PART 4 - ULTRASONIC

ACOUSTIC FAN DUCT INNER COWL BOND INSPECTION

1. Purpose

A. Use this procedure to find far-side skin-to-core disbonds in the top half of the acoustic fan duct inner cowl. See Figure 1 for the inspection area.

B. This procedure uses low frequency bondtest equipment to find far-side disbonds that are 2 x 2 inches (51 x 51 mm) (or more) in area.

C. This procedure is done from the perforated skin side of the acoustic fan duct inner cowl. The acoustic fan duct inner cowl is examined from Nacelle Station (NAC STA) 205.4 to 238.3, and Nacelle Water Line (NAC WL) 100.0 to 117.5. See Figure 1 for the inspection area.

D. Service Letter Reference: 737-SL-78-038

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 bondtest equipment that can find a 2 x 2 inch (51 x 51 mm) far-side skin-to-core disbond.

(2) The bondtesters and probes specified below were used to help prepare this procedure.

(a) Zetec S-5 Sondicator, probe part number SP3 with blunt nylon tips, or SP3L/DTE with a DTE attenuator and Teflon radius tips.

(b) Zetec S-9 Sondicator, probe part number SP3L/DTE with Teflon radius tips, or blunt Teflon standard tips.

(c) Uniwest US-5200, probe SF3624, part number 94207.

C. Reference Standards

(1) Use reference standard ST8870D shown in Figure 3.

(2) Reference standard ST8870D is available from Boeing. Tell Boeing Spares if you want to be supplied with this reference standard.

D. Tools

(1) Use a syringe or an equivalent type of tool that can remove water from the core cells.

3. Prepare for the Inspection

A. Prepare to access the inspection area as follows:

(1) Move the thrust reverser sleeve to the extended position shown in Figure 1 as specified in Airplane Maintenance Manual (AMM) 78-31-00.

(2) Remove cascade segments 2, 3, 4, 13, 14, and 15 as specified in AMM 78-31-05. More cascade segments can be removed if more access is necessary.

(3) Disconnect the blocker door drag links from the blocker door pivot links as specified in AMM 78-31-06. Tape the blocker doors to the sleeve to get access to the inspection area.

B. Use a clean, dry cloth to remove dirt and exhaust material from the perforated skin surface.

4. Instrument Calibration

NOTE: (1) The calibration procedures that follow are for the Zetec S-5 and S-9 and the Uniwest US 5200 bondtesters. When calibrated, these instruments will find far-side skin-to-core disbonds. Refer to the manufacturers' instructions to calibrate all other bondtest instruments.

NOTE: (2) The instrument must be calibrated for the configuration of the fan duct inner cowl to be examined. There are two configurations; one configuration has a layer of insulation and the other configuration does not. To examine the area of the inner cowl that has an insulation layer you must calibrate your instrument on the area of the reference standard that has the insulation layer. If you then want to do the inspection on an area that does not have an insulation layer, you must first calibrate the instrument again on the area of the reference standard that does not have the insulation layer. Figure 2 identifies the insulation areas of the fan duct inner cowl.

A. Calibrate the Zetec S-5 Sondicator as follows:

(1) When the SP3L/DTE probe is used, connect the DTE Attenuator in-line with the transmit transducer.

(2) Turn the amplitude and the phase dials counter-clockwise to zero.

(3) Hold the probe so that the tips touch an area of the reference standard that has a good bond.

(a) For the inspection of an area without an insulation layer, put the probe at probe position 1 as shown in Figure 4.

(b) For the inspection of an area with an insulation layer, put the probe at probe position 4 as shown in Figure 4.

NOTE: (1) The SP3 and SP3L/DTE probes are pressure sensitive. Operators must keep the probe pressure constant.

NOTE: (2) The SP3 and the SP3L/DTE probes are tip direction sensitive. Operators must keep the tip direction constant as they do the scan.

(4) Turn the amplitude dial clockwise to 250.

NOTE: Ignore all amplitude needle movement during calibration and inspection. Make no more adjustments to the amplitude dial.

(5) Slowly turn the phase dial clockwise and monitor the phase needle as it goes to full scale and then back to zero.

(6) Continue to slowly turn the phase dial clockwise and monitor the phase needle as it goes to full scale and then back to zero for the second time.

(7) Move the probe a short distance (back and forward) at the good bond area and monitor the phase needle. Make sure to keep the probe in the applicable (insulation or no insulation) area of the reference standard.

(8) If the phase needle moves when the probe is moved, turn the phase dial clockwise one small dial division.

NOTE: It is necessary to adjust the phase dial in small increments because large adjustments can cause a loss of instrument sensitivity.

(9) Do Paragraph 4.A.(7) and Paragraph 4.A.(8) until probe movement does not cause the phase needle to move.

(10) Move the probe across the reference standard to a simulated disbond location and monitor the phase needle for a fast upscale deflection. A fast upscale deflection of the phase needle is a disbond indication for this instrument. Make sure to keep the probe in the applicable (insulation or no insulation) area of the reference standard.

NOTE: The phase needle can move upscale fast at times during the scan because of noise and probe lift-off. Operators must be careful to keep the probe pressure constant to keep lift-off and noise signals to a minimum.

NOTE: Operators must be careful so that lift-off or noise signals are not identified as disbonds. A disbond signal will remain above 50% of the full meter scale for the full time that the probe is in the disbonded area.

(a) For the inspection of an area without an insulation layer, move the probe to probe position 2 as shown in Figure 4.

(b) For the inspection of an area with an insulation layer, move the probe to probe position 3 as shown in Figure 4.

(11) If the disbond signal can not be identified as specified in Paragraph 4.A.(10), turn the phase dial to zero and do Paragraph 4.A.(5) thru Paragraph 4.A.(10) again.

(12) Set the alarm switches as follows:

(a) Polarity to +.

(b) Audio to on.

(c) Mode to phase.

(13) Adjust the alarm level dial so that the alarm will sound when the phase meter needle goes above 50% of the full meter scale.

(14) Identify the maximum speed that the probe can be moved during a scan as follows:

(a) Move the probe from the bonded area to the simulated disbond area of the reference standard. Make sure to keep the probe in the applicable (insulation or no insulation) area of the reference standard.

(b) Continue to do Paragraph 4.A.(14)(a) above but gradually increase the speed of probe travel. The maximum scan speed is the maximum speed of probe travel at which the instrument alarm always identifies the edge of the simulated disbond.

B. Calibrate the Zetec S-9 Sondicator as follows:

(1) Get Zetec radius S-9 tips or use a set of blunt standard S-9 tips for this inspection.

NOTE: Use worn tips or sand new tips so that the tips are approximately 0.050 inches in diameter. Blunt tips are used so the tips do not fall in the small holes of the inspection surface. Noise and false indications occur when the probe tips fall into the small holes of the inspection surface.

(2) Prepare the instrument as follows and as shown in screen display A of Figure 6.

(a) Set the Display to the YT mode.

(b) Set the Preamplifier (PAX) to 10.

(c) Set the Repetition Rate (PPS) to 400.

(d) Set the transmit drive voltage (V) to 10.

(e) Set the transmitted cycles (CYC) between 3 and 10.

(f) Set the Frequency (KHz) to 14.

(g) Set the voltage ratio to 01/01.

(h) Set the Start at 0000.

(i) Set the µs/DIV at 80.

(3) Hold the probe so that the probe tips touch an area of the reference standard that has a good bond.

NOTE: The probe will be held at this position as you do Paragraph 4.B.(4) thru Paragraph 4.B.(10).

(a) For the inspection of an area without an insulation layer, put the probe at probe position 1 as shown in Figure 4.

(b) For the inspection of an area with an insulation layer, put the probe at probe position 4 as shown in Figure 4.

NOTE: (1) The SP3L/DTE probe is pressure sensitive. Operators must keep the probe pressure constant.

NOTE: (2) The SP3L/DTE probe is tip direction sensitive. Operators must keep the tip direction constant as they do the scan.

(4) Push the balance key.

(5) Adjust the gain as follows so that the maximum height of the signal is 100% of full screen height as shown in screen display A of Figure 6.

(a) Move the probe a small distance, back and forward.

(b) As the probe is moved during Paragraph 4.B.(5)(a), make sure the signal is at or near 100% of full screen height. If necessary, adjust the gain to get the signal at or near 100% of full screen height.

(c) Make a record of this signal height. This height is referenced during the cowl inspection procedure.

(6) Adjust the delay to position the gates on the third complete wave as shown in screen display A of Figure 6.

(7) Set the display to XY.

(8) Push the balance key.

(9) Position the balance dot to the center of the screen as shown in screen display B of Figure 6.

(10) Prepare the alarm as follows:

(a) Set the alarm to out.

(b) Center the alarm box in the middle of the display as shown in screen display B of Figure 6.

(c) Set the dimensions of the alarm box to include the center four grid squares as shown in screen display B of Figure 6.

(11) Move the probe from the good bond area to a simulated disbond area of the reference standard. Make sure to keep the probe in the applicable (insulation or no insulation) area of the reference standard.

(a) For the inspection of an area without an insulation layer, move the probe to probe position 2 as shown in Figure 4.

(b) For the inspection of an area with an insulation layer, move the probe to probe position 3 as shown in Figure 4.

(12) The alarm must sound when the probe moves into the simulated disbond area.

NOTE: A disbond indication for this instrument is a fast balance dot movement away from the center position. The alarm will sound when the balance dot moves out of the alarm box as shown in screen display C of Figure 6.

(13) If the disbond cannot be identified by the alarm, do Paragraph 4.B.(2) thru Paragraph 4.B.(11) again.

(14) Identify the maximum speed that the probe can be moved during a scan as follows:

(a) Move the probe from the bonded area to the simulated disbond area of the reference standard. Make sure to keep the probe in the applicable (insulation or no insulation) area of the reference standard.

(b) Continue to do Paragraph 4.B.(14)(a) above but gradually increase the speed of probe travel. The maximum scan speed is the maximum speed the probe can travel for which the instrument alarm always identifies the edge of the simulated disbond.

C. Calibrate the Uniwest US-5200 as follows:

(1) Turn the probe base in relation to the probe body to adjust the SF3624 probe for lift-off.

NOTE: A probe lift-off of approximately 0.010 inches (0.3 mm) is satisfactory for most inspections. During an inspection, the probe face must not touch the inspection part.

(2) Hold the probe on an area of the reference standard that has a good bond.

NOTE: The probe will be held at this position as you do Paragraph 4.C.(3) thru Paragraph 4.C.(8).

(a) For the inspection of an area without an insulation layer, put the probe at probe position 1 as shown in Figure 4.

(b) For the inspection of an area with an insulation layer, put the probe at probe position 4 as shown in Figure 4.

(3) Push the SET-UP soft key. The SET-UP indicator will come on.

(4) Push the SELECT soft key. The BATT COND indicator will come on and the remaining battery voltage will show on the LED bargraph.

(5) Push the SELECT soft key. The probe power (PROBE PWR) indicator will come on.

(a) Push the up-arrow soft key until the PROBE PWR indicator begins to flash.

NOTE: The LED bargraph can be ignored in this step.

1) While the PROBE PWR indicator flashes, push the down-arrow soft key until the PROBE PWR indicator no longer flashes.

2) Push the up-arrow soft key until the PROBE PWR indicator begins to flash.

NOTE: The best probe power level occurs when the PROBE PWR indicator first starts to flash.

(6) Push the PROBE soft key. The PROBE indicator will come on. The PROBE PWR indicator will go out.

(7) Push the SELECT soft key. The sensitivity (SENS) indicator will come on.

(a) Push the up-arrow soft key until you can see approximately 75% of the LED bargraph's length.

(b) Push the SELECT soft key. The SENS indicator begins to flash.

NOTE: Sensitivity is set to fine adjustment when the SENS indicator flashes.

(c) Push the down-arrow until the LED bargraph goes out.

(8) Move the probe a short distance, back and forward. Make sure to keep the probe in the applicable (insulation or no insulation) area of the reference standard.

(a) The LED bargraph must not light more than 10% of the bargraphs' length when the probe is moved in the good bond area of the reference standard.

(b) If the LED bargraph lights more than 10% of its length:

1) Decrease the fine sensitivity until the LED bargraph does not light more than 10% of the bargraph's length when the probe is moved.

2) Do a check of the probe lift-off and increase it if necessary (see Paragraph 4.C.(1)).

NOTE: The probe face must not touch the inspection part.

3) Do Paragraph 4.C.(1) thru Paragraph 4.C.(8) again.

(9) Prepare the alarm as follows:

(a) Push the SET-UP soft key. The SET-UP indicator will come on.

(b) Push the SELECT soft key five times. The GATE indicator will come on.

