## PART 4 - ULTRASONIC

## HORIZONTAL STABILIZER CENTER SECTION REAR SPAR ATTACHMENT LUG AND CLEVIS FITTINGS

### 1. Purpose

A. To detect cracks in right and left stabilizer center section rear spar and hinge housing support attach points, clevis and lugs, at BS 1142.5, using ultrasonic inspection procedures.

B. 737 Supplemental Structural Inspection Document (D6-37089) Reference:

(1) Item: E-20

### 2. Equipment

A. Any ultrasonic equipment which will satisfy performance requirements of this procedure is suitable for this inspection. The following equipment was used during development of this procedure and found acceptable.

**NOTE:** Refer to Part 1, 51-01-00, for information on equipment manufacturers.

(1) Instrument - Pulse-echo ultrasonic instrument capable of operating between 4 and 6 MHz.

(a) NDT 131; Nortec Incorporated

(2) Transducer - 45° shear wave, aluminum, maximum case size approx 1.0 inch (2.54 cm) long, 0.35 inch (0.89 cm) wide and 0.65 inch (1.65 cm) high.

(a) P/N 57A3064, Type SMZ, 5.0 MHz, 45°A; Automation Industries, Inc.

(3) Transducer - 5 MHz, 0.25-inch (0.64 cm) diameter in a 0.375-inch (0.952 cm) diameter case.

(4) Cable Connector - P/N 57A4488 right angle Microdot; Automation Industries, Inc.

(5) Transducer Positioning Fixture 323P - Fabricate as shown in Figure 3.

(6) Reference Standard - Manufacture Reference Standards 323A and 323B per Figure 1 and Figure 2.

**NOTE:** Refer to Part 1, 51-01-00, for manufacturing and ordering information.

(7) Couplant - Ultrasonic couplant compatible with structure being inspected.

### 3. Prepare for the Inspection

A. Place horizontal stabilizer jackscrew in full down position.

B. Gain access through access door 3701L and over top of horizontal stabilizer star truss.

C. Wipe surfaces clean in inspection area and remove loose paint.

D. Lightly sand with 360 or 400 grit wet or dry paper to remove surface roughness.

### 4. Instrument Calibration

A. Transducer - 45° shear wave, type SMZ, 5 MHz.

(1) Use Reference Standard 323A for inspection of horizontal stabilizer upper hinge support clevis and upper hinge rear spar lug. See Figure 4 and Figure 7, sections A-A and B-B. Use reference standard 323B for inspection of horizontal stabilizer lower hinge support clevis and lug. See Figure 5 and Figure 7, sections C-C and D-D.

(2) Connect transducer and make preliminary instrument adjustments per manufacturer's instructions.

(3) Apply thin film of couplant and place rear edge of transducer at Position 1A, Figure 4 and Figure 5, approximately 2.0 inches (5.1 cm) from center of hole.

**NOTE:** Sound emission point of transducer will be 0.4 inch (1.0 cm) from trailing edge.

(4) Rotate and move transducer toward or away from hole to obtain maximum response from hole.

**NOTE:** (1) Maximized hole signal for Reference Standard 323A, as a result of hole bushing, will display one major signal and several minor signals. See Figure 4 and Figure 5, Positions 1A and 1B.

**NOTE:** (2) With hole signal maximized, mark reference standard at rear edge of transducer.

(5) Adjust maximized hole response to 75% of scope width and 100% of full scale height. See Figure 4 and Figure 5, Positions 1A and 1B.

(6) Rotate and move transducer toward notch until hole signal is eliminated and notch signal is maximized on scope. Mark reference standard at rear edge of transducer and note transducer travel between hole and notch.

(7) Adjust notch response so that minimum response from either notch (45° or 90°) is 90% of full scale height. Response should be positioned at 60% to 70% of scope width distance. See Figure 4 and Figure 5, Positions 2A and 2B. Note width but do not adjust.

**NOTE:** Maximum hole/notch response should be obtained when transducer is rotated 5 to 15 degrees from edge toward hole/notch. See Figure 4, Figure 5 and Figure 7, section C-C.

B. Plexiglas shoe/transducer - 5 MHz combination

(1) Use Reference Standard 323B for inspection of horizontal stabilizer lower hinge, rear spar clevis. See Figure 6.

(2) Connect transducer and make preliminary instrument adjustments per manufacturer's instructions.

(3) Apply couplant to end of transducer and place transducer in hole of shoe.

