



**737**  
**NON-DESTRUCTIVE TEST MANUAL**  
**PART 4 - ULTRASONIC**

**BULKHEAD CHORD AND SPLICE ANGLE AT BS 540, STRINGERS S-20 THRU S-26**

**1. Purpose**

- A. Use this procedure to examine the horizontal flange of the chord and the splice angle at the BS 540 bulkhead for cracks. The inspection areas are between stringers S-20 to S-26 on the left and right sides of the airplane. This inspection examines the locations where the stringer channels are attached to the chord or the splice angle. See Figure 3 for the locations to examine.
- B. This inspection uses a transducer that puts a 70 degree shear wave in aluminum. The transducer is put on the horizontal flange of the chord and on the splice angle to find cracks that are between two inspection fasteners. Figure 4 shows the transducer positions on the inspection surfaces.
- C. 737 Supplemental Structural Inspection Document (D6-37089) Reference:
  - (1) Item: F-25

**2. Equipment**

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

- A. All ultrasonic equipment that can do the calibration instructions of this procedure can be used.
  - (1) Instrument – It is necessary to use an ultrasonic instrument that can operate from 4 to 6 MHz. Broadband instruments can be used if they can be calibrated as specified in the calibration instructions of this procedure. The instruments that follow were used to help prepare this procedure:
    - (a) Sonic-136, Nortec 1000; Staveley Instruments, Inc.
    - (b) USD 15, USN 50, 52L, 60; Krautkramer Branson
  - (2) Transducer – Use a 5 MHz transducer that can put a 70-degree shear wave in aluminum. Use a transducer with a length of no more than 0.75 inches (19 mm). The transducers that follow were used to help prepare this procedure.
    - (a) 57A3065, Type SMZ; Staveley Sensors
    - (b) AP-HP-3/16-5.00-70; Xactec Corp.
    - (c) 389-020-490, KBA; Krautkramer Branson
  - (3) Reference Standards - Make reference standard NDT3046 as specified in Figure 1.

**NOTE:** If you have reference standard 362, you can use it for the inspection.
  - (4) Couplant - All ultrasonic couplants that will not damage the airplane structure can be used. A light commercial grease works well.

**3. Prepare for the Inspection**

- A. Go through the access panels in the BS 520 bulkhead at the aft end of the forward cargo compartment to get access to the inspection areas.
- B. Identify the transducer inspection surfaces. See Figure 3 and Figure 4.
- C. Clean the inspection surfaces.
  - (1) Remove sealant and/or corrosion inhibitor.
  - (2) Remove paint only if it is loose.
  - (3) If necessary, use a light abrasive (Scotch-Brite™) to make the inspection surface smooth.

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### 4. Instrument Calibration

- A. Set the instrument frequency from 4 to 6 MHz.
- B. Put a sufficient amount of couplant on the inspection surface of reference standard NDT3046 at transducer positions 1 and 2. Detail I in Figure 2 identifies the transducer calibration positions.
- C. Put the transducer at transducer position 1 on the inspection surface of the reference standard as shown in Detail I in Figure 2.
  - (1) Make sure the front edge of the transducer is against the 0.85 inch (21.6 mm) wide top piece and the sound beam points in the direction of the hole.
  - (2) Adjust the instrument delay, range and gain controls to get a signal from the hole to occur on the screen display.
- D. Move the transducer along the surface to get a maximum signal from the hole.
- E. Adjust the instrument delay and range controls to set the maximum hole signal at 70% of full screen width (FSW) with the initial pulse at 0% of FSW. See Detail II in Figure 2 for an example of the screen display.
- F. Move the transducer along the surface of the reference standard to transducer position 2 with the sound beam pointed at the notch. See Detail I in Figure 2.
  - (1) Adjust the instrument gain as necessary to keep the notch signal on the screen display.
  - (2) Move the transducer from side to side along the edge of the top piece to get the maximum signal from the notch.
- G. Adjust the instrument gain to get the maximum notch signal (approximately 70% of FSW) to be between 70 and 90% of full screen height (FSH). See Detail III in Figure 2 for the screen display.
- H. Increase the gain 10 dB. Do not remove the 10 dB gain during the inspection.

**NOTE:** Do not use reject.

**NOTE:** The additional gain is used because of the paint on the inspection area.

### 5. Inspection Procedure

- A. Calibrate the instrument as specified in Paragraph 4.
- B. Put a sufficient amount of couplant on the transducer inspection surfaces of the horizontal flange of the BS 540 bulkhead chord and the splice angle at all the fastener locations shown in Figure 3 and Figure 4.
- C. Put the transducer on the inspection area of the chord or splice angle with the front of the transducer against the stringer channel and the transducer pointed so that the sound will go in the direction of the fastener hole to be examined. The signal from the fastener hole will occur at approximately 70% of FSW.