1) Push the up-arrow soft key or the down-arrow soft key to put the alarm inside the gated area.

NOTE: The LED bargraph will identify the selection.

(c) Push the SELECT soft key. The AUDIO indicator will come on. This will start an alarm you can hear when the light of the bargraph goes into the alarm gates.

1) Push the up-arrow soft key or the down-arrow soft key to energize the alarm.

NOTE: The alarm is on when the LED bargraph is fully on.

(d) Push the PROBE soft key. The PROBE indicator will come on.

(e) Push the SELECT soft key. The sensitivity (SENS) indicator will come on.

(f) Push the SELECT soft key two times. The low alarm (LO) indicator will come on.

1) Push the up-arrow soft key or the down-arrow soft key to set the LO value to 50% of the LED bargraph's length.

NOTE: The LO value will flash on a piece of the LED bargraph.

(g) Push the SELECT soft key. The high alarm (HI) indicator will come on.

1) Push the up arrow soft key or the down arrow soft key to set the HI value to 100% of the LED bargraph's length.

NOTE: The HI value will flash on a piece of the LED bargraph.

(10) Move the probe to a simulated disbond location on the reference standard. Make sure to keep the probe in the applicable (insulation or no insulation) area of the reference standard.

(a) For the inspection of an area without an insulation layer, move the probe to probe position 2 as shown in Figure 4.

(b) For the inspection of an area with an insulation layer, move the probe to probe position 3 as shown in Figure 4.

(c) When the probe is moved to the simulated disbond location, 50% (or more) of the LED bargraph length must light and the alarm must sound.

1) If 50% (or more) of the LED bargraph length does not light, do Paragraph 4.C.(2) thru Paragraph 4.C.(10) again.

NOTE: The alarm will sound when the bargraph moves into the alarm gates.

(11) Identify the maximum speed that the probe can be moved during a scan as follows:

(a) Move the probe from the bonded area to the simulated disbond area of the reference standard. Make sure to keep the probe in the applicable (insulation or no insulation) area of the reference standard.

(b) Continue to do Paragraph 4.C.(11)(a) above but gradually increase the speed of probe travel. The maximum scan speed is the maximum speed the probe can travel for which the instrument alarm always identifies the edge of the simulated disbond.

5. Inspection Procedure

A. Identify the inspection areas on the acoustic fan duct inner cowl; from Nacelle Station (NAC STA) 205.4 to 238.3, and Nacelle Water Line (NAC WL) 100.0 to 117.5. See Figure 1.

B. Calibrate the instrument as specified in Paragraph 4. for the configuration type (see NOTE) to be examined.

NOTE: The instrument must be calibrated for the configuration of the fan duct inner cowl to be examined. There are two configurations; one configuration has a layer of insulation and the other configuration does not. For example, to examine the area of the inner cowl that has an insulation layer you must calibrate your instrument on the area of the reference standard that has the insulation layer. If you then want to do the inspection on an area that does not have an insulation layer, you must first calibrate the instrument again on the area of the reference standard that does not have the insulation layer. Figure 2 identifies the insulation areas of the fan duct inner cowl.

C. Get access to the inspection area through the thrust reverser opening.

D. Use a clean, dry cloth to remove dirt and exhaust material from the perforated skin surface.

E. Balance the Zetec S-5 and S-9 Bondtesters on the fan duct inner cowl as follows:

(1) Hold the probe tips against the perforated skin surface below nacelle water line (NAC WL) 100. The probe tips must be aligned as shown in Figure 5. Make sure to keep the probe in the applicable (insulation or no insulation) area for which the instrument was calibrated.

(2) For the Zetec S-5:

NOTE: Make no adjustments to the amplitude dial.

(a) Slowly turn the phase dial counter-clockwise and monitor the phase needle as it goes to full scale.

(b) Slowly turn the phase dial clockwise and monitor the phase needle as it goes from full scale back to zero.

(c) Move the probe a short distance (back and forward) and monitor the phase needle.

(d) If the phase needle moves when the probe is moved, turn the phase dial clockwise one small dial division.

NOTE: It is necessary to adjust the phase dial in small increments because large adjustments can cause a loss of instrument sensitivity.

(e) Do Paragraph 5.E.(2)(c) and Paragraph 5.E.(2)(d) until probe movement does not cause the phase needle to move.

(3) For the Zetec S-9:

(a) Set the instrument display to YT.

(b) Push the balance key.

(c) Compare the signal height on the cowl to the signal height you got from the reference standard during calibration.

1) If the signal from the cowl is higher than the signal you got from the reference standard during calibration, move the probe to a different location on the cowl in the area below NAC WL 100.

NOTE: The height of the signal from the cowl is usually less than (or equal to) 100% of full screen height. If the cowl signal is higher than 100% of full screen height, the probe is possibly on a disbond area.

(d) If necessary, adjust the instrument gain to get a signal height that is approximately 100% of the full screen height as shown in screen display A of Figure 6.

(e) Set the instrument display to XY.

(f) Push the balance key.

F. Do a scan of the fan duct inner cowl from the perforated skin surface. See Figure 1 and Figure 5 for the inspection areas. During the scan:

(1) Move the probe slowly along the surface of the fan duct inner cowl and monitor the instrument display at the same time.

(2) Do not examine the potted areas around the anchor fittings or the high density core at the edges of the fan duct inner cowl.

(3) Move the probe approximately 0.6 inches (15 mm) between scans as shown in Figure 5.

(4) Do not move the probe faster than the maximum scan speed identified during calibration.

(5) When you use the Zetec S-5 or S-9 bondtesters, make sure to hold the probe as shown in Figure 5.

NOTE: The SP3 and the SP3L/DTE probes are tip direction and pressure sensitive. When you use these probes, make sure to keep the tip direction and probe pressure constant. If the tip direction or the probe pressure changes, an incorrect disbond indication can occur.

(6) For the Zetec S-9 instrument:

(a) As you do a scan in the insulation areas, the balance dot will move because the thickness of the insulation layer changes

(b) A disbond indication for this instrument is a quick balance dot movement away from the center position.

(c) During the inspection, if the balance dot moves slowly out of the alarm box as the probe is moved, it will be necessary to balance the instrument and examine that area again.

(7) Make a mark on the perforated skin at the locations that cause the instrument to alarm.

NOTE: Use only markers that will not damage the structure.

(8) Frequently do a check of the instrument calibration during the inspection as follows:

(a) Hold the probe on the reference standard in an area that has a good bond.

1) For the inspection of an area that does not have an insulation layer, put the probe at probe position 1 as shown in Figure 4.

2) For the inspection of an area that has an insulation layer, put the probe at probe position 4 as shown in Figure 4.

(b) Balance the Zetec S-5 and S-9 bondtesters as follows:

1) For the Zetec S-5:

NOTE: Make no adjustments to the amplitude dial.

a) Slowly turn the phase dial counter-clockwise and monitor the phase needle as it goes to full scale.

b) Slowly turn the phase dial clockwise and monitor the phase needle as it goes from full scale back to zero.

c) Move the probe a short distance (back and forward) and monitor the phase needle.

d) If the phase needle moves when the probe is moved, turn the phase dial clockwise one small dial division.

NOTE: It is necessary to adjust the phase dial in small increments because large adjustments can cause a loss of instrument sensitivity.

e) Do Paragraph 5.F.(8)(b)1)c) and Paragraph 5.F.(8)(b)1)d) until the probe movement does not cause the phase needle to move.

2) For the Zetec S-9 bondtester:

a) Set the instrument display to YT.

b) Push the balance key.

c) If necessary, adjust the instrument gain to get a signal height that is approximately 100% of the full screen height as shown in screen display A of Figure 6.

d) Set the instrument display to XY.

e) Push the balance key.

(c) Move the probe from the good bond area to the simulated disbond area of the reference standard. Make sure to keep the probe in the applicable (insulation or no insulation) area of the reference standard.

(d) If the simulated disbond in the reference standard can not be identified as it was during calibration, it will be necessary to do the calibration and inspection again.

6. Inspection Results

A. Compare all disbond indications in the fan duct inner cowl with the simulated disbonds in the reference standard.

NOTE: Balance the Zetec S-5 and S-9 Bondtester on the reference standard or on the fan duct inner cowl as necessary.

B. Do a check to identify if there is fluid in the core cells at the indication area.

(1) Put a syringe needle through a hole in the area of the indication and use suction to remove fluid from the core cell.

(2) If fluid is found in the core cells:

(a) Remove as much of the fluid as possible.

(b) Examine the area that gave the disbond indication again.

C. Use the Contact Through Transmission Ultrasonic (CTTU) procedure specified in Part 4, 51-00-02, to make sure of the bondtest indications.

(1) Examine an area that is a minimum of 2 inches (51 mm) larger in all directions than the indication found by the bondtest procedure.

(2) Apply a transparent plastic or Teflon tape that is 0.003 - 0.006 inch (0.10 - 0.15 mm) thick to the perforated skin in the area to be examined.

NOTE: Push the tape onto the skin surface to remove all air between the tape and the perforated skin.

(3) Remove the insulation layer from the area to be examined before you do the CTTU inspection.

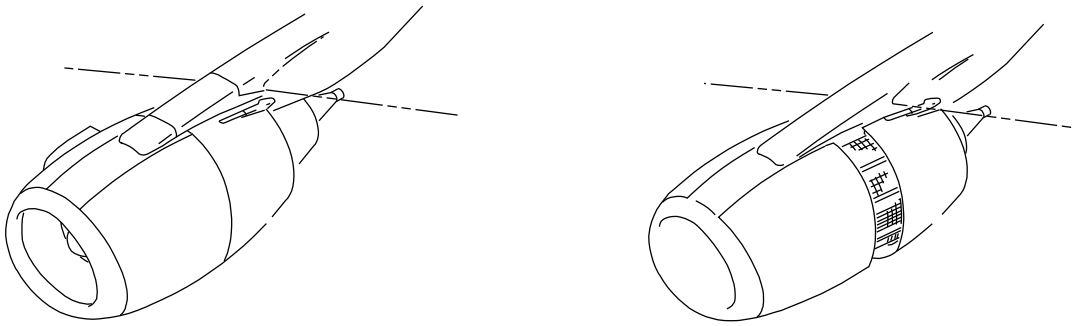
(4) Do the CTTU inspection.

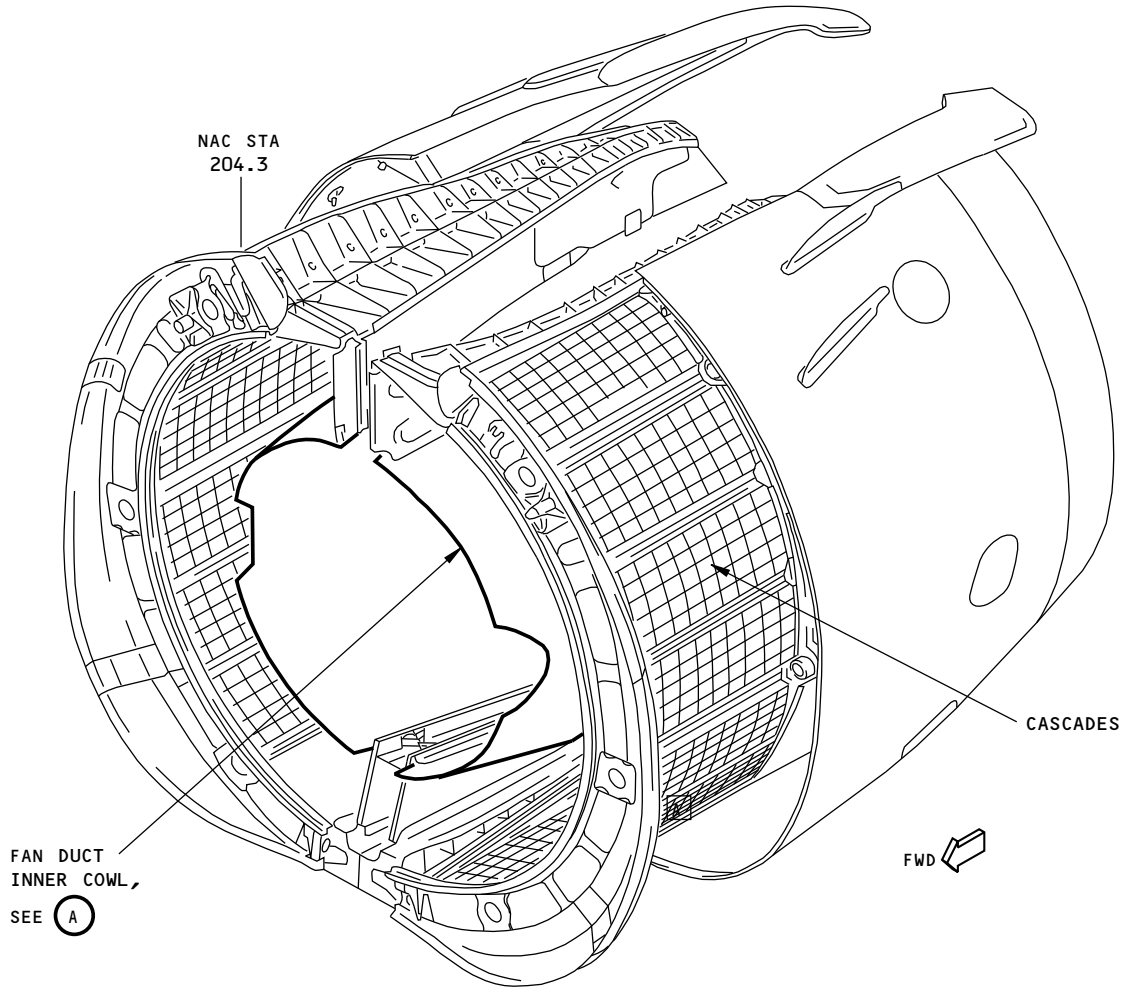
(a) Use the area of reference standard ST8870D that does not have an insulation layer to calibrate the instrument.