**NOTE:** Couplant should squeeze out of number 40 hole to ensure adequate coupling between shoe and transducer.

(4) Apply couplant to Reference Standard 323B and place shoe/transducer at Position A of Figure 6.

(5) Move shoe/transducer around radius of reference standard until notch A signal is maximized.

(6) Apply couplant to reference standard, check shoe to transducer couplant and place shoe/transducer at Position B of Figure 6.

(7) Move shoe/transducer around radius of reference standard until notch B signal is maximized.

**NOTE:** Mark the location of shoe on reference standard, when notch signal is maximized per Paragraph 4.B.(5) and Paragraph 4.B.(7).

(8) Adjust instrument to show a maximum notch response from either notch (45° or 90°) of 90% of full scale height. Adjust instrument notch response baseline Position to 65% of full scale width. See Figure 5, Notch Signal Response.

**NOTE:** Align edge of shoe to edge of reference standard to match shoe to part orientation.

**5. Inspection Procedure**

A. Transducer - 45° shear wave, Type SMZ, 5 MHz

(1) Calibrate instrument per Paragraph 4.A.(1) thru Paragraph 4.A.(7).

(2) Measure 2.0 inches (5.1 cm) aft from lug radius transition and mark both clevis and lug upper and lower surfaces per Figure 4 and Figure 5.

(3) Apply couplant to top and bottom surfaces of clevis/lug from mark to radius.

(4) Inspect by placing rear edge of transducer on mark and scanning forward for 1.7 inches (4.3 cm) from Positions 1A or 1B to Position 2A or 2B per Figure 4 and Figure 5. Inspect both top and bottom surfaces along edges.

**NOTE:** (1) To maximize hole crack signal, transducer must be rotated 5 to 15 degrees toward the edge being inspected.

**NOTE:** (2) Bottom lug will require 4 passes on top and bottom surface for complete inspection; one on each edge and two on center parting line of mating surfaces. See Figure 7, section C-C.

B. Plexiglas shoe/transducer combination

(1) Calibrate instrument per Paragraph 4.B.(1) thru Paragraph 4.B.(8).

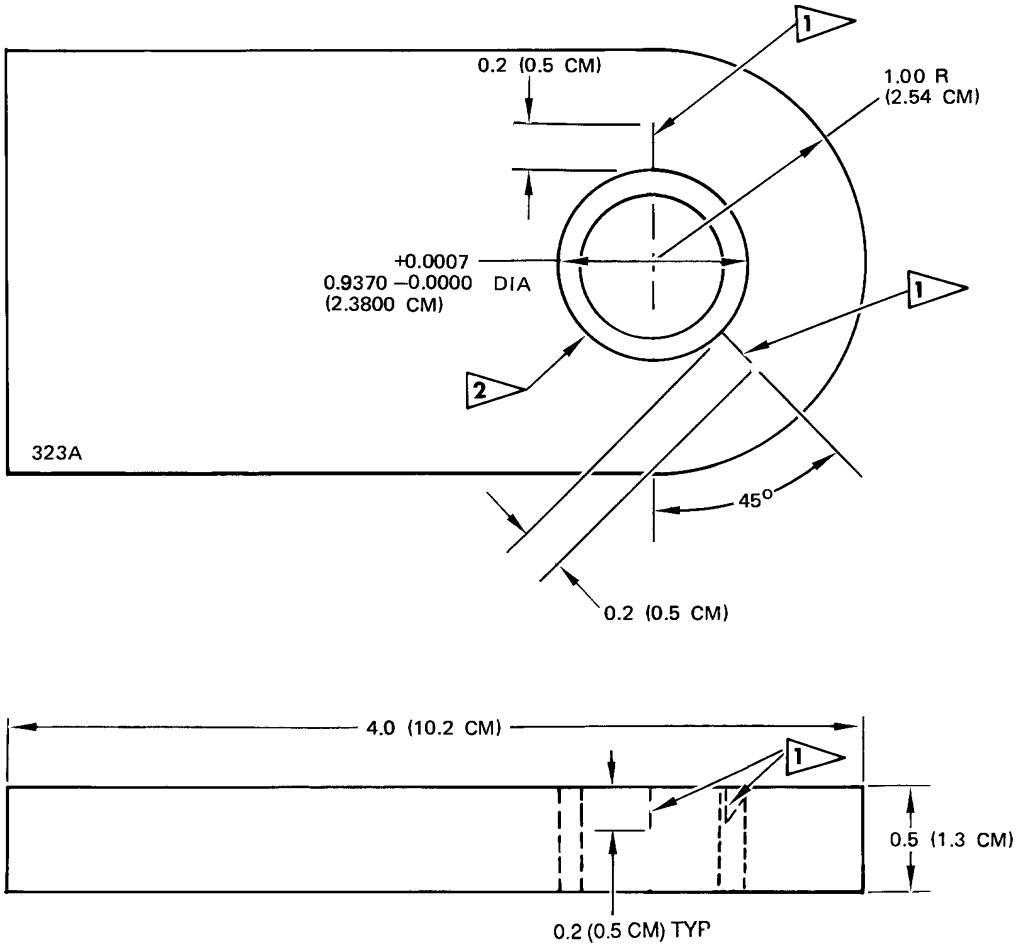
(2) Apply couplant around radii ends of hinge rear spar lower clevis.

