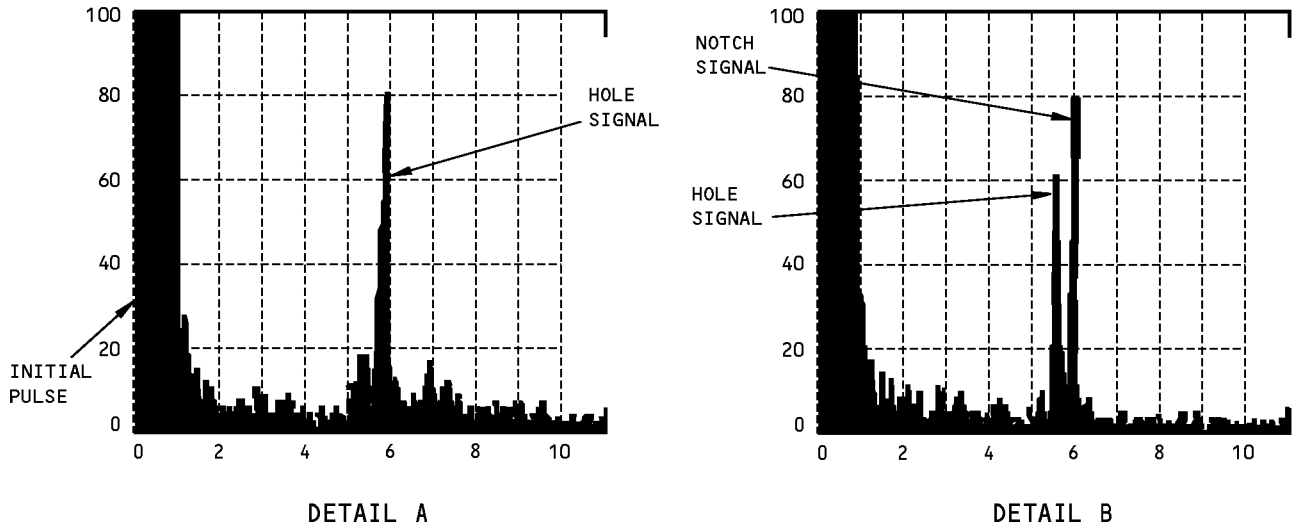
- EDM NOTCH:
WIDTH: 0.020 (0.51)
LENGTH: 0.135 (3.43)
DEPTH: FULL PART THICKNESS
- ETCH OR STEEL STAMP THE REFERENCE STANDARD NUMBER NDT658 AT APPROXIMATELY THIS LOCATION
- SCRIBE A LINE AT THIS LOCATION

Reference Standard NDT658
Figure 2

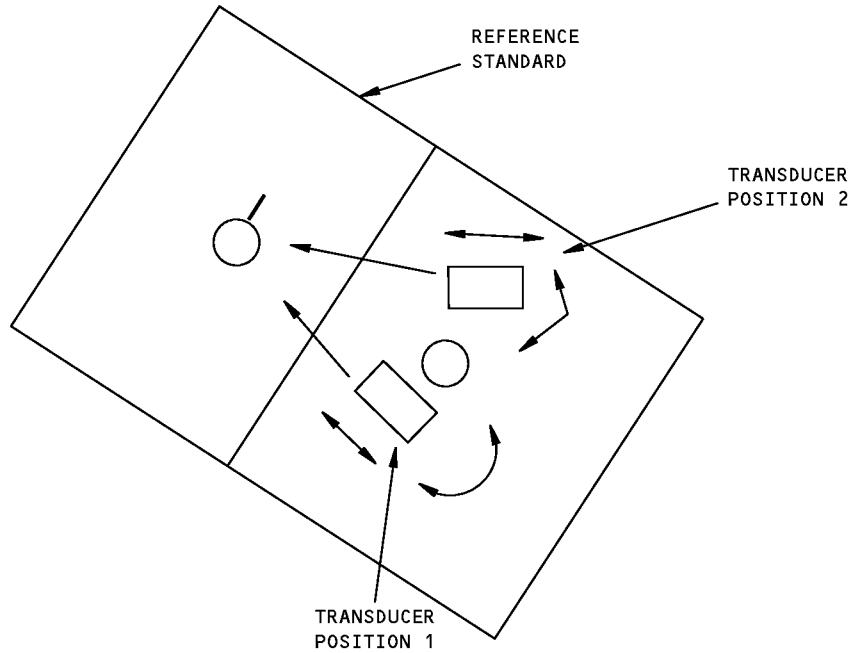
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INSTRUMENT SIGNAL DISPLAYS