(b) Apply the same type of tape to the perforated skin on reference standard as that which was applied to the perforated skin of the inner cowl.

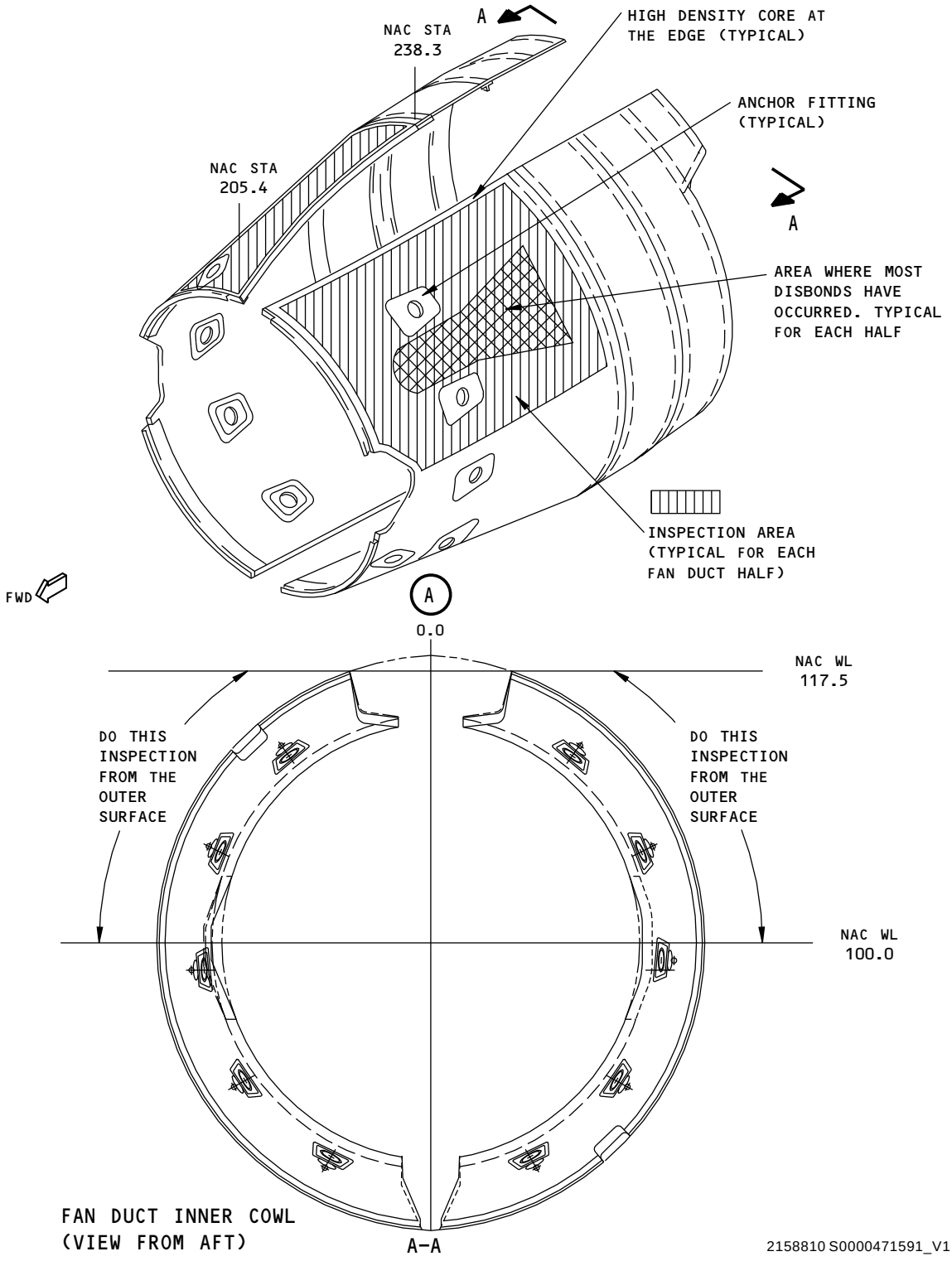
(c) To simulate a good bond area, use probe position 1 as shown in Figure 4.

(d) To simulate a disbond area, use probe position 2 as shown in Figure 4.

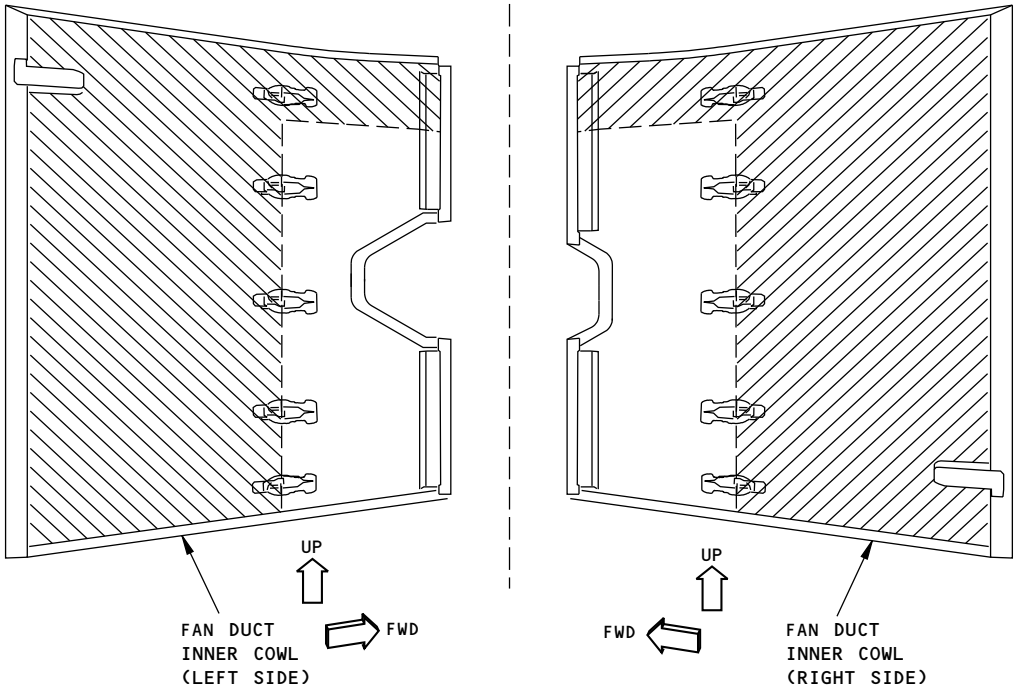




Inspection Area
Figure 1 (Sheet 1 of 2)



Inspection Area
Figure 1 (Sheet 2 of 2)



NOTES

INSULATION AREAS

- VIEW AS YOU LOOK AT THE INSIDE SOLID FACESHEET

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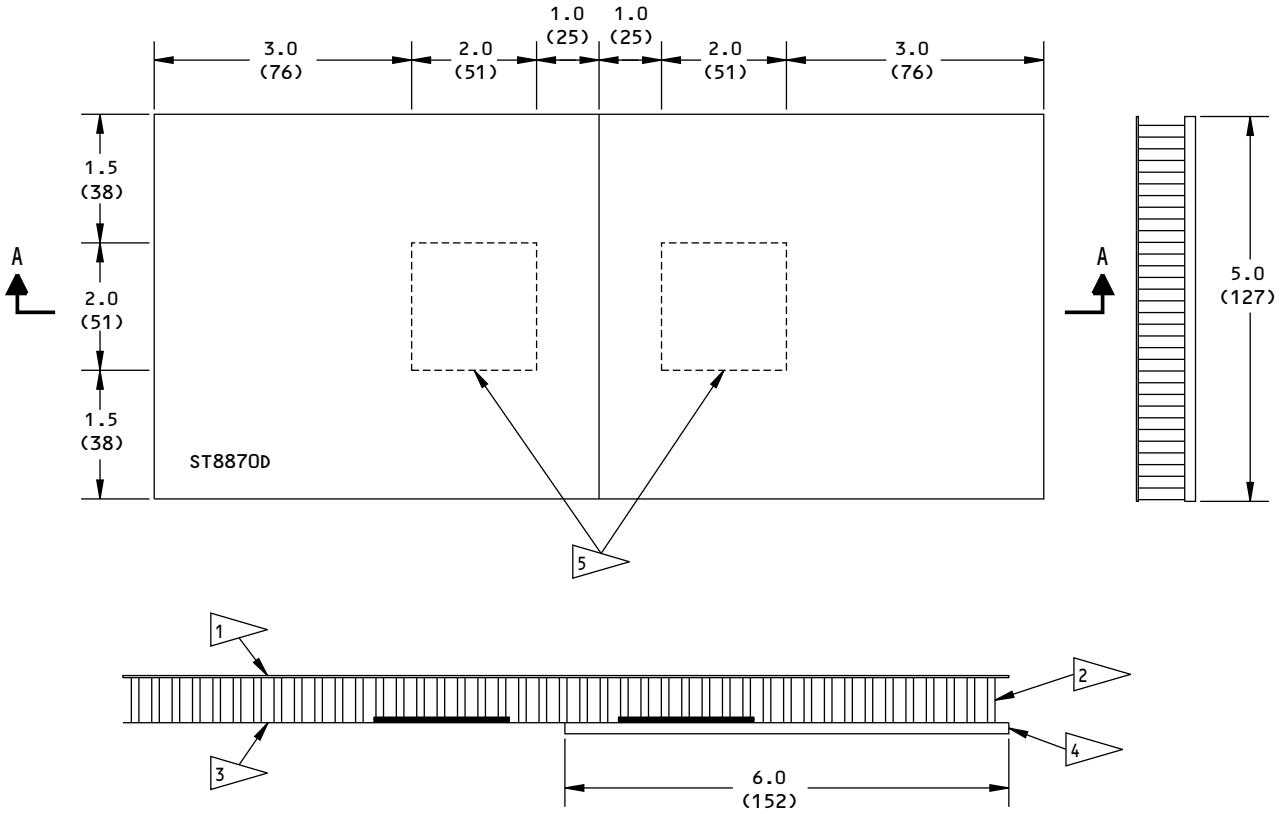
Insulation Areas
Figure 2



A–A

NOTES

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

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

- TELL BOEING SPARES IF YOU WANT REFERENCE STANDARD ST8870D

1. TOP SHEET - 0.032 (0.8) THICK ALUMINUM 2024-T62 PERFORATED CLAD SHEET.
2. CORE PANEL - 0.700 (18) THICK ALUMINUM HONEYCOMB CORE.
3. BACK SHEET - 0.020 (0.5) THICK ALUMINUM 2024-T3 BARE SHEET.
4. INSULATION LAYER - 0.20 (5.0) THICK, APPLIED TO ONE HALF OF THE REFERENCE STANDARD AS SHOWN.
5. SIMULATED DISBONDS.