(3) Apply couplant on end of transducer and place transducer in hole of shoe. Place shoe on part per Figure 7, section D-D and inspect around radii from one direction.

(4) Apply couplant, per Paragraph 5.B.(2) and reinspect clevis radii from other direction. See Figure 7.

**6. Inspection Results**

A. Ultrasonic indications equal to or greater than 30% of full screen height and between 60 and 70% of full screen width are probable cracks and should be investigated further.




NOTES

- ALL DIMENSIONS ARE IN INCHES (CENTIMETERS IN PARENTHESES) EXCEPT AS NOTED
- TOLERANCE: X.X ± 0.05 (0.13 CM), X.XX ± 0.02 (0.05 CM) X.XXX ± 0.005 (0.013 CM) EXCEPT AS NOTED
- MATERIAL: 7075-T73 ALUMINUM
- ETCH OR STEEL STAMP WITH 323A
- P/N 6411-103 AVAILABLE FROM IDEAL SPECIALTY CO.

1 JEWELER'S SAWCUT 0.03 (0.08 CM) MAX WIDTH X 0.2 (0.5 CM) X 0.2 (0.5 CM)

2 PRESS IN AMS 4640 ALUMINUM-NICKLE-BRONZE BUSHING WITH 0.9380 +0.0006 (2.3825 CM) OD X 0.688 (1.748 CM)ID −0.0000 X 0.6 (1.5 CM) LONG

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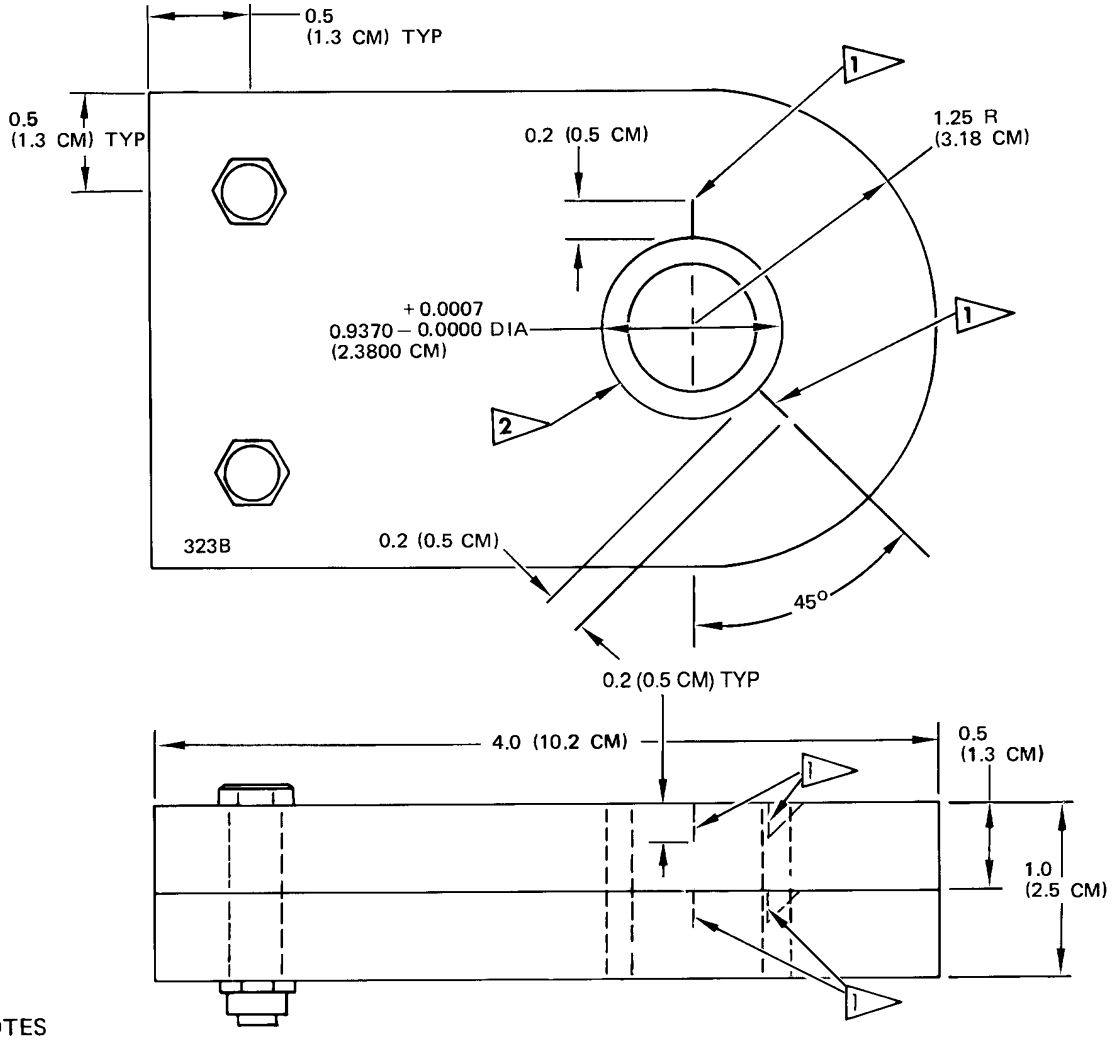
**Reference Standard 323A**
**Figure 1**