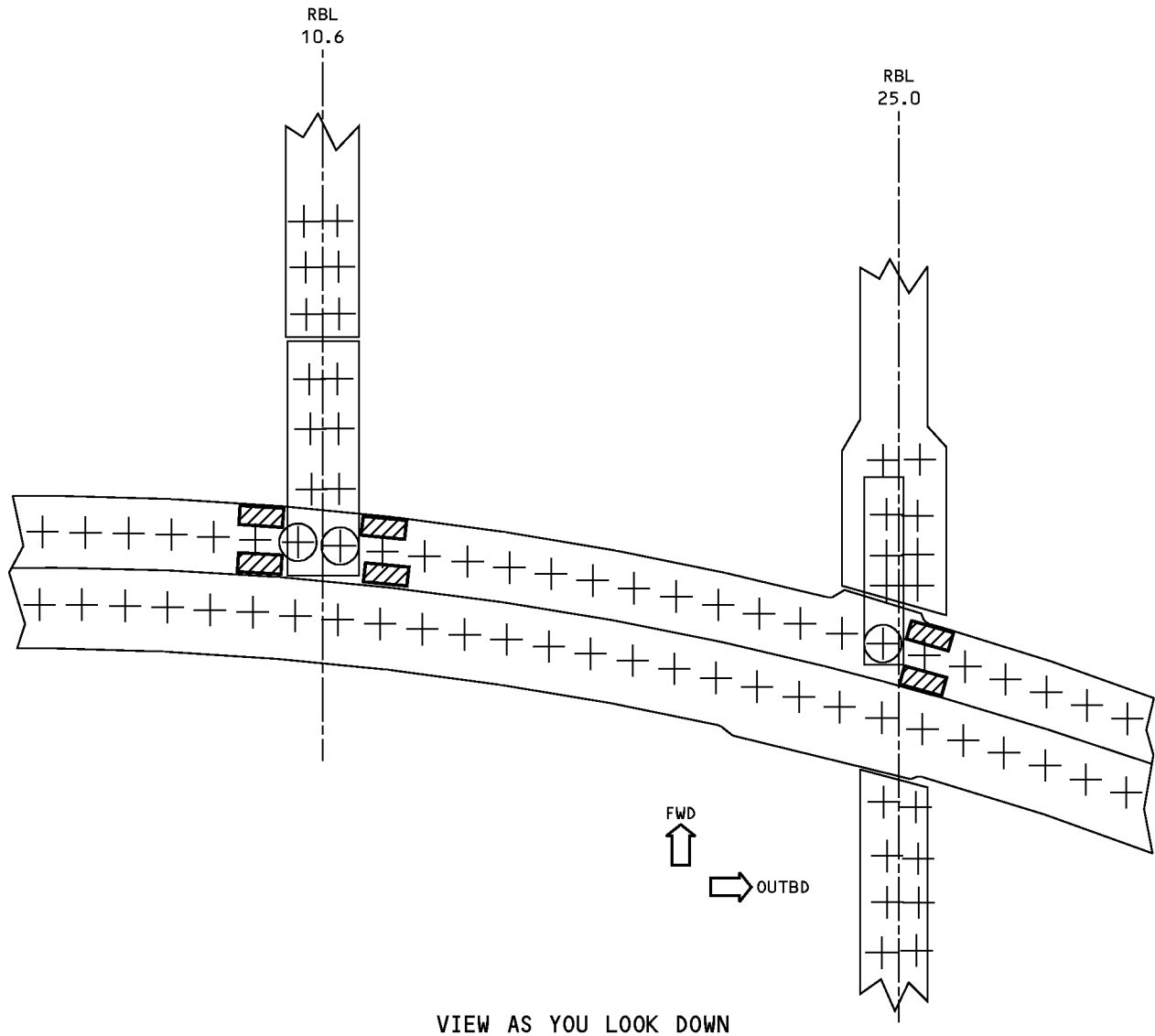
DETAIL C

**Instrument Calibration
Figure 3**

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NOTES

- THE RIGHT SIDE OF THE AIRPLANE IS SHOWN;
THE LEFT SIDE IS ALMOST THE SAME.

- ⊕ INSPECTION FASTENERS
- ▨ TRANSDUCER POSITIONS

**Transducer Positions
Figure 4**

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PART 4 - ULTRASONIC

OUTER CHORD OF THE NOSE LANDING GEAR WHEEL WELL AT BS 287

1. Purpose

- A. Use this procedure to examine the outer chord at BS 287 for cracks at the fastener holes on the aft side at stringers 36L and 36R. The inspection is done from inside the airplane. See Figure 1 for the location of the inspection areas.
- B. MPD Appendix B DTR Check Form reference:
 - (1) ITEM 53-10-I21D

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 an ultrasonic instrument that can:
 - (a) Do pulse echo inspection.
 - (b) Operate at a frequency between 4 MHz and 6 MHz.
 - (2) The instruments that follow were used to help prepare this procedure.
 - (a) USD 15; Krautkramer Branson
 - (b) Sonic 136; Staveley Instruments
- 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 (approximately) 0.7 inch (18 mm) long, 0.3 inch (8 mm) wide and 0.6 inch (15 mm) high. A top mounted connector is recommended.
 - (2) The shear wave transducers that follow were used to help prepare this procedure.
 - (a) 57A3066TC; 5 MHz, 70 degrees in aluminum. Made by Staveley Sensors, Inc.
 - (b) 389-020-490; 5 MHz, 70 degrees in aluminum. Made by Krautkramer Branson.
- D. Reference Standards - Make reference standard NDT670 as specified in Figure 2.
- E. Ultrasonic Couplant - Use a couplant that will not damage the airplane structure.

3. Preparation for Inspection

- A. Remove the interior panels and insulation blankets as necessary to get access to the inspection areas.
- B. Loosen and move the wire bundles on the right side of the airplane to get to the inspection area.
- C. Make sure 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 between 4 and 6 MHz.
- B. Apply couplant to reference standard NDT670 at the transducer position shown in Figure 3, Detail C.
- C. Set the initial pulse signal at 0% of full-screen width.

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- D. Put the transducer on the reference standard so that it points directly at the fastener hole, as shown in Figure 3, Detail C. Make sure the front edge of the transducer does not move across the reference line.

NOTE: The reference line shows the location of the stringer splice fitting on the airplane.

- E. Move the position of the transducer so that the highest signal from the reference standard fastener hole is shown on the screen display.
- F. Adjust the range and delay controls so that the maximum signal from the fastener hole is at 80% of full screen width. Make sure the initial pulse stays at 0% of full-screen width.
- G. Adjust the instrument gain so that the highest signal from the fastener hole is at 80% of full screen height. See Figure 3, Detail A.
- H. Slowly turn the transducer to point at the notch (Figure 3, Detail D). The signal from the reference standard notch occurs at approximately 85% of full screen width, as shown in Figure 3, Detail B.
- I. Move and turn the transducer to identify the difference between the signals from the fastener hole and notch.
- J. Increase the gain by 16 dB.

NOTE: Do not remove the 16 dB of gain during the inspection.