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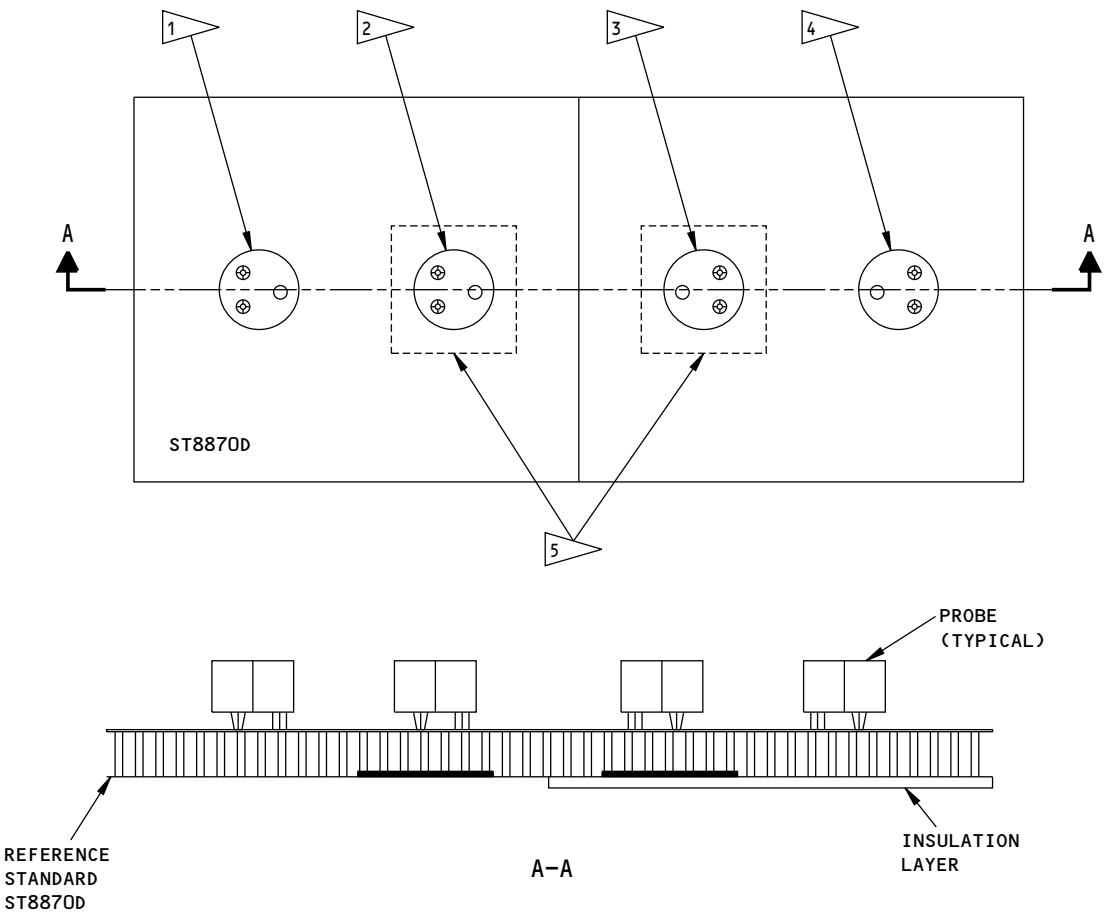
Reference Standard ST8870D
Figure 3



NOTES

1. PROBE POSITION 1: PROBE ON THE GOOD BOND LOCATION, IN THE AREA WITHOUT AN INSULATION LAYER
2. PROBE POSITION 2: PROBE ON THE DISBOND LOCATION IN THE AREA WITHOUT AN INSULATION LAYER
3. PROBE POSITION 3: DISBOND LOCATION IN THE AREA WITH AN INSULATION LAYER
4. PROBE POSITION 4: PROBE ON THE GOOD BOND LOCATION IN THE AREA WITH AN INSULATION LAYER
5. SIMULATED DISBOND LOCATIONS

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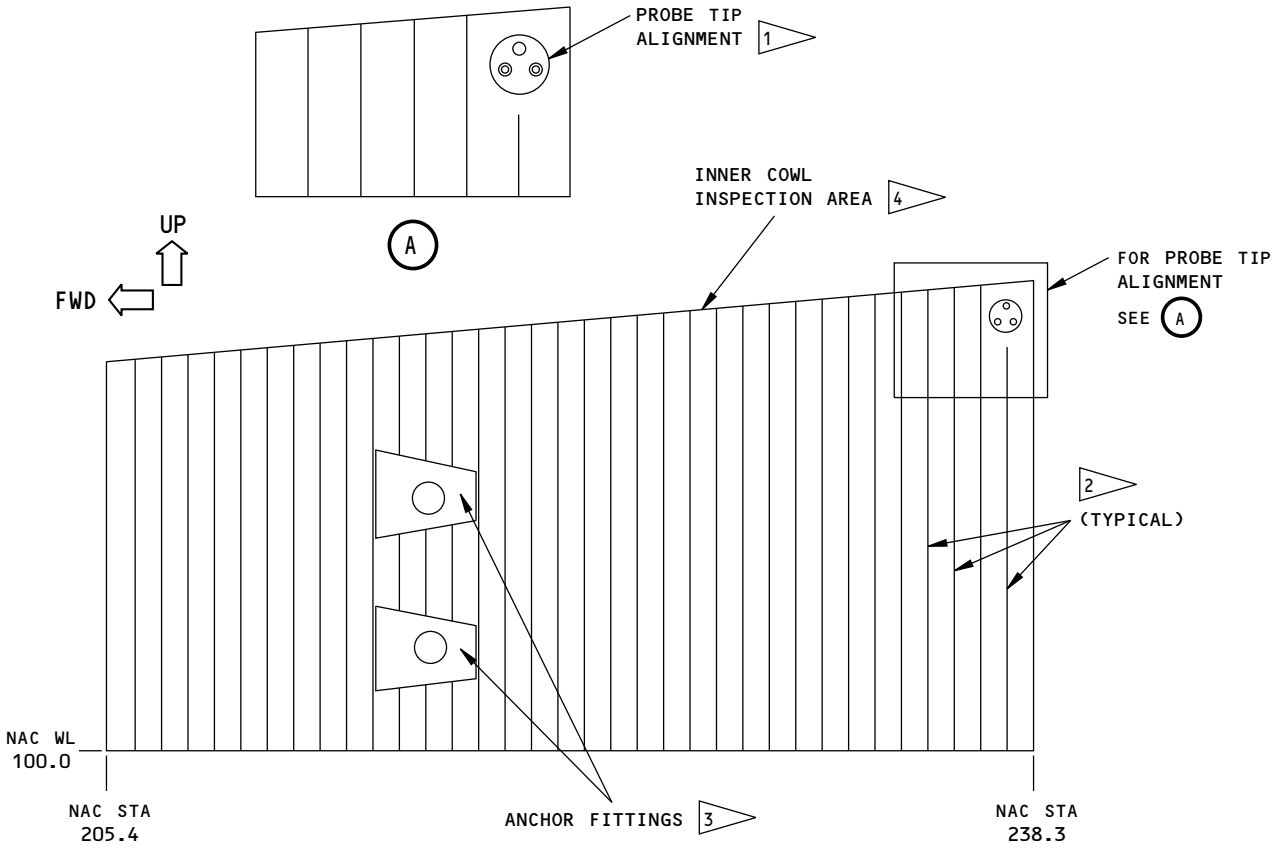
Instrument Calibration - Probe Locations
Figure 4



NOTES

1. THE PROBE INSPECTION TIPS MUST BE KEPT PARALLEL TO THE NAC WL 100 AXIS DURING THE INSPECTION. THE ZETEC S-5 AND S-9 PROBES ARE DIRECTION SENSITIVE; BE CAREFUL TO KEEP THE TIP DIRECTION CONSTANT DURING THE SCAN.
2. SCAN LINES. MAKE THE DISTANCE BETWEEN SCAN LINES APPROXIMATELY 0.6 INCHES (15 MM) APART.
3. DO NOT EXAMINE AROUND THE ANCHOR FITTINGS. THE ANCHOR FITTINGS ARE POTTED AND ARE NOT SIMULATED BY THE REFERENCE STANDARD.
4. DO NOT EXAMINE THE EDGES OF THE INNER COWL. THE EDGES ARE SPLICED WITH HIGH DENSITY CORE AND ARE NOT SIMULATED BY THE REFERENCE STANDARD.

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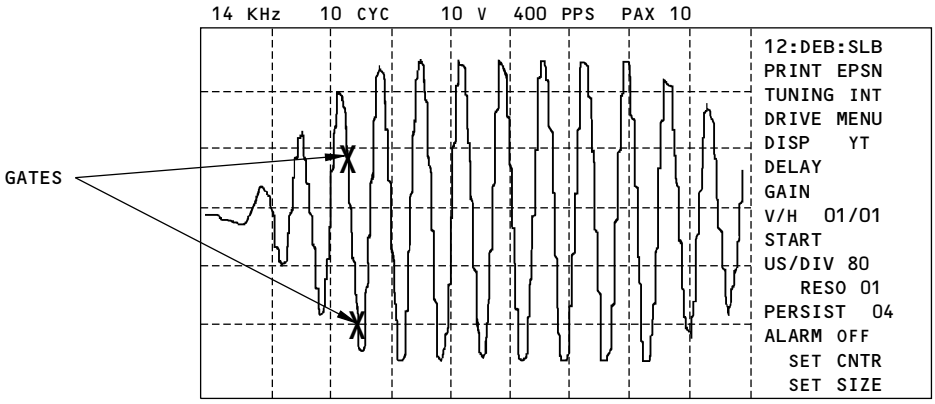
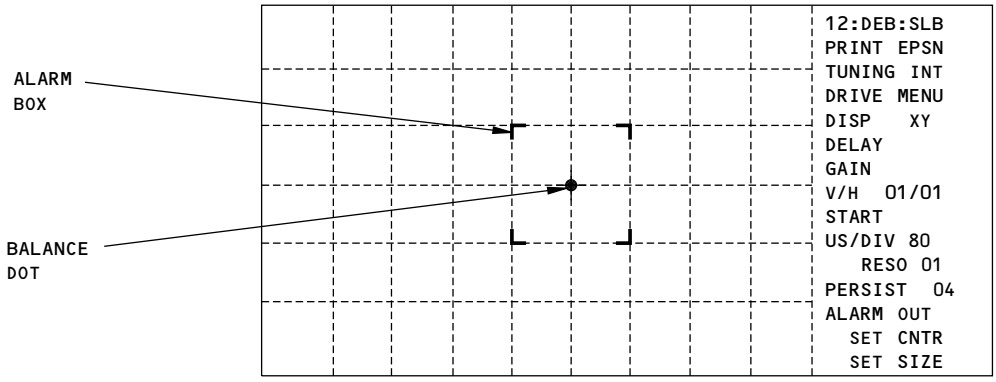
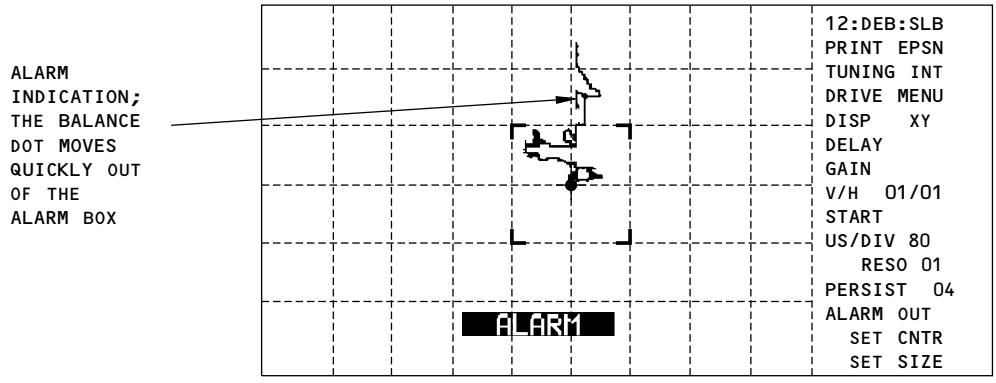
Inspection Pattern and Probe Position
Figure 5



SCREEN DISPLAY A



SCREEN DISPLAY B



SCREEN DISPLAY C

2158817 S0000471596_V1

S-9 Bondtester Instrument Screen Displays
Figure 6

PART 4 - ULTRASONIC

THRUST REVERSER - INNER WALL

1. Purpose

A. Use this procedure to examine the inner wall of the thrust reverser to find the conditions that follow:

(1) A 1.0 inch x 1.0 inch (25 mm x 25 mm) or larger disbond between the skin and the honeycomb core.

(2) A 2.0 inch x 2.0 inch (51 mm x 51 mm) or larger interply delamination.

B. This procedure uses the Olympus NDT Bondmaster 1000 Series and the B600 or the NDT Systems Bondascope 3100 ultrasonic bondtester in the pitch-catch (low frequency) mode to examine the inner wall on the bag side surface (engine side).

C. See Figure 1 for the inspection areas on the inner wall.

D. See Figure 2 for the ply lay-up thicknesses for the group 1 airplanes and Figure 3 for the group 2 airplanes.

E. Service Bulletin Reference: 737-78-1079

2. Equipment

A. General

(1) Use the Olympus NDT Bondmaster 1000, 1000+, 1000e+, or B600 and one of the specified probe combinations or the NDT Systems Bondascope 3100 and one of the specified Bondmaster 1000 series or Bondascope 3100 probe combinations, that can be calibrated on the reference standard as specified in Paragraph 4. of this procedure. No other ultrasonic bondtester can be used for this inspection procedure.