NOTES

- ALL DIMENSIONS ARE IN INCHES (CENTIMETERS IN PARENTHESES) EXCEPT AS NOTED
- TOLERANCE: X.X ± 0.05 (0.13 CM), X.XX ± 0.02 (0.05 CM), X.XXX ± 0.005 (0.013 CM) EXCEPT AS NOTED
- MATERIAL: 7075–T73 ALUMINUM
- FASTENERS: USE A 3/16 DIAMETER BOLT WITH A NUT FOR EXAMPLE, YOU CAN USE BACB30NE3-D-16 3/16 DIAMETER BOLTS WITH BACN10JD-3 NUTS
- ETCH OR STEEL STAMP WITH 323B
- P/N 6411–102 AVAILABLE FROM IDEAL SPECIALTY CO.

1 JEWELER'S SAWCUT 0.030 (0.08 CM) MAX WIDTH X 0.2 (0.5 CM) X 0.2 (0.5 CM); (4 PLACES)

2 PRESS IN AMS 4640 ALUMINUM–NICKLE–BRONZE BUSHING WITH 0.9380 ± 0.0006 (2.3825 CM) OD X 0.688 (1.748 CM) ID 0.0000
X 1.1 (2.3 CM) LONG

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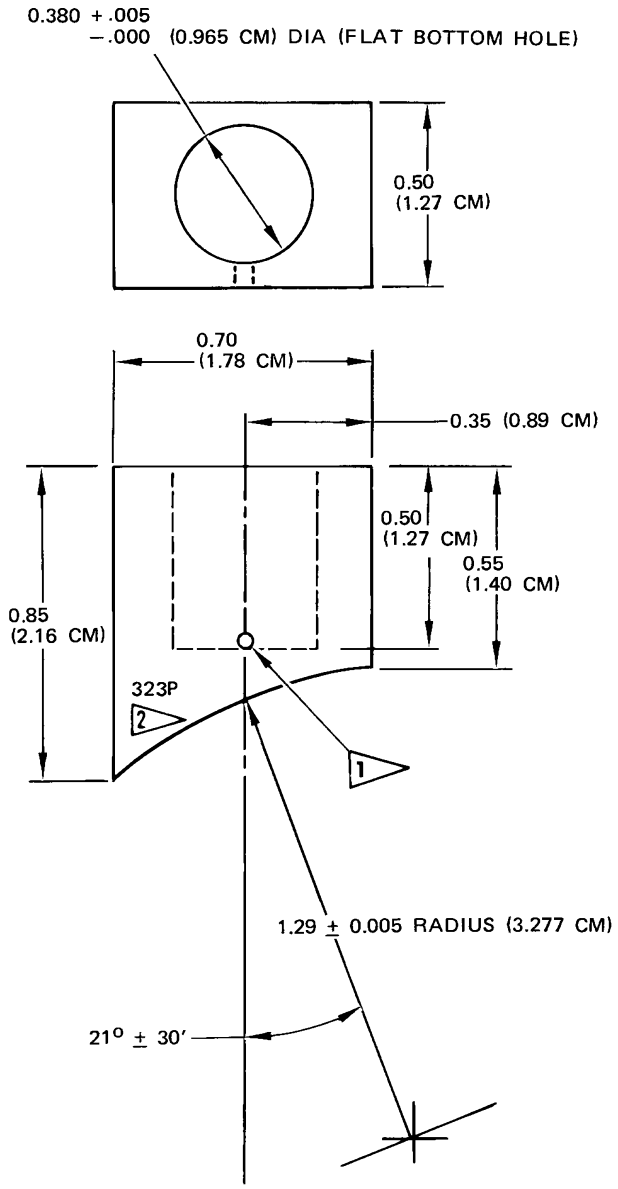
**Reference Standard 323B**
**Figure 2**