**NOTE:** If the distance between the stringer channel and the fasteners that are adjacent to the stringer channel does not permit the transducer sufficient access to do a complete scan, position the transducer between the two adjacent fasteners and examine as much of the area between the inspection fasteners as possible.

**NOTE:** Most of the fastener holes will cause small signals to occur that are between 5 and 40% of FSH. Some fastener holes will not give a signal at all. Do not add more gain to try to increase the fastener hole signals. Cracks can be found in areas where fastener hole signals are small.



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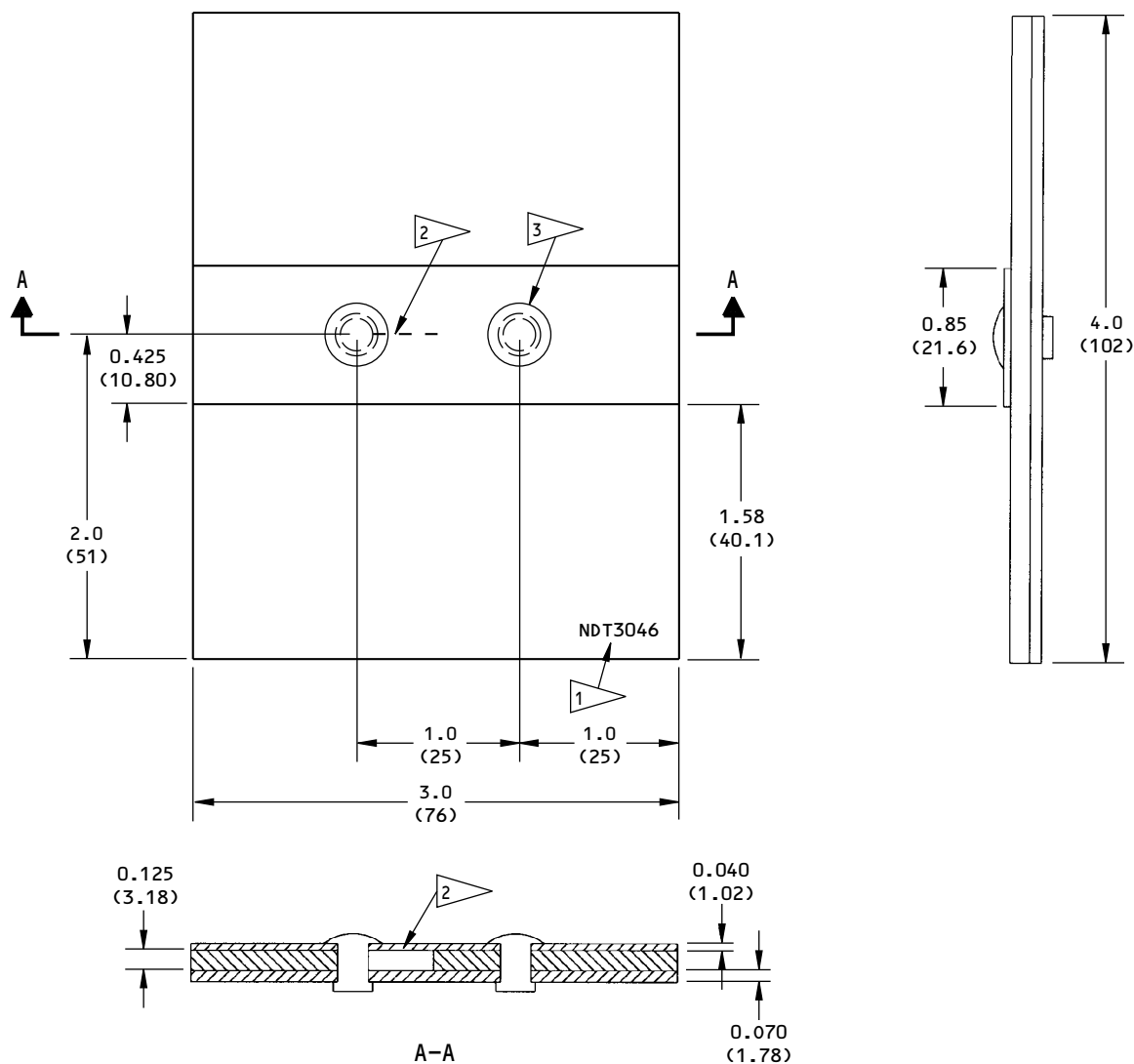
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- D. Move the transducer away from the fastener hole in the direction of the other fastener hole to be examined. As you move the transducer, do the steps that follow:
- (1) Keep the transducer against the stringer channel at all times.
  - (2) Turn the transducer a small amount (approximately 10 degrees) in the forward and aft directions to examine for off-angle cracks.
  - (3) Monitor the screen display for crack type signals.
    - (a) A possible crack signal from the fastener hole will occur on the screen display at approximately 70 to 80% of FSW.
    - (b) The signal from the fastener hole will decrease quickly as the transducer is moved or turned away. Look for a crack type signal to occur to the right of the hole signal as you move or turn the transducer.
  - (4) Carefully monitor the direction and position of the transducer at all times to help identify the causes of the signals that occur.