(2) Refer to Part 1, 51-01-00, for data about the equipment manufacturers.

B. Instrument

(1) The Olympus NDT Bondmaster 1000 Series and the B600 ultrasonic bondtesters are the only Olympus NDT Bondmaster instruments that can be used and were used to help prepare this procedure.

(a) The probes that follow are the only probes that can be used.

1) S-PC-P13 (high voltage); Olympus NDT

2) S-PC-P14 (high voltage); Olympus NDT

3) SPO-5629PHV (high voltage); Olympus NDT

NOTE: The S-PC-P13 probe is larger and more stable than the SPO-5629PHV probe.

(2) The NDT Systems Bondascope 3100 ultrasonic bondtester is the only NDT Systems Bondascope that can be used and was used to help prepare this procedure.

(a) The probes that follow are the only probes that can be used.

1) PCLHV32 (low frequency - high voltage); NDT Systems, Inc.

2) S-PC-P13 (high voltage); Olympus NDT

3) S-PC-P14 (high voltage); Olympus NDT

4) SPO-5629PHV (high voltage); Olympus NDT

C. Reference standard

(1) Use reference standard ST8871D. See Figure 4. The Service Engineering Group at Boeing can be used to help get a copy of reference standard ST8871D.

D. Probe Guide/Scan Pattern Sheet

(1) It is recommended to use a probe guide or a scan pattern sheet to better control the accuracy of the scan and to get 100% of the inspection area examined. If a scan pattern sheet is used, make it of approximately 0.003 inch (0.070 mm) thick, transparent material that has 0.5 inch (13 mm) spaced lines.

3. Prepare for the Inspection

A. Open the thrust reversers and remove the insulation blankets.

B. Clean the inspection surfaces so that they are free of dirt, grease or sealant.

C. Identify the inspection areas in Figure 1 and the ply lay-up thicknesses for group 1 airplanes in Figure 2 and group 2 airplanes in Figure 3.

4. Instrument Calibration

A. Calibration instructions for the Olympus NDT Bondmaster

NOTE: Two calibration instructions are given for the Bondmaster. Go to Paragraph 4.A.(1) for the Pitch-Catch RF mode and Paragraph 4.A.(2) for the Pitch-Catch Swept mode for the 1000 series instruments. Go to Paragraph 4.A.(3) for the Pitch-Catch RF mode and Paragraph 4.A.(4) for the Pitch-Catch Swept mode for the B600 instrument.

(1) Calibration instructions for the Pitch-Catch RF mode for the 1000 series instruments.

(a) Connect the probe and energize the instrument.

(b) Push the PROGRAM key to recall a stored setup file, if available.

(c) If a setup file for this procedure has not been stored, do the steps that follow to make a setup file.

1) Push the SETUP key to go to SETUP 2 and set the instrument parameters as follows:

a) DISPLAY mode set to RF.

b) V POS set to 50%.

c) GATE set to the minimum value because it is not used.

d) WIDTH set to an initial setting of 840 µs.

2) Push the SETUP key to go to SETUP 1 and set the instrument parameters as follows:

a) FREQ set as follows:

<1> If the Bondmaster 1000 is used, set the instrument frequency to 15 kHz.

<2> If the Bondmaster 1000+ or 1000e+ is used, set the instrument frequency to 23 kHz.

b) BANDPASS set to ON.

c) GAIN set to an initial setting of 45.0 dB, if 15 kHz is used, and 30.0 dB, if 23 kHz is used.

3) Push the ALARM key and set the instrument parameters as follows:

a) ALARM set to ON.

b) ± set to NEGATIVE.

c) Push the SIZ/POS key to set the instrument parameters as follows:

<1> TOP set to 75.0%

<2> BOTTOM set to 25.0%

4) Push the SPECIAL key and set the instrument parameters as follows:

a) IMP DET set to PH AMP.

b) # PULSE set to 5.

c) PRB DRV set to HIGH.

NOTE: It can be necessary to set the PRB DRV to MED or LOW during the calibration if the gain cannot be adjusted to a lower setting.

5) Push the SETUP key to display the screen for the inspection.

(d) Go to Paragraph 4.C. to continue with the instrument calibration.

(2) Calibration instructions for the Pitch-Catch Swept mode.

(a) Connect the probe and energize the instrument.

(b) Push the PROGRAM key to recall a stored setup file, if available.

(c) If a setup file for this procedure has not been stored, do the steps that follow to make a setup file.

1) Push the SETUP key to go to SETUP 2 and set the instrument parameters as follows:

a) DISPLAY mode set to SWEPT.

b) H POS and V POS set to 50%.

2) Push the SETUP key to go to SETUP 1 and set the instrument parameters as follows:

a) H and V GAIN set to an initial setting of 0.0 dB.

b) START set to 10 kHz and STOP set to 23 kHz.

3) Push the ALARM key and set the instrument parameters as follows:

a) ALARM set to ON.

b) ± set to NEGATIVE.

4) Push the SIZ/POS key to set the instrument parameters as follows:

a) TOP set to 70.0%

b) BOTTOM set to 30.0%

c) LEFT set to 30.0%

d) RIGHT set to 70.0%

5) Push the SPECIAL key and set the instrument parameters as follows:

a) IMP DET set to PH AMP.

b) # PULSE set to 5.

c) PRB DRV set to HIGH.

NOTE: It can be necessary to set the PRB DRV to MED or LOW during the calibration if the gain cannot be adjusted to a lower setting.

6) Push the SETUP key to display the screen for the inspection.

(d) Go to Paragraph 4.C. to continue with the instrument calibration.

(3) Calibration for the Pitch-Catch RF mode for the Bondmaster B600M instrument.

(a) Connect the probe and energize the instrument.

(b) After the probe is recognized, push the Return key to go the application quick setup menu screen.

(c) Select Skin To Core Disbonds (Flat) application and push the Accept key.

(d) Push the MEM menu key to recall a stored setup, if available.

(e) If a setup file for this procedure has not been stored, do the steps that follow to make a setup file.

1) Push the DISP/DOTS menu key and set the RUN function key “A” to RF SIGNAL.

2) Push the MAIN menu key and set the instrument parameters as follows:

a) FREQ set to 23 kHz.

b) RF GAIN set to an initial setting of 30.0 dB.

c) WIDTH set to 800 µs.

d) GATE set to AUTO.

e) RF DISPLAY set to RF.

f) CYCLES set to 10.

g) REP RATE set to 300.

h) PRB DRV set to MEDIUM.

3) Push the ALARM menu key and set the instrument parameters as follows:

a) RF ALARM set to NEG.

b) TOP set to 70.0%.

c) BOTTOM set to 30.0%.

4) Push the SAVE direct function key to store the setup file.

(f) Go to Paragraph 4.C. to continue with the instrument calibration.

(4) Calibration for the Pitch-Catch Swept mode for the Bondmaster B600M instrument.

(a) Connect the probe and energize the instrument.

(b) After the probe is recognized, push the Return key to go the application quick setup menu screen.

(c) Select Skin To Core Disbonds (Tapered) application and push the Accept key.

(d) Push the MEM menu key to recall a stored setup, if available.

(e) If a setup file for this procedure has not been stored, do the steps that follow to make a setup file.

1) Push the DISP/DOTS menu key and set the RUN function key “A” to XY FLY DOT.

2) Push the MAIN menu key and set the instrument parameters as follows:

a) START FREQ set to 10.0 kHz.

b) STOP FREQ set to 23.0 kHz.

c) SW RATE set to HIGH.

d) H and V GAIN set to an initial setting of 30.0 dB.

e) PRB DRV set to MEDIUM.

3) Push the ALARM menu key and set the instrument parameters as follows:

a) XY ALM 1 set to NEG.

b) SHAPE set to BOX.

c) TOP and RIGHT set to 70.0%.

d) BOTTOM and LEFT set to 30.0%.

4) Push the SAVE direct function key to store the setup file.

(f) Go to Paragraph 4.C. to continue with the instrument calibration.

B. Calibration Instructions for the NDT Systems Bondascope 3100

NOTE: Two calibration instructions are given for the Bondascope. Go to Paragraph 4.B.(1) for the Pitch-Catch RF mode, and Paragraph 4.B.(2) for the Pitch-Catch Swept mode.

(1) Calibration instructions for the Pitch-Catch RF mode.

(a) Connect the probe and energize the instrument.

(b) Select the probe:

1) If an NDT Systems probe is connected to the instrument before it is energized, the probe will be automatically selected. If the probe is not automatically selected, select PCLHV Series - HV Toneburst.

2) If an Olympus NDT Bondmaster probe is connected to the instrument before it is energized, select PCLHV Series - HV Toneburst.

(c) Select Setup:

1) Select a stored setup file for this procedure, if available.

2) Select Defaults if a setup file for this procedure has not been stored and do the steps that follow to make a setup file.

NOTE: The main menu screen will automatically display in the RF mode if a setup file is not stored in the memory.

a) Set the instrument parameters as follows:

<1> Gain set to an initial setting of 50.0 dB.

<2> FREQ set to 23.00 kHz.

<3> RNG-RANGE set to 519.

<4> DLY set to the lowest value.

<5> VLTS set to 200.

<6> GATE set to the minimum value because it is not used.

<7> CYC set to 6.

<8> Select DISP and set the parameters as follows:

<a> OFFS–OFFSET set to 0.

<b> GRID set to ON.

<c> FILTER set to OFF if a Bondascope probe is used and 28 kHz if a Bondmaster probe is used.

<9> Select ALRM and set the parameters as follows:

<a> AMP set to ON

<b> AMP-THRSH set to 40%

<10> SETUP-SAVE to store the setup in memory.

(d) Go to Paragraph 4.C. to continue with the instrument calibration.

(2) Calibration instructions for the Pitch-Catch Swept mode.

(a) Connect the probe and energize the instrument.

(b) Select the probe:

1) If an NDT Systems probe is connected to the instrument before it is energized, the probe will be automatically selected. If the probe is not automatically selected, select PCLHV Series - HV Toneburst.

2) If an Olympus NDT Bondmaster probe is connected to the instrument before it is energized, select PCLHV Series - HV Toneburst.

(c) Select Setup:

1) Select a stored setup file for this procedure, if available.

2) Select Defaults if a setup file for this procedure has not been stored and do the steps that follow to make a setup file.

NOTE: The main menu screen will automatically display in the RF mode if the file is not stored in the memory.

a) Push the SWEEP key to display the Sweep Setup main menu screen (waveform display). Set the parameters as follows:

<1> HI-FQR set to 23.0 kHz.

<2> LO-FQR set to 10.0 kHz.

<3> PTS set to 40.

<4> Select DISP and set the parameters as follows:

<a> OFFS–OFFSET set to 0.

<b> GRID set to ON.

<c> FILTER set to OFF for a Bondascope or a Bondmaster probe.

b) Push the SWEEP key to display the Swept Freq main menu screen. Set the parameters as follows:

<1> Select POS and RST to make sure the null point is set to the center of the screen display. See Detail III in Figure 5.

<2> Go to the main menu and push null.

<3> Select DOTS to make the alarm box and set the parameters as follows:

<a> With DOT# set to 1, select the STORE key to store the #1 DOT (null point) on the screen.

- Push NULL to make sure the #1 DOT is set to the center of the screen as shown in Detail II in Figure 5.

<b> GATE set to RECT.

<c> WID set to two divisions on the right and left of the center of the screen as shown in Detail III in Figure 5.

<d> HT set to two divisions on top and bottom of the center of the screen as shown in Detail III in Figure 5.

<e> ALM set to OUT.

<f> Push MENU/ESC to go to the main menu.

<4> Select Xsci and Ysci and set each to the same value of 0.050.

<5> Select VLTS and set to 50.0 if a Bondascope probe is used and 200.0 if a Bondmaster probe is used.

(d) Go to Paragraph 4.C. to continue with the instrument calibration.

C. To identify what ply step on the reference standard to use for the instrument calibration, refer to the calibration table in Figure 2 or Figure 3 for the applicable group of airplanes.

D. Put the probe on the applicable step of the reference standard at probe position 1 (bonded area). Position the probe as shown in Detail I in Figure 5 for the pitch-catch swept mode or Detail I in Figure 6 for the pitch-catch RF mode.

NOTE: Hold the probe on the surface of the reference standard at a constant pressure during the calibration. Use the same pressure during the inspection on the airplane.

E. Press the NULL key to position the bonded signal to the center of the screen display as shown in Detail II in Figure 5 or Details II, III or IV in Figure 6.