NOTES

- ALL DIMENSIONS ARE IN INCHES (CENTIMETERS IN PARENTHESES)
- TOLERANCE: ± 0.030 EXCEPT AS NOTED
- MATERIAL: PLEXIGLAS OR EQUIVALENT
- P/N 6410–28 AVAILABLE FROM IDEAL SPECIALTY CO.

1 DRILL 0.0980 DIA (NO. 40) HOLE FLUSH WITH BOTTOM FOR COUPLANT RELIEF

2 ETCH WITH 323P

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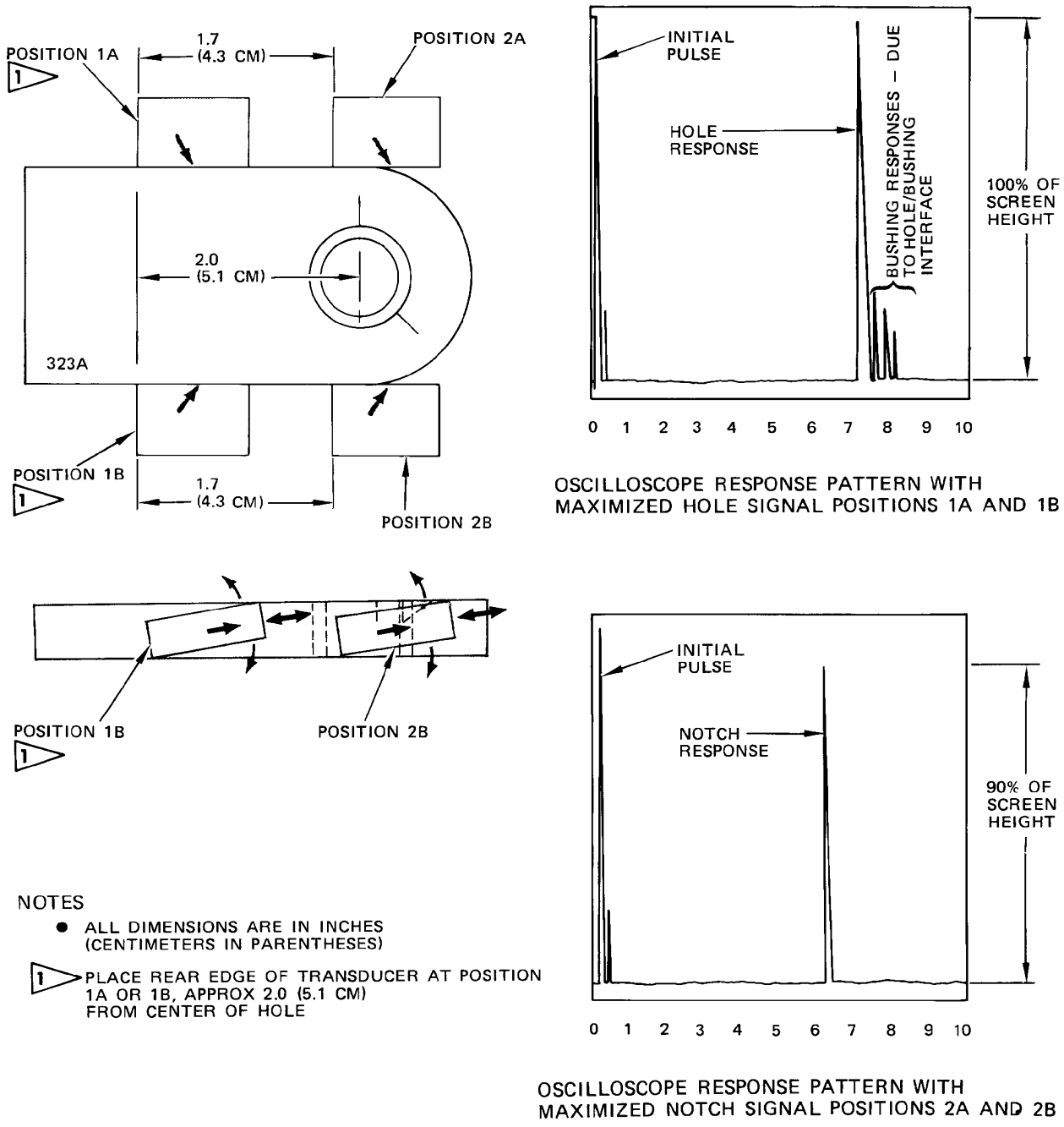
**Ultrasonic Transducer Shoe 323P for Horizontal Stabilizer Hinge Rear Spar Lower Clevis**
**Figure 3**