### 6. Inspection Results

- A. Ultrasonic signals that are 50% (or more) of the signal height set in Paragraph 4.G. and are between 70 to 80% of FSW are indications of possible cracks.
- B. Make an analysis of a possible crack signal as follows:
- (1) Make sure of the position of the transducer. A signal from the fastener hole will be at a maximum height when the transducer is pointed at the center of the hole.
  - (2) A crack signal will occur immediately to the right of the hole signal and the hole signal will decrease. Move the transducer away from the stringer channel and turn it as necessary to get the signal from the indication to be at a maximum height.
  - (3) An off angle crack can occur at the same screen width location as the hole signal. Be very careful to monitor the screen display for such a crack.
  - (4) Monitor the position of the transducer at all times to help identify the cause of signals.

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## NOTES:

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

INCHES	MILLIMETERS
X.XXX = $\pm 0.005$	X.XX = $\pm 0.1$
X.XX = $\pm 0.025$	X.X = $\pm 0.5$
X.X = $\pm 0.050$	X = $\pm 1$

- MATERIAL: CLAD OR BARE ALUMINUM
- SURFACE ROUGHNESS = 63 Ra OR BETTER
- IF YOU HAVE REFERENCE STANDARD 362, YOU CAN USE IT FOR THE INSPECTION

- 1 STAMP OR ETCH THE REFERENCE STANDARD NUMBER NDT3046
- 2 EDM NOTCH:  
WIDTH: 0.010 (0.25)  $\pm 0.002$  ( $\pm 0.05$ )  
LENGTH: 0.40 (10.2)  
DEPTH: THROUGH THE THICKNESS  
THE NOTCH MUST BE WITHIN  $\pm 0.005$  ( $\pm 0.10$ ) OF THE CENTERLINE OF THE HOLE AS SHOWN
- 3 BACR15BB6D-7 ALUMINUM PROTRUDING-HEAD RIVET (2 LOCATIONS)

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Reference Standard NDT3046  
Figure 1