5. Inspection Procedure

- A. Examine the chord at Station 287, stringers 36R and 36L as shown in Figure 1.
- (1) Calibrate the instrument as specified in Paragraph 4.
 - (2) Apply sufficient couplant to the inspection surfaces that the transducer will touch. See Figure 1.
 - (3) Put the transducer on the outer chord at one of the inspection locations.
 - (4) Point the transducer at the fastener. Adjust the transducer-to-fastener distance so that the maximum signal from the fastener hole is at approximately 80% of full screen width (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 highest signal from the fastener hole.
 - (a) It is possible to receive little or no signal 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 full screen height (FSH). Put the gain back to the original amount before you examine a different fastener hole.
- (6) Slowly turn the transducer away from the fastener hole to examine the outer chord for cracks. Use Figure 1, transducer position 1 to look for cracks between the fastener hole and the edge of the chord. Use Figure 1, transducer position 2 to look for cracks between the fastener hole and the web. Monitor the screen display for crack-type signals.
- (7) Do Paragraph 5.A.(2) thru Paragraph 5.A.(6) to examine the fastener hole at the opposite side of the airplane.

6. Inspection Results

- A. Signals that are 40% of full screen height (or higher) and are also between 80% and 90% of full screen width are crack indications. Make sure the fastener hole is not the cause of the crack-type signal (see the Paragraph 5.A.(4) note).
- (1) If a crack indication occurs, remove the paint from the surfaces that the transducer touches. Remove the 16 dB of gain added in Paragraph 4.J. and do the inspection again.

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- B. To make sure that a crack-type 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.

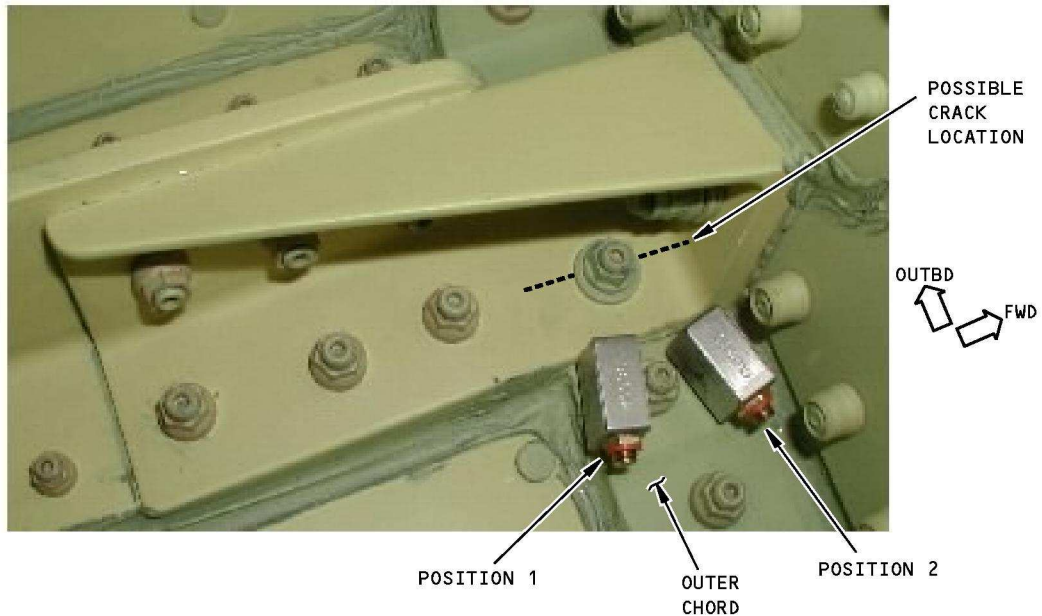
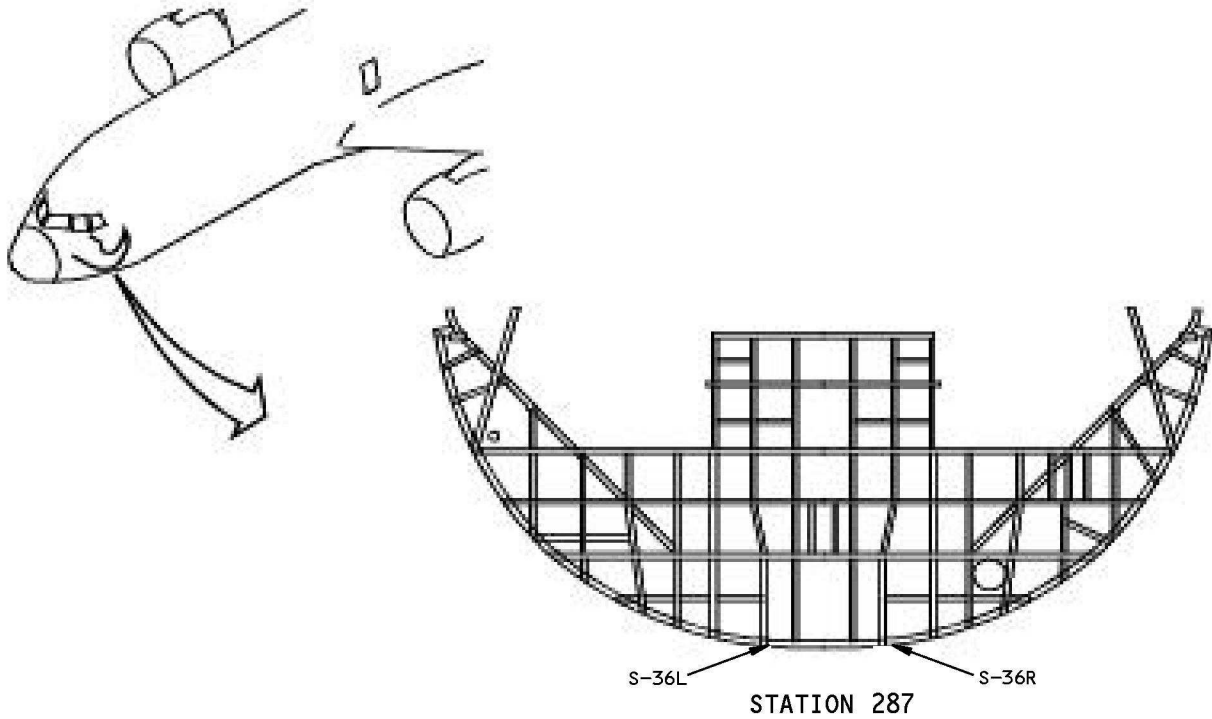