F. Move the probe to position 2 (disbonded area) with the pitch tip and catch tip within the disbond area and do as follows:

(1) Move the probe in the disbonded area to make sure that a disbond signal occurs.

(2) If the pitch-catch swept mode is used with the Bondmaster 1000 series or B600 instruments or the Bondascope 3100, adjust the gain and turn the signal as necessary to get the disbond signal to be two divisions outside of the alarm box as shown in Detail II in Figure 5.

(3) If the pitch-catch RF mode with the Bondmaster 1000, at 15 kHz, is used, adjust the gain to get the disbond signal to just touch the alarm box at the 25% and 75% levels, as shown in Detail II in Figure 6.

(4) If the pitch-catch RF mode with the Bondmaster 1000+, 1000e+, or B600, at 23 kHz, is used, adjust the gain to get the disbond signal between 0.0% and 16.5% and 83.0% and 100%, below and above the alarm levels, as shown in Detail III in Figure 6.

(5) If the pitch-catch RF mode with the Bondascope 3100 is used, adjust the gain to get the disbond signal between 0% and 10% and 90% and 100%, below and above the alarm levels, as shown in Detail IV in Figure 6.

G. Make more than one scan from position 1 to position 2 (see Figure 5 or Figure 6) to make sure you get the results specified in Paragraph 4.F. If you do not get the results to occur, make sure your calibration is correct and/or the equipment works correctly.

H. Identify the maximum scan speed that can be used during the inspection as follows:

(1) Put the probe on the reference standard at position 1 (see Figure 5 or Figure 6).

(2) Move the probe to position 2 and then back to position 1 (see Figure 5 or Figure 6).

(3) Do Paragraph 4.H.(1) and Paragraph 4.H.(2) a number of times and increase the scan speed each time until the alarm does not operate. The maximum scan speed is the maximum speed that the probe can be moved across the disbond area and continue to have the alarm operate correctly.

5. Inspection Procedure

A. Identify the inspection areas in Figure 1 and the ply lay-up thicknesses in Figure 2 or Figure 3, as applicable.

B. Calibrate the instrument as specified in Paragraph 4. Refer to the calibration table in Figure 2 or Figure 3 to identify the reference step to use during calibration (for the number of plies to examine).

C. It is recommended to divide the large area with the same ply thickness into 18 to 24 inch (460 to 610 mm) square sections. Tape or a grease pencil or felt tip marker can be used to identify the section size and location. If tape is used, make sure to remove it after the inspection is complete.

D. If a scan pattern sheet is used, attach it to the surface and make the scans across the sheet.

E. Examine the bag side surface (engine side) of the inner wall as follows:

(1) Put the probe on the surface in the ply thickness area for which the instrument was calibrated and, if a scan pattern is used, on a scan line.

(2) Monitor the signal you get when the probe is first put on the surface. Compare the signal you get from this location to the bonded signal you got from the reference standard, at the same location. If the signal you get looks to be a disbond signal, move the probe to a different location to make sure the initial area is not disbonded.

NOTE: The bonded signal you get on the inner wall can be smaller than the signal you got from the bonded area of the reference standard. If this occurs, it is not necessary to increase the gain.

(3) Do the steps that follow to examine the area for disbonds or delaminations:

(a) Slowly make a scan along the scan line, if a scan pattern sheet is used. If a scan pattern sheet is not used, use a probe guide. Use a scan speed that is not faster than the maximum scan speed identified during the instrument calibration.

(b) Monitor the instrument display for a signal that looks almost the same as the disbond signal that you got from the reference standard during calibration.

(c) Make a record of all areas that give a disbond signal or mark the surface with a grease pencil or felt tip marker.

(4) Increment the probe 0.5 inch (13 mm) and do Paragraph 5.E.(3) again until the inspection area is fully examined.

(5) Do Paragraph 5.E.(1) thru Paragraph 5.E.(4) again on all the ply lay-up thicknesses shown in Figure 2 or Figure 3, as applicable.

6. Inspection Results

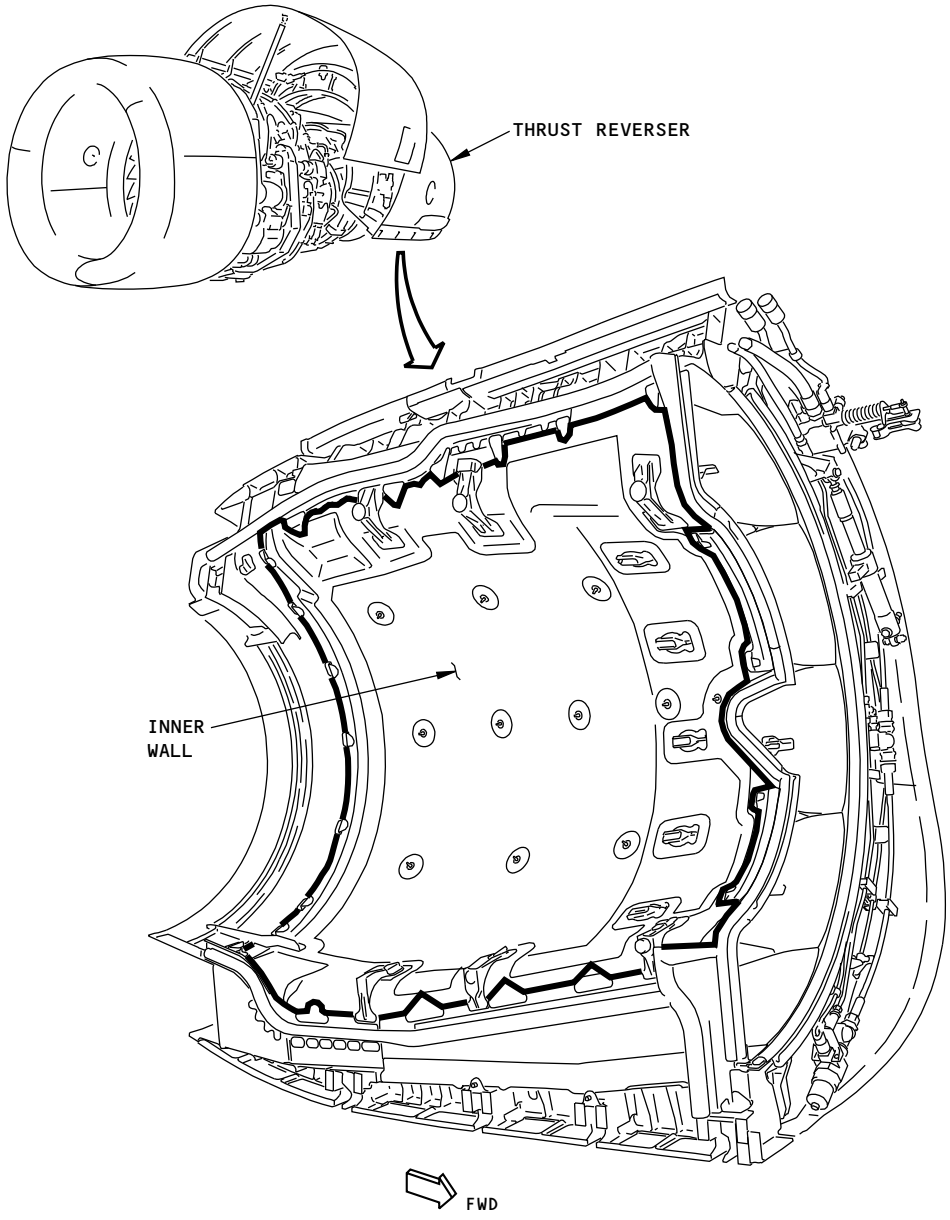
A. An area that gives a signal that looks the same or larger than the signal you got from the disbond area of the reference standard is a possible disbond.

NOTE: Make sure that each tip is on the disbond area to get the maximum signal.

B. The signal from a disbond can change when the probe is moved across the edge of a disbond to an area completely above the disbond. It is possible that the signal can decrease as the probe is moved above the disbond (a typical disbond is larger than 1 inch x 1 inch (25 mm x 25 mm)).

C. More analysis can be done, but is not mandatory. Make an analysis of possible disbonds as follows:

(1) Examine the area with TTU ultrasonics as specified in Part 4, 51-00-02 or Part 4, 51-00-06. If a contact TTU procedure is used, make sure that water or couplant does not get into the acoustic holes of the outer skin. A thin tape can be used to cover the holes.



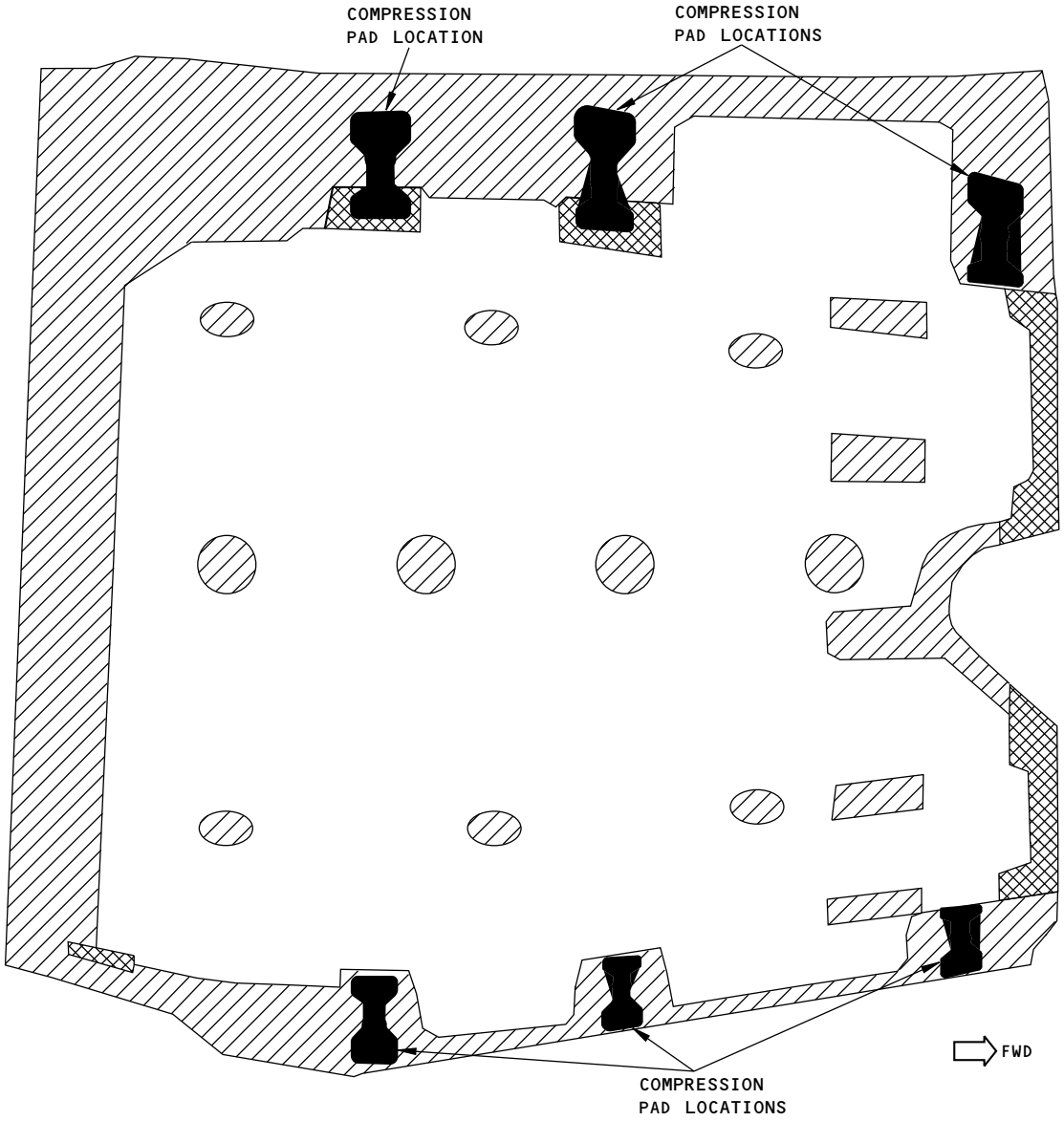
THE LEFT SIDE IS SHOWN;
THE RIGHT SIDE IS ALMOST THE SAME

NOTES:

- THE VIEW ABOVE IS WITH THE INSULATION BLANKETS REMOVED.
- THE INSPECTION AREAS ARE INSIDE THE HEAVY LINES SHOWN ABOVE.