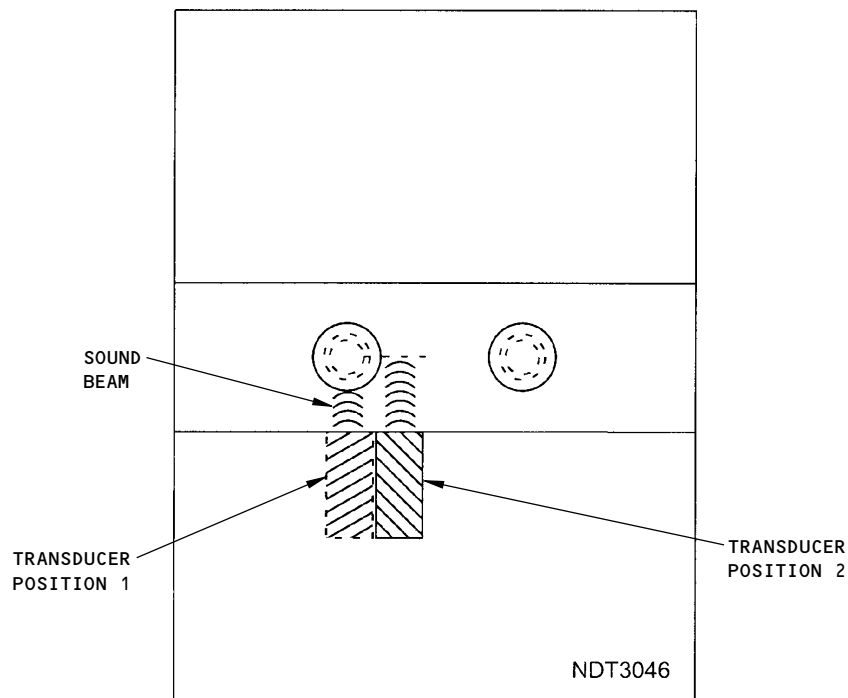
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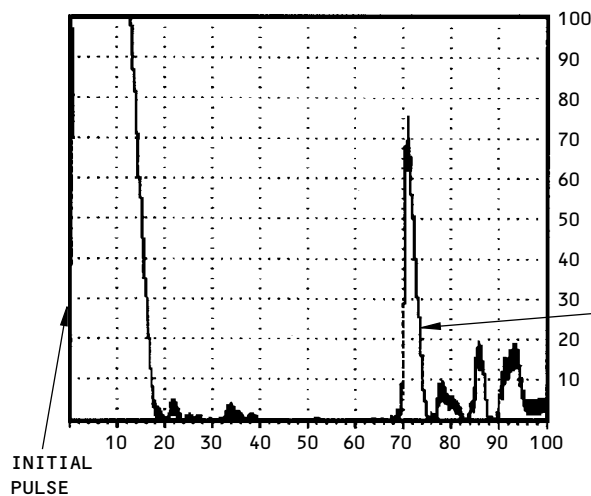
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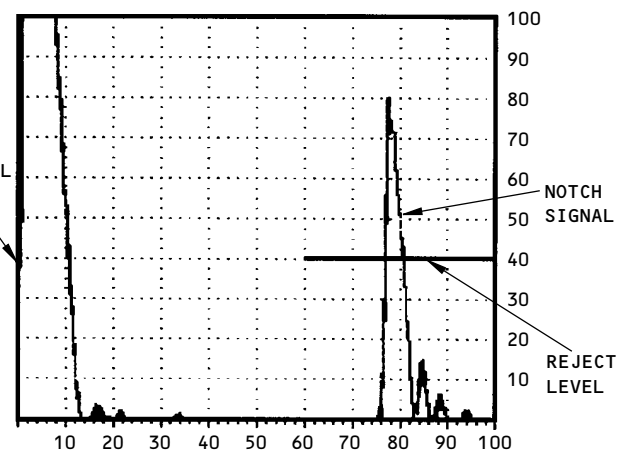
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TRANSducer POSITIONS ON THE  
REFERENCE STANDARD  
DETAIL I



SCREEN DISPLAY OF THE  
HOLE SIGNAL (TRANSducer POSITION 1)  
DETAIL II



SCREEN DISPLAY OF THE  
NOTCH SIGNAL (TRANSducer POSITION 2)  
DETAIL III

## NOTES:

- THE SCREEN DISPLAYS IN DETAILS II AND III ARE EXAMPLES

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Instrument Calibration  
Figure 2

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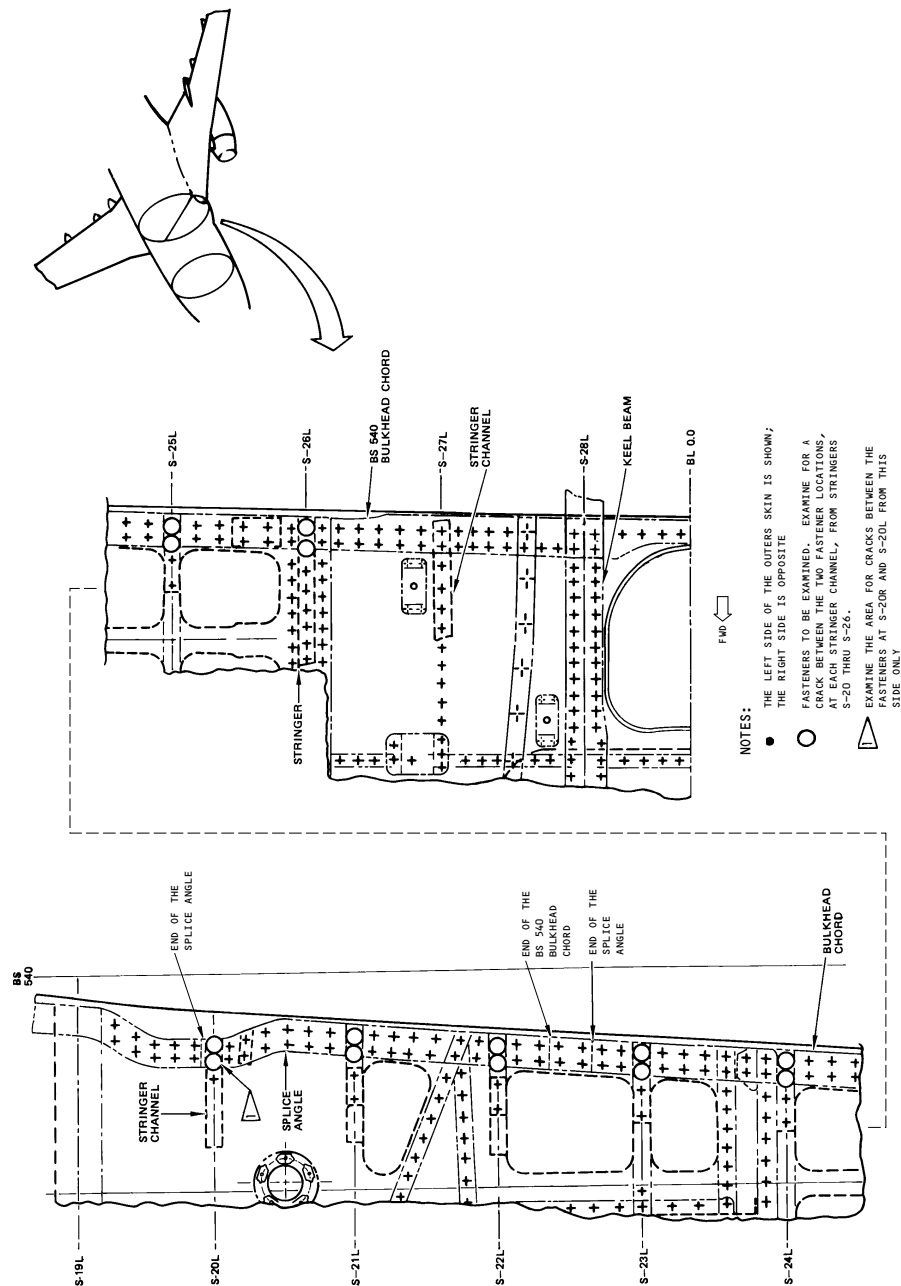
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**Bulkhead Chord and Splice Angle at BS 540, Stringers S-20 thru S-26**