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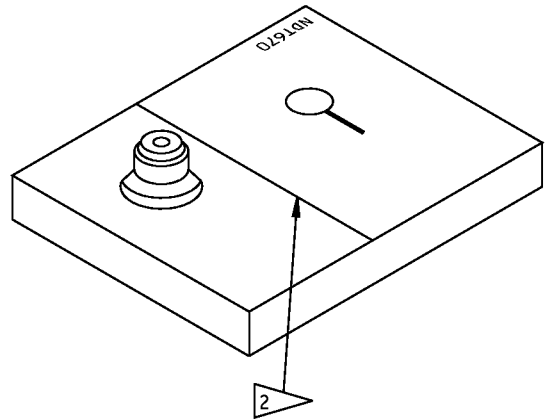
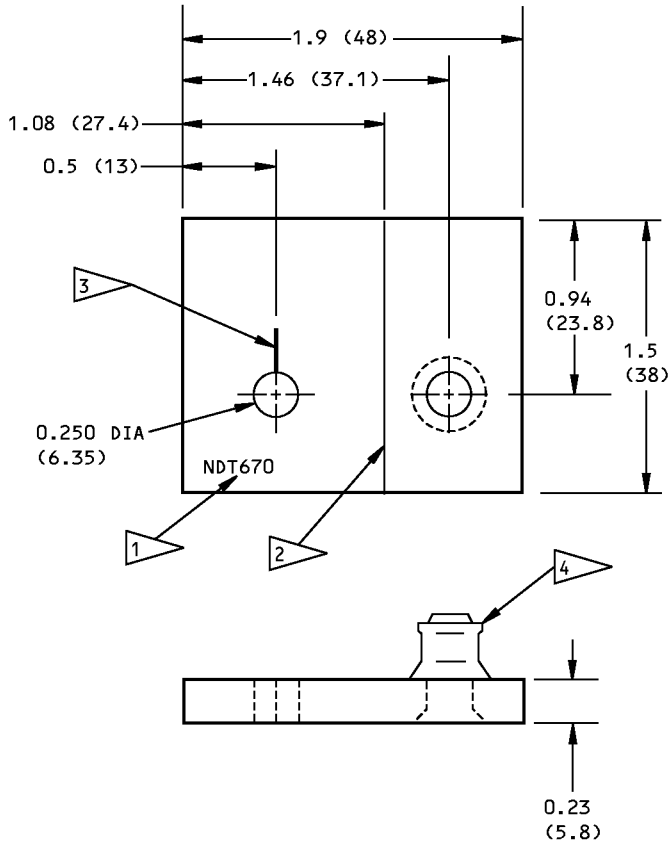
- THE TRANSDUCERS ARE SHOWN IN POSITION TO EXAMINE THE AFT SIDE OF THE OUTER CHORD AT STRINGER 36L. DO THE SAME INSPECTION AT STRINGER 36R.

**Inspection Location
Figure 1**

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NOTES

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

<u>INCHES</u>	<u>MILLIMETERS</u>
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,-T4 OR 7075-T6,-T735,-T76
- SURFACE ROUGHNESS: 125 Ra OR BETTER

- 1 ▶ ETCH OR STEEL STAMP THE REFERENCE STANDARD NUMBER NDT670 AT APPROXIMATELY THIS LOCATION
- 2 ▶ ETCH OR SCRIBE A LINE ON THE REFERENCE STANDARD: THE MAXIMUM DEPTH IS 0.006 (0.15)
- 3 ▶ NOTCH LOCATION AND TOLERANCES: THE NOTCH MUST BE WITHIN ±0.005 (0.13) OF THE CENTERLINE OF THE HOLE AS SHOWN.

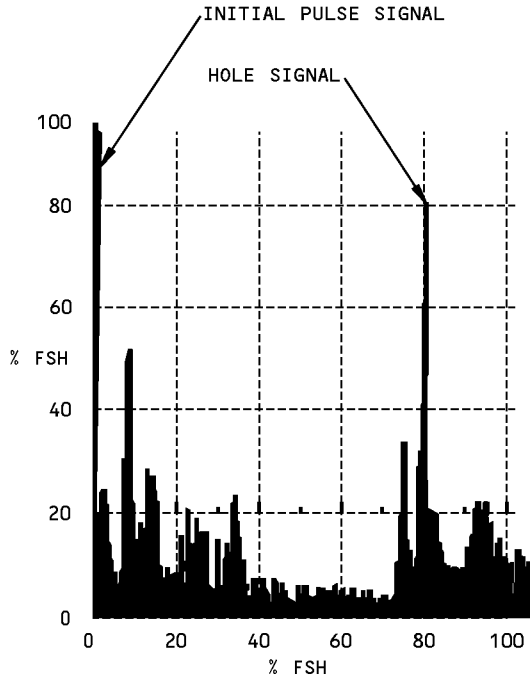
NOTCH DIMENSIONS AND TOLERANCES:
WIDTH: 0.030 (0.76) MAXIMUM
LENGTH: 0.23 (5.8) ±10%
DEPTH: FULL PART THICKNESS
- 4 ▶ INSTALL BACB30NW8K HI-LOK FASTENER AND BACC30M COLLAR OR EQUIVALENTS.