2158819 S0000471599_V1

Thrust Reverser Inner Wall Inspection Areas
Figure 1



INNER WALL PLY LAY-UP (TYPICAL)

THE LEFT IS SIDE SHOWN;
THE RIGHT SIDE IS ALMOST THE SAME

NOTES:

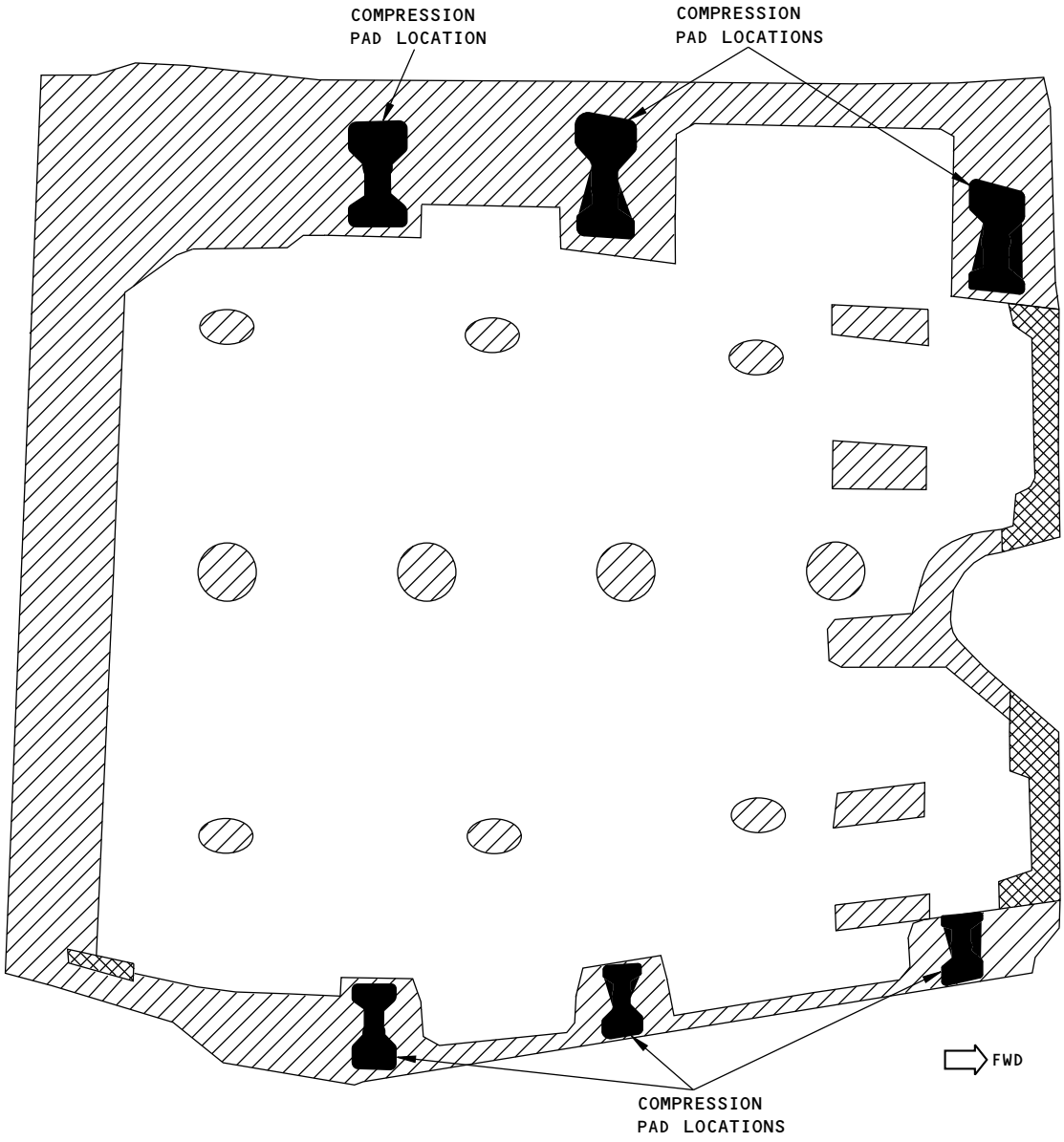
- GROUP 1 AIRPLANES IN SERVICE BULLETIN 737-78-1079; LINE NUMBERS 515-1980, 1982-2092, 2094-2229
- REFER TO THE CALIBRATION TABLE FOR THE CORRECT REFERENCE STANDARD PLY STEP TO USE FOR THE APPLICABLE INSPECTION AREA.

CALIBRATION TABLE

INSPECTION AREA	REFERENCE STANDARD PLY STEP
	5
	15
	20

2158823 S0000471600_V1

Group 1 Airplanes - Ply Lay-Up Thicknesses
Figure 2



INNER WALL PLY LAY-UP (TYPICAL)

THE LEFT SIDE IS SHOWN;
THE RIGHT SIDE IS ALMOST THE SAME

NOTES:

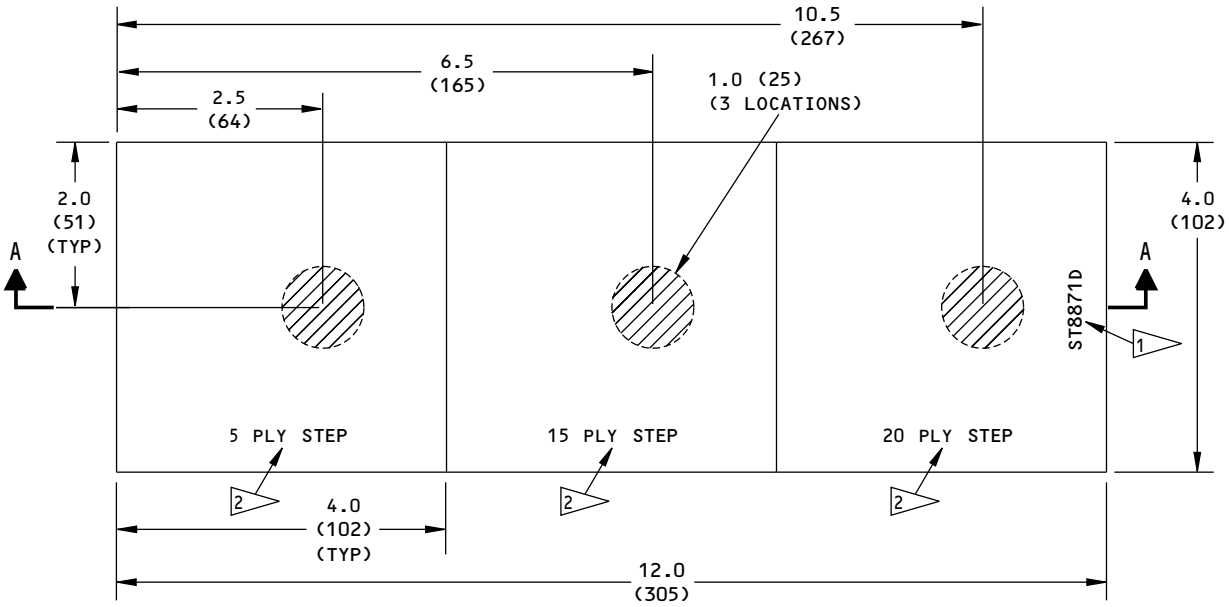
- GROUP 2 AIRPLANES IN SERVICE BULLETIN 737-78-1079; LINE NUMBERS 1-514
- REFER TO THE CALIBRATION TABLE FOR THE CORRECT REFERENCE STANDARD PLY STEP TO USE FOR THE APPLICABLE INSPECTION AREA.

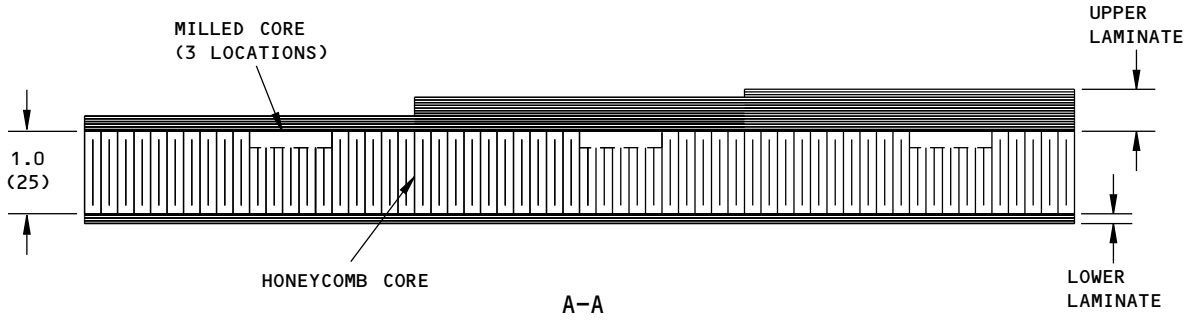
CALIBRATION TABLE

INSPECTION AREA	REFERENCE STANDARD PLY STEP
	5
	15
	20

2158824 S0000471601_V1

Group 2 Airplanes - Ply Lay-Up Thicknesses
Figure 3





A-A

NOTES:

MILLED CORE TO MAKE THE SKIN-TO-CORE DISBOND (3 LOCATIONS)

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

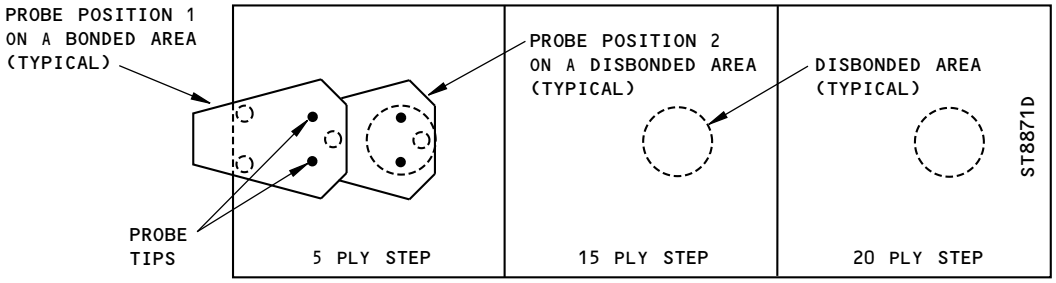
INCHES	MILLIMETERS
X.X = ±0.050	X = ±1

1 PUT THE REFERENCE STANDARD NUMBER, ST8871D, ON THE UPPER LAMINATE.

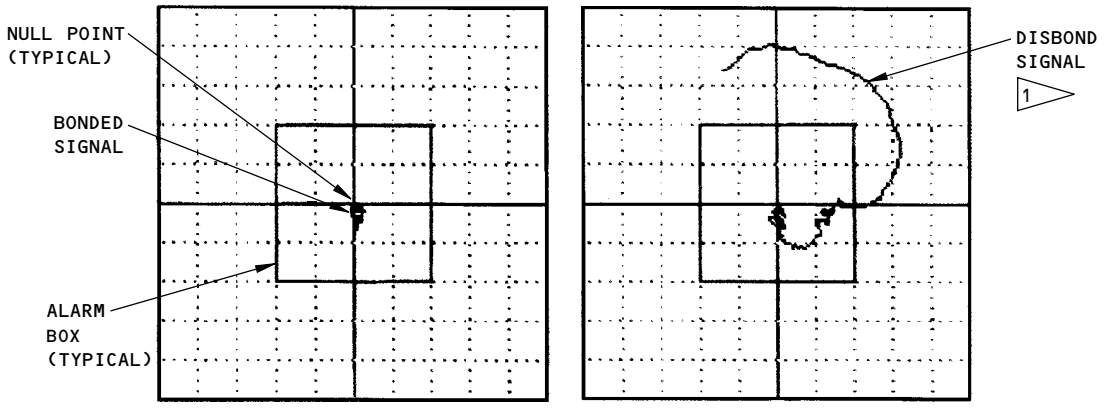
2 NUMBER OF PLIES IN THE UPPER LAMINATE.