**Figure 3**

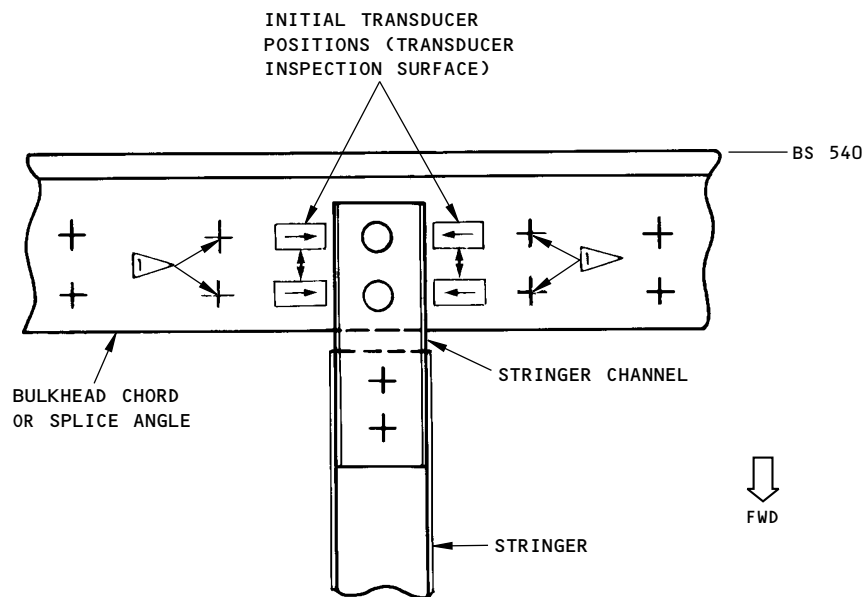
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TYPICAL INSPECTION AREA - STRINGER S-20 THRU S-26

## NOTES:

- EXAMINE THE AREAS OF THE BULKHEAD CHORD AND SPLICE ANGLE THAT ARE BETWEEN THESE FASTENERS FOR CRACKS.
- ➡ INITIAL TRANSDUCER POSITION WITH THE SOUND BEAM POINTED AT THE FASTENER HOLE. FOR STRINGERS S-20L AND S-20R, REFER TO FLAGNOTE 1 IN FIGURE 3 FOR THE TRANSDUCER POSITIONS (ONLY ON THE LOWER SIDE OF THE STRINGER CHANNEL).
- 1 ▸ AT LOCATIONS WHERE THESE FASTENERS PREVENT A COMPLETE SCAN ALONG THE STRINGER CHANNEL, DO A SCAN FOR AS MUCH OF THE AREA BETWEEN THE FASTENERS AS POSSIBLE.

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Transducer Positions for Inspection  
Figure 4

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