**Reference Standard NDT670
Figure 2**

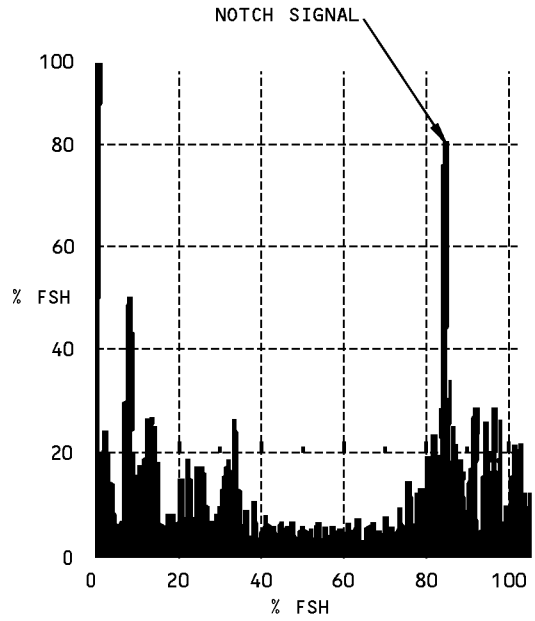
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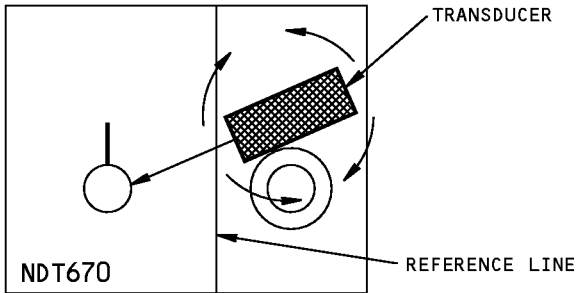
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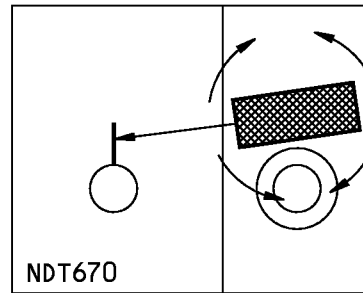
DETAIL A



DETAIL B



**PROBE POSITION
DETAIL C**



**PROBE POSITION
DETAIL D**

NOTES

- MAKE SURE THAT THE TRANSUDCER IS BEHIND THE REFERENCE LINE AT ALL TIMES DURING INSTRUMENT CALIBRATION.

**Screen Displays
Figure 3**

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PART 4 - ULTRASONIC

BS 287 BULKHEAD AT WL 159

1. Purpose

- A. Use this procedure to examine the horizontal beam at the BS 287 bulkhead for cracks at specified WL 159 fastener locations. The inspection locations are the fastener locations that attach the horizontal beam to the web, from LBL 23 to LBL 27 and RBL 23 to RBL 27. See Figure 1.
- B. MPD DTR Check Form Reference: 53-10-I21E

2. Equipment

A. General

- (1) Use 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.
- (3) Refer to Part 1, 51-04-00, for more data about ultrasonic inspections.

B. Instrument

- (1) Use an ultrasonic instrument that:
 - (a) Can do pulse echo inspection.
 - (b) Operates in a frequency range of 4 to 6 MHz.
- (2) The instrument that follows was used to help prepare this procedure.
 - (a) Masterscan 340; Sonatest, Inc.

C. Transducer

- (1) Use a transducer that has these properties:
 - (a) Operates at 5 MHz.
 - (b) Puts a shear wave of approximately 45 degrees in aluminum.
 - (c) Has a top mounted connector.
- (2) The transducer that follows was used to help prepare this procedure.
 - (a) SA-455T, 5 MHZ, 45A; Techna NDT

D. Reference Standard

- (1) Make or buy reference standard NDT6016. See Figure 2.

3. Preparation for Inspection

- A. Get access to the inspection areas and remove equipment if necessary.
- B. Remove loose paint and sealant as necessary.

NOTE: It can be necessary to remove the finish from the area the transducer touches if the ultrasound does not transmit into the part.

4. Instrument Calibration

- A. Connect the transducer to the instrument.
- B. Apply couplant to the reference standard at transducer positions TP 1, TP 2 and TP 3 as shown in Figure 3.
- C. Put the transducer on the reference standard at position TP 1 as shown in Figure 3, Detail 1. Move the transducer away from the fastener hole and adjust it to get a maximum signal from the lower edge of the fastener hole. This position is TP 2. Refer to Figure 3, Detail 2.

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- D. Adjust the initial pulse signal to 0% of full screen width (FSW) and the hole signal to 80% of FSW and 90% of full screen height (FSH). Refer to Figure 4, Detail 1.
- E. Move the transducer to position TP 3 shown in Figure 3, Detail 2, and adjust it to get the maximum notch signal. The notch signal must occur at approximately 80% of FSW.
- F. Adjust the gain so that the notch signal is 80% of FSH. Refer to Figure 4, Detail 2.
- G. Record the distance between the transducer and the edge of the fastener.
- H. Move and turn the transducer so the signals from the fastener hole and the notch show on the screen display. Identify the difference between these two signals. Refer to Figure 4, Detail 2.
 - (1) As you move the transducer around the fastener, keep it at the distance that was recorded in Paragraph 4.G. from the edge of the fastener.

5. Inspection Procedure

- A. Calibrate the instrument as specified in Paragraph 4.
- B. Add 6 db gain.
- C. Apply couplant to the inspection areas shown in Figure 1.
- D. Examine the BS 287 bulkhead for cracks in the inspection areas shown in Figure 1 as follows:
 - (1) Keep the transducer from the fastener at the distance that was recorded in Paragraph 4.G. as the transducer is moved around the fastener.
 - (2) Move the transducers from side to side while the transducer is moved around the fastener holes.
 - (3) Examine the fastener locations for cracks that can occur in the vertical direction above or below the fastener holes. Examine the top and bottom of each fastener hole from each direction.
 - (4) If the transducer movement is blocked by a fastener, put the transducer against the fastener and turn the transducer as shown in Figure 5.
 - (5) Examine the left and right sides of the airplane.

6. Inspection Results

- A. Ultrasonic signals that are between 70 and 90% of FSW and 40% (or more) of FSH are indications of possible cracks.
- B. Compare the crack indications that occur during the inspection to the signals you got during calibration. Crack signals will occur just after the hole signal and be equal to or more than 40% of FSH.
- C. To make sure a crack indication is from a crack, remove the fastener and do an open hole eddy current inspection as specified in Part 6, 51-00-16.