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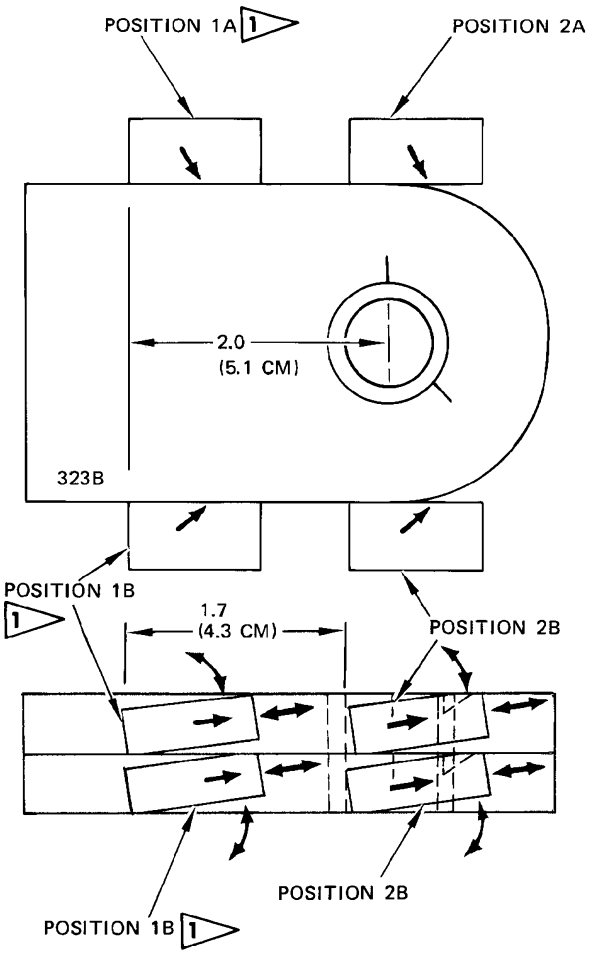
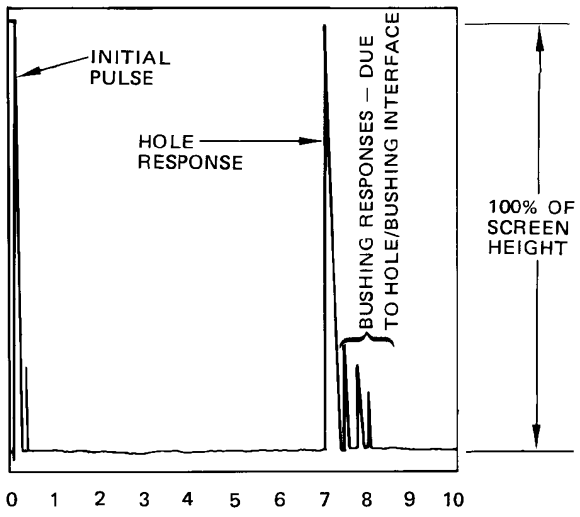
**Transducer Calibration Positions for Reference Standard 323A**
**Figure 4**