2158827 S0000471602_V1

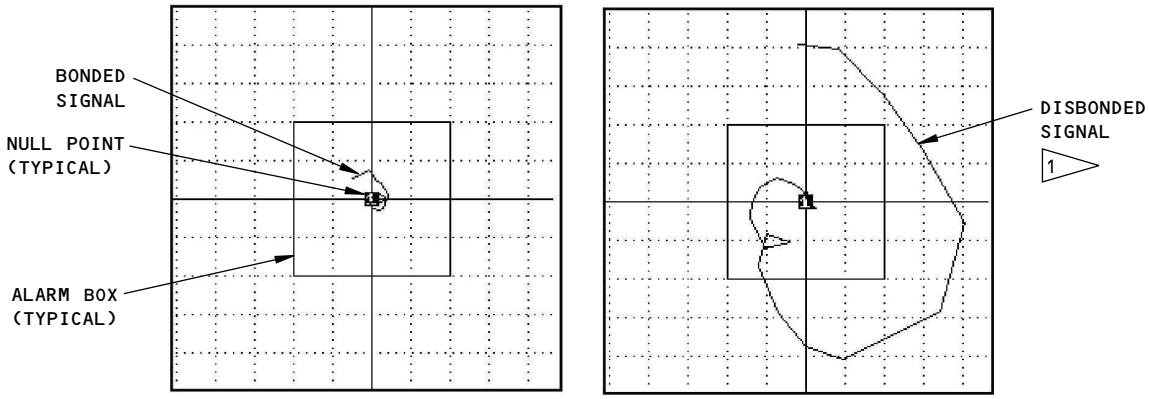
Reference Standard ST8871D
Figure 4



PROBE POSITIONS ON THE REFERENCE STANDARD
DETAIL I



BONDMASTER 1000 SERIES AND B600 - PITCH-CATCH SWEPT MODE SCREEN DISPLAYS
DETAIL II



BONDASCOPE 3100 - PITCH-CATCH SWEPT MODE SCREEN DISPLAYS
DETAIL III

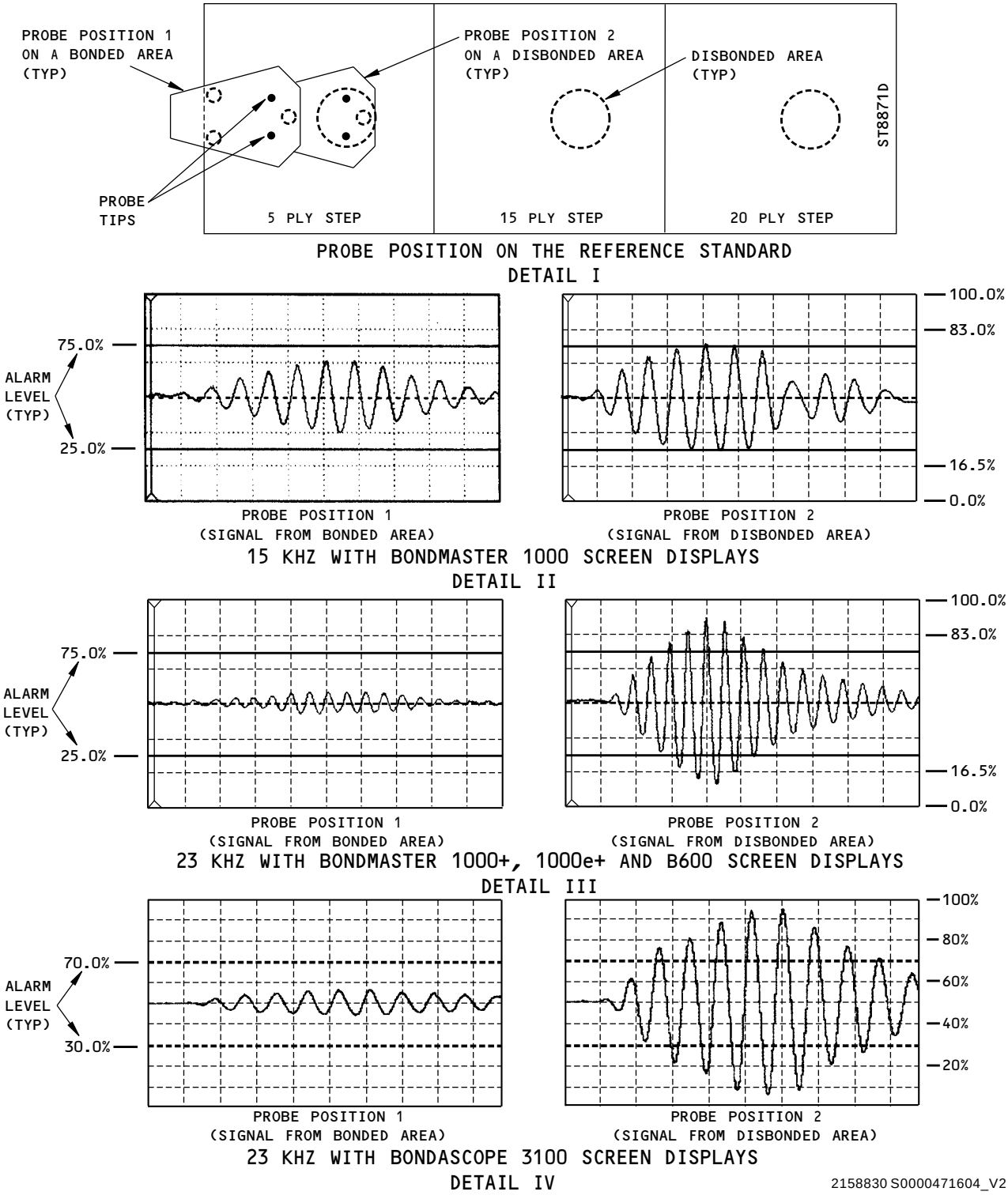
NOTES:

- THE SIGNALS IN THE DETAIL II AND III SCREEN DISPLAYS ARE FROM THE 15 PLY STEP ON THE REFERENCE STANDARD.

1 THERE WILL BE A DIFFERENCE IN THE SHAPE AND ROTATION IN THE DISBOND SIGNAL SHOWN BETWEEN THE THREE PLY STEPS IN THE REFERENCE STANDARD.

2158829 S0000471603_V2

Instrument Calibration Pitch-Catch Swept Mode
Figure 5



Instrument Calibration Pitch-Catch RF Mode
Figure 6

PART 4 - ULTRASONIC

THROUGH-TRANSMISSION INSPECTION OF THE INNER WALL OF THE THRUST REVERSER (AIR-COUPLED)

1. Purpose

A. Use this procedure to find skin-to-core disbonds or interply delaminations in the inner wall of the thrust reverser. See Figure 1 for the inspection areas. See Service Bulletin 737-78-1079, Appendix C for the ply lay-up diagram.

B. This procedure was prepared with an air-coupled through-transmission ultrasonic (ATTU) system. The Through-Transmission Ultrasonic (TTU) systems specified in Part 4, 51-00-06, can also be used to do this inspection.

C. Service Bulletin reference: 737-78-1079

2. Equipment

A. General

(1) Use inspection equipment that can be calibrated on the thrust reverser as specified in Paragraph 4.

B. Instrument

(1) Use a TTU system than can identify a 1.0 x 1.0 inch (25 x 25 mm) skin-to-core disbond or interply delamination.

(2) The ATTU system that follows was used to help prepare this procedure.

(a) Curlin Air Kit component part numbers:

1) Instrument - part number 150-10000-1

2) Airborne Transducers (2 each) - part number AT1

3) BNC to BNC Cables (2 each) - part number BBR01-10

4) Yoke Assembly (1 fixed end, 1 gimbaled end) - part number 150-81000

NOTE: This is a 48 inch (1219 mm) long (or longer) yoke. To do this inspection with the thrust reverser on the airplane, it can be necessary to use a 60 inch long yoke.

5) BNC to Lemo 1 Cables (2 each) - part number ATC-10

NOTE: These cables are necessary if you do not use the yoke and use the transducers in contact with the thrust reverser.

(b) You can get this equipment from:

NDT Systems

17811 Georgetown Ln

Huntington Beach, CA 92647

Phone: (714) 893-2438

C. Couplant - None

D. Reference Standard

(1) Use the thrust reverser inspection areas as the reference standard.

NOTE: Put a 1.0 x 1.0 inch (25 x 25 mm) foam tape or a paper shim on each of the inspection areas to simulate a delamination or disbond.

3. Prepare for the Inspection

A. Find the inspection area on the thrust reverser. Refer to Figure 1.

B. Remove all dirt, grease, and sealant from the outer and inner skin inspection surfaces of the thrust reverser.

4. Instrument Calibration

A. Calibrate the ATTU instrument as follows:

NOTE: The thrust reverser has 3 inspection areas. Once the instrument is calibrated, only the instrument gain will be necessary to adjust.

(1) Connect the transducer to the instrument and the yoke.

(2) Adjust the gimbaled transducer so that it is in the locked position and is at a right angle to the inspection surface. Keep the transducers in the air during the calibration of the system.

NOTE: The gimbaled transducer will be unlocked after the instrument calibration is completed. The gimbaled transducer will be put on the outer skin of the outer wall so that it will follow the thrust reverser curvature. This will help keep the transducers perpendicular to the surface.

(3) Adjust the distance between the transducers on the yokes to approximately 8 inches (203 mm).

(4) Energize the instrument.

(5) Set the primary instrument controls to the general positions as follows:

Parameter	Value	Notes
Energy	8	
Blank	Off/On	Start with the Blank off. After you set the Gate start and width, put the Blank on.
Rep Rate	40	
Average	0	
Gate	AMPL	
Alarm	NEG	
Start	2.100	
Width	4.000	Adjust as necessary to examine the different inspection areas.
Alarm Level	35% Full screen height	
Audio	On	
Range	36.60	
Delay	0.000	
Reject	Off	
Disp.	Solid	

(Continued)

Parameter	Value	Notes
Smooth	ON	
Grid	On	
Beep	On	
Tune	Norm	
Alum Time	0.2	
Velocity	0.01400	

(6) Put a 1.0 x 1.0 inch (25 x 25 mm) foam tape or a paper shim (simulated defect) on each of the 3 inspection areas. See flagnote 5 in Details 1 and 2 in Figure 2.

(7) Move the gimbaled transducer so that it is adjacent to a simulated defect. Make sure the upper and lower transducers are aligned to each other. See Figure 2, flagnote 1.

(8) Adjust the instrument to put the received signal at approximately 70% of full screen height (FSH) and approximately 10% of full screen width (FSW) as shown in Figure 2, Screen Display 1.

NOTE: The receiver transducer can be above or below the thrust reverser.

(9) Slowly move the transducers above and below the simulated defect. The defect signal on the screen display must go below 35% of FSH when the top transducer is above the simulated defect. See Figure 2, flagnote 2 and Screen Display 2.

(10) Do Paragraph 4.A.(7) thru Paragraph 4.A.(9) again for each inspection area. When you calibrate for a different inspection area, you will only have to adjust the instrument gain.

5. Inspection Procedure

A. Examine the thrust reverser inner wall for interply delaminations and skin-to-core disbonds as follows:

(1) Identify the inspection areas as shown in Figure 1.

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

(3) Examine the three inspection areas with the gimbaled transducer unlocked as follows (see Figure 1):

(a) Inspection area 1 - Put the gimbaled transducer against the outer perforated skin of the thrust reverser. See Detail 1 in Figure 2.

(b) Inspection area 2 - Put the gimbaled transducer against the outer perforated skin of the thrust reverser.

(c) Inspection area 3 - Put the gimbaled transducer against the inner wall of the bifurcation radius. See Detail 2 in Figure 2.

NOTE: This will help keep the transducers aligned when you unlock the gimbaled transducer and put it in touch with the curved surface of the thrust reverser.

(4) Examine each inspection area independently as follows:

(a) Adjust the instrument gain to put the signal at 70% of FSH.

(b) Slowly move the transducers through the inspection area. Move the transducers in approximately 0.5 inch (13 mm) increments after each scan. Make sure the transducers are aligned. Refer to Figure 1.

NOTE: There will be changes in the ply buildup or core density at the edge of an inspection area. Refer to Service Bulletin 737-78-1079.

(c) Monitor the instrument screen display to make sure the signal does not go above 80% of FSH. If the signal goes above 80% of FSH, adjust the instrument gain to put the signal at 70% of FSH.

(d) Stop the transducers and make a temporary mark on the thrust reverser at the locations that cause the signal to decrease to 35% of FSH or lower. Make sure the transducers are aligned.

NOTE: Use markers that will not damage the structure and can be easily removed.

(5) Do Paragraph 5.A.(4)(a) thru Paragraph 5.A.(4)(d) again in all of the inspection areas.

(6) Record and mark all areas on the thrust reverser that cause the signal to go below 35% of FSH.

6. Inspection Results

A. All inspection areas are satisfactory if they do not cause a skin-to-core disbond or an interply delamination indication to occur. A skin-to-core disbond or an interply delamination indication is shown on the air-coupled screen display when the receive signal decreases to 35% of FSH or lower.

B. It is possible to get incorrect skin-to-core disbond or interply delamination indications (signals that are 35% of FSH or lower) if:

(1) The transducers are moved too fast.

(2) The yoke is angled more than 10 degrees.

(3) The transducers are not perpendicular to the surfaces.

(4) The transducers are above a core splice.

(5) The transducers are moved into a different inspection area.

NOTE: At the intersection of two inspection areas, there can be a fast change in the number of plies or core density. Make sure the signals caused by these changes are not identified as skin-to core disbonds or