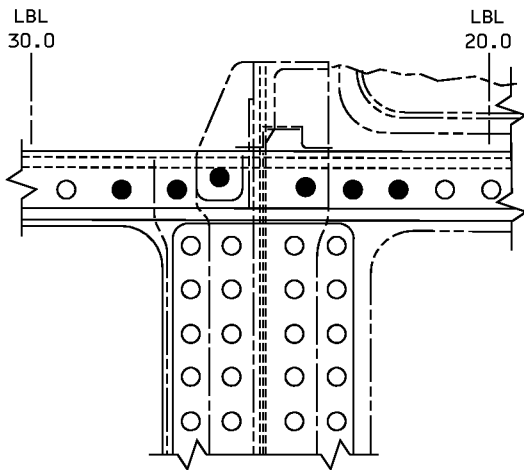
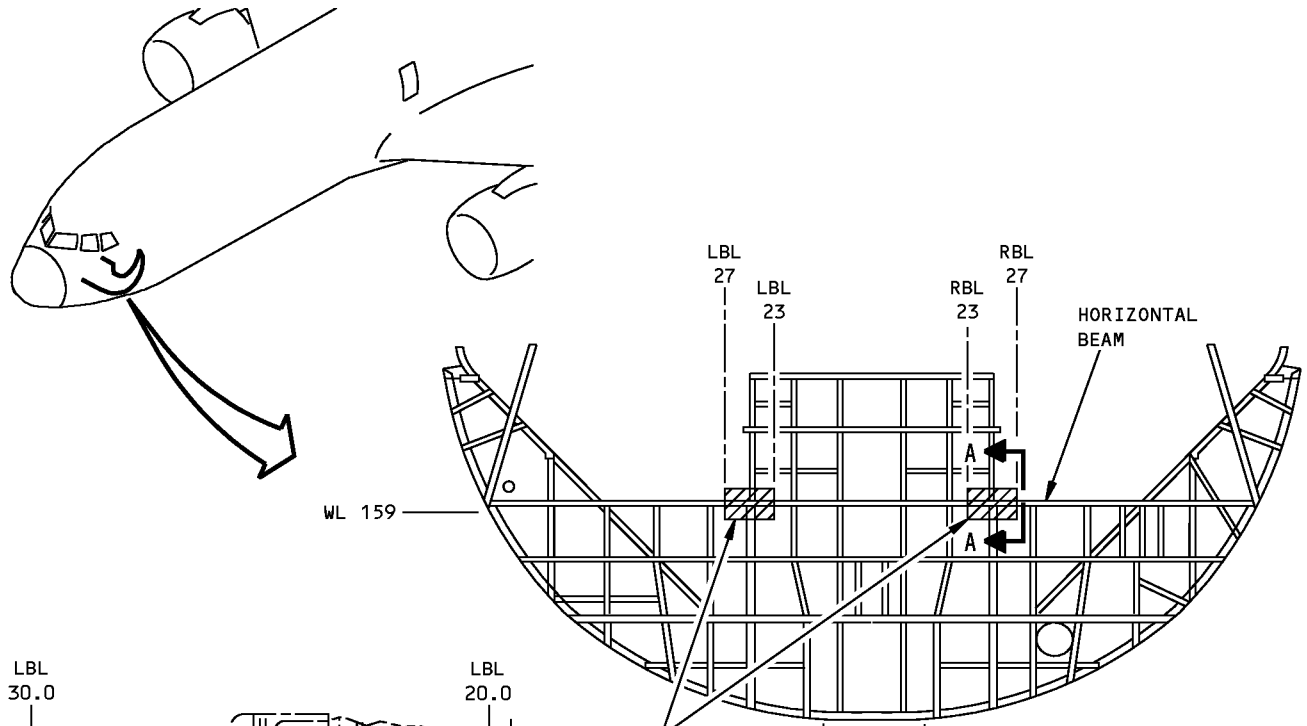
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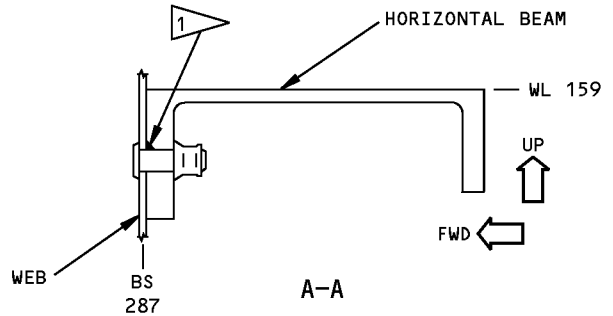
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THE LEFT SIDE IS SHOWN;
THE RIGHT SIDE IS OPPOSITE
DETAIL 1

SEE DETAIL 1 FOR
THE INSPECTION
FASTENERS

BODY STATION (BS) 287
VIEW AS YOU LOOK FORWARD



NOTES:

● INSPECTION FASTENERS

▨ INSPECTION AREA

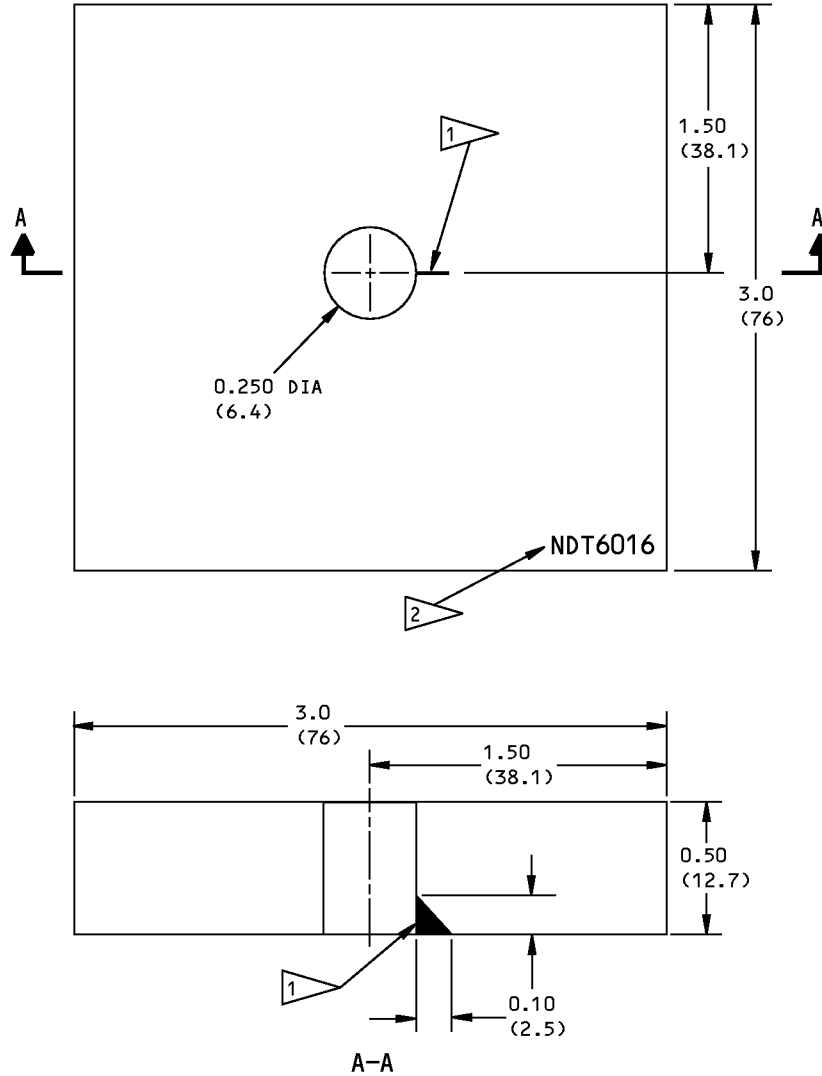
1 ▴ A CRACK CAN START AT A FASTENER HOLE ON THE FORWARD FLANGE OF THE HORIZONTAL BEAM. THE CRACK WILL GROW FROM THE BEAM AND WEB FAYING SURFACE. EXAMINE THE FASTENER LOCATIONS FOR CRACKS THAT CAN OCCUR IN THE VERTICAL DIRECTION ABOVE AND BELOW THE FASTENER HOLE.

**Inspection Location
Figure 1**

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NOTES:

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

<u>INCHES</u>	<u>MILLIMETERS</u>
X.XXX = ±0.005	X.XX = ±0.10
X.XX = ±0.025	X.X = ±0.5
X.X = ±0.05	X = ±1
- MATERIAL: 7075-T73, -T6 (ALTERNATIVE 2024-T3, -T4)

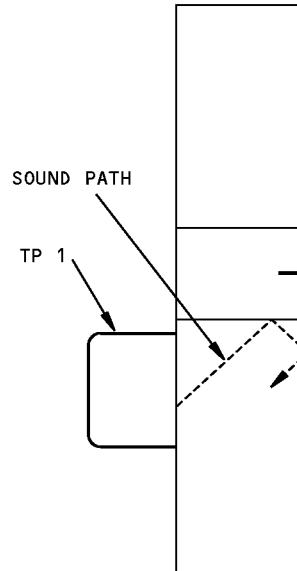
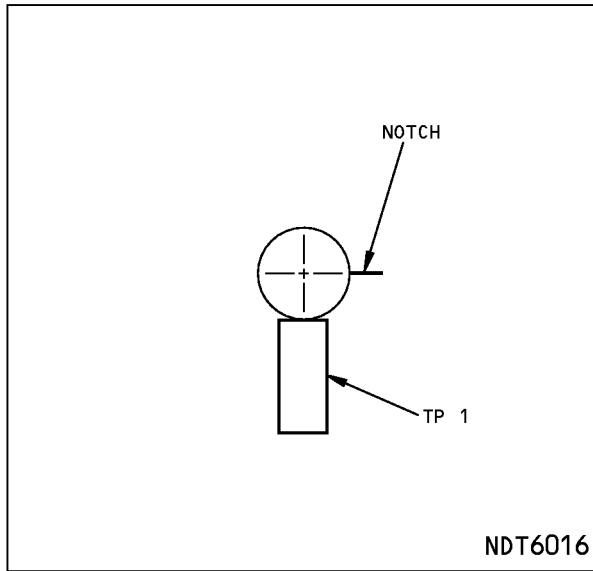
- 1 EDM NOTCH: 0.020 (0.50) WIDE (MAXIMUM)
- 2 ETCH OR STEEL STAMP THE REFERENCE STANDARD NUMBER NDT6016 AT APPROXIMATELY THIS LOCATION.

Reference Standard NDT6016
Figure 2

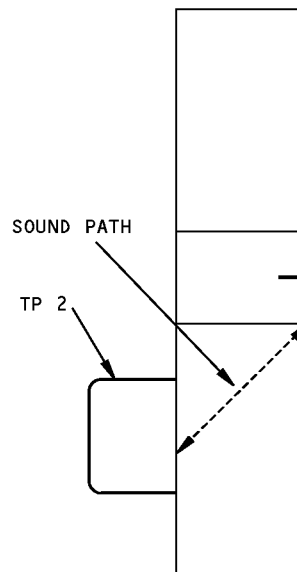
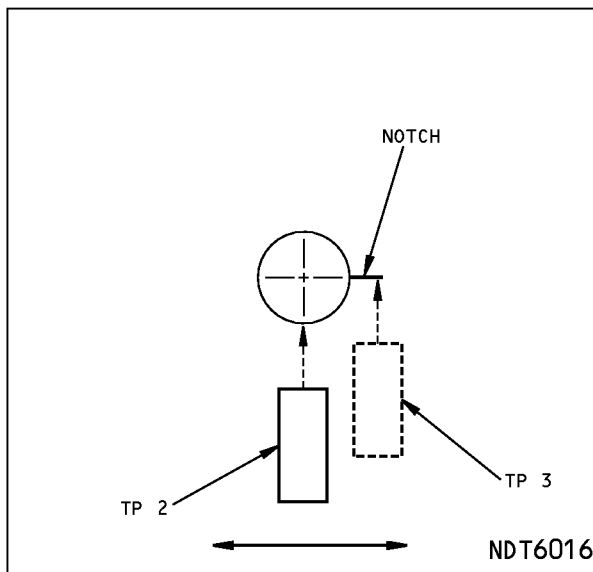
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DETAIL 1