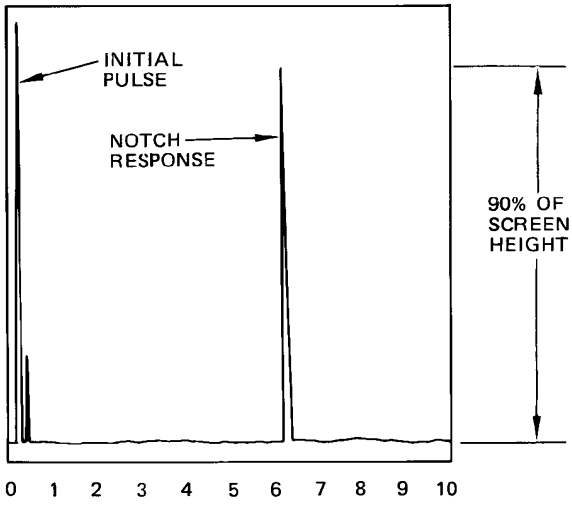

NOTES

- ALL DIMENSIONS ARE IN INCHES (CENTIMETERS INPARENTHESES)

1 PLACE REAR EDGE OF TRANSDUCER AT POSITION 1A OR 1B, APPROX 2.0 (5.1 CM) FROM CENTER OF HOLE




OSCILLOSCOPE RESPONSE PATTERN WITH MAXIMIZED HOLE SIGNAL (POSITIONS 1A AND 1B)




SCREEN RESPONSE PATTERN WITH MAXIMIZED NOTCH SIGNAL (POSITIONS 2A AND 2B)

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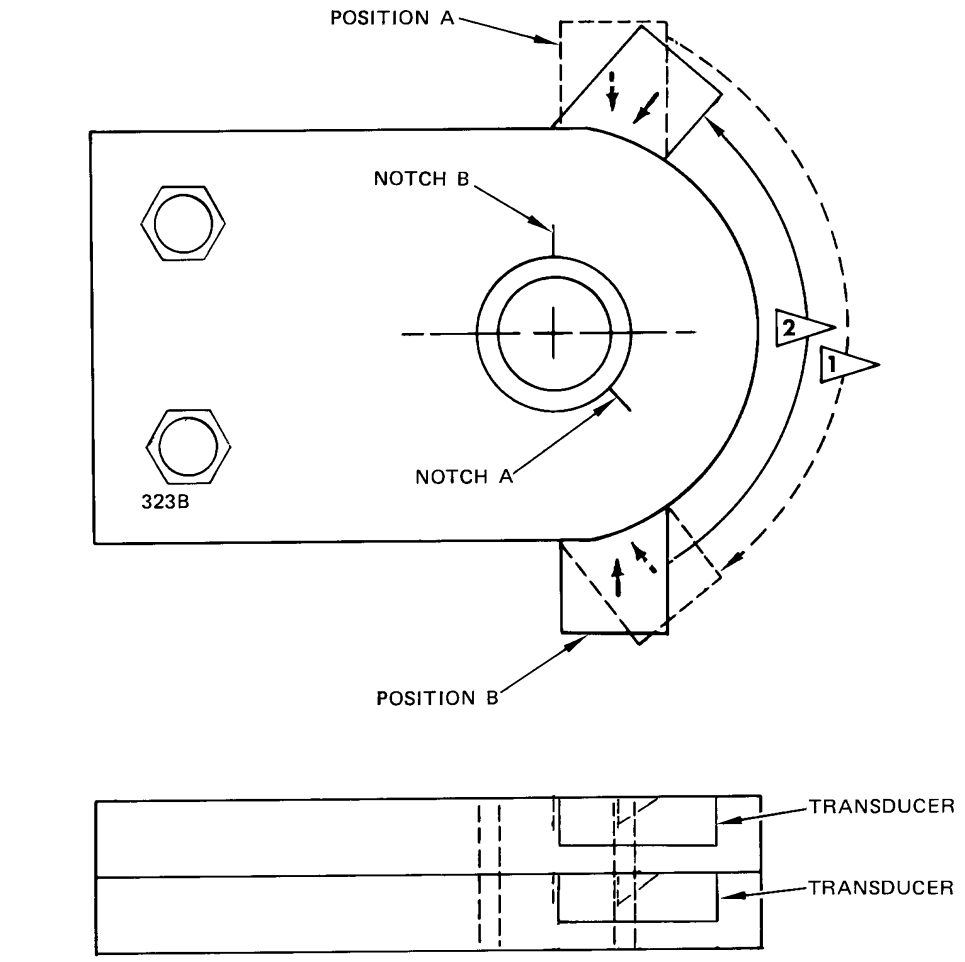
**Transducer Calibration Positions for Reference Standard 323B**
**Figure 5**