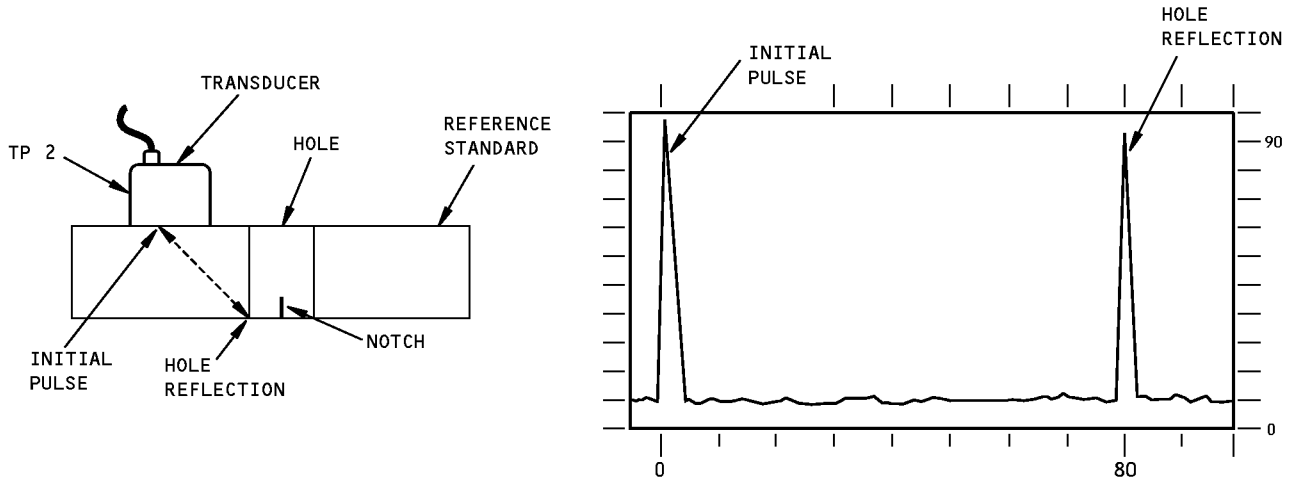


DETAIL 2

**Transducer Calibration Locations
Figure 3**

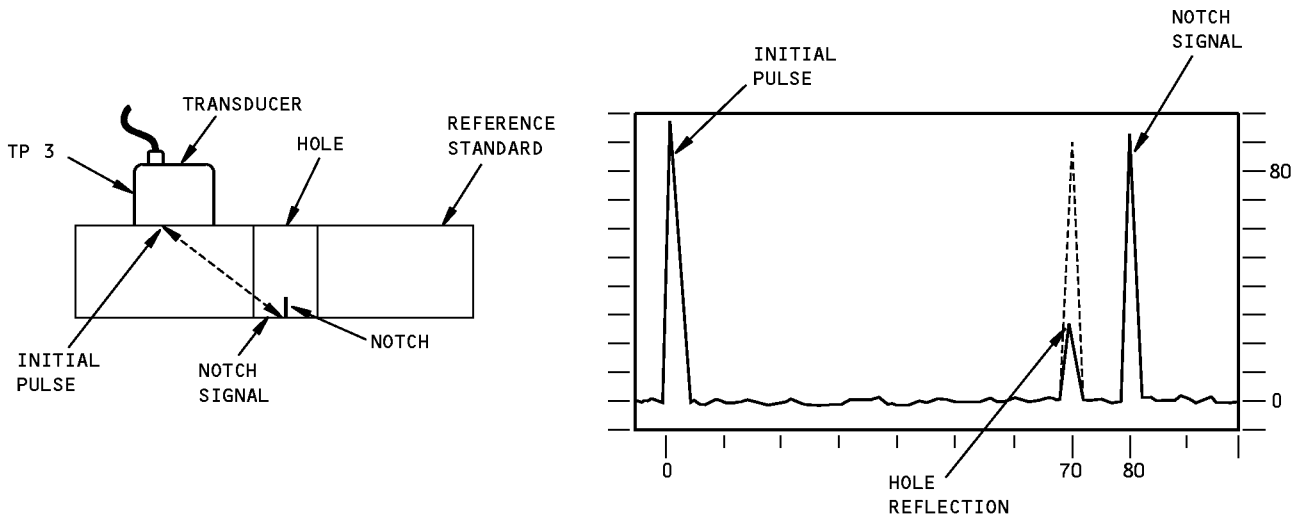
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BOLT HOLE SCREEN SIGNAL

DETAIL 1



NOTCH SCREEN SIGNAL

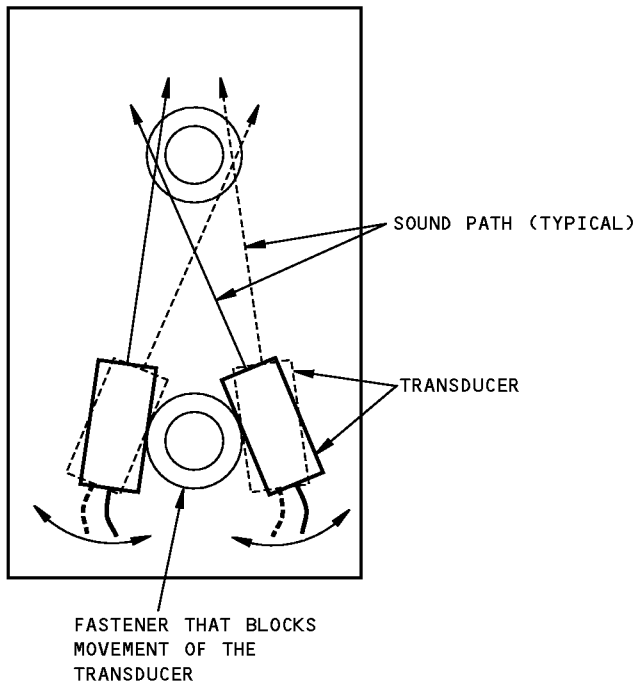
DETAIL 2

**Instrument Calibration Signals
Figure 4**

EFFECTIVITY
ALL

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**767
NONDESTRUCTIVE TEST MANUAL**



**Inspection Procedure
Figure 5**

	EFFECTIVITY
ALL	

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