NOTES

1. SHOE/TRANSDUCER SCAN FOR NOTCH A
2. SHOE/TRANSDUCER SCAN FOR NOTCH B

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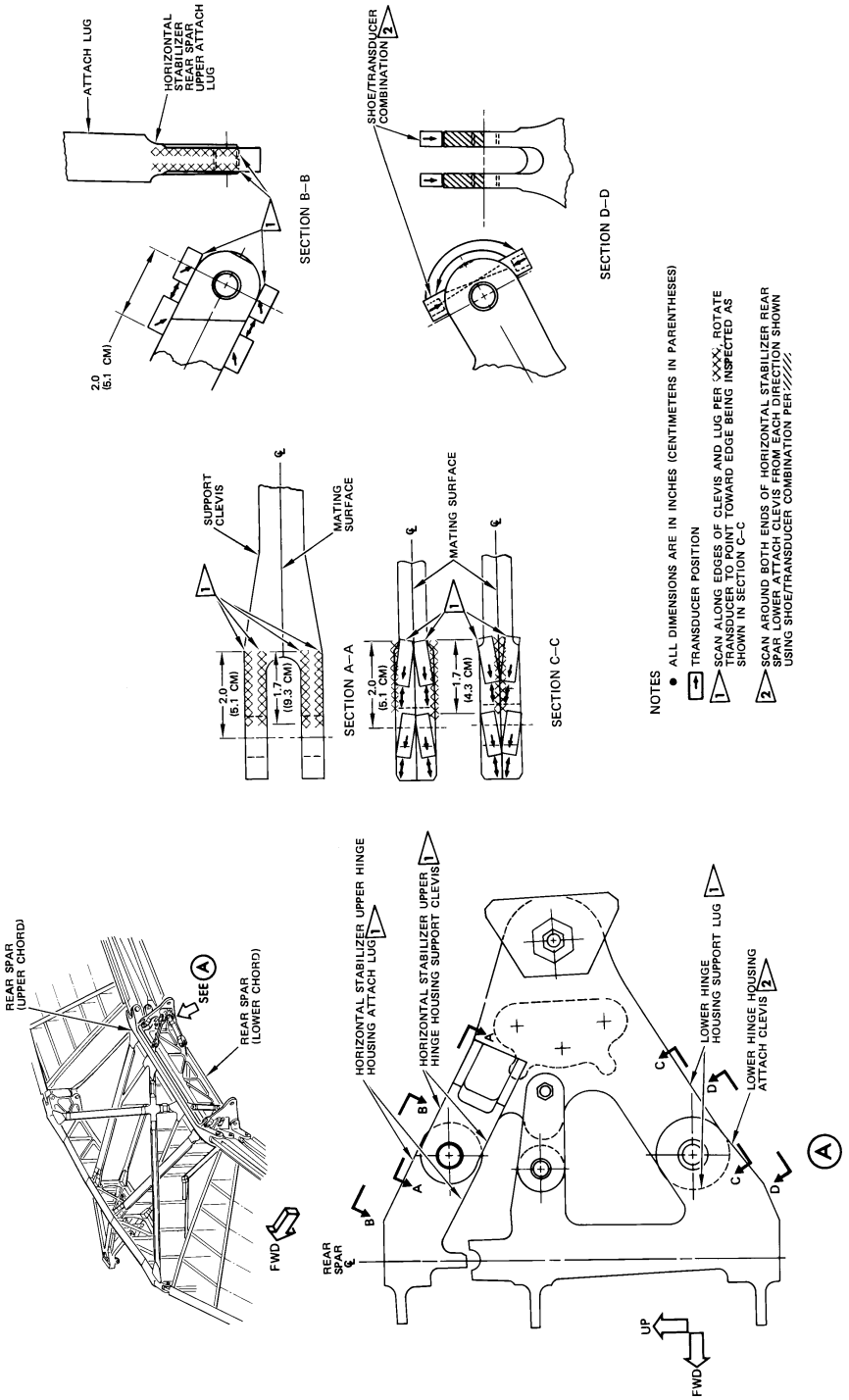
**Transducer Calibration Positions for Reference Standard 323B with Plexiglass Shoe**
**Figure 6**




**Horizontal Stabilizer Center Section Rear Spar Attachment Lug and Clevis Fittings**
**Figure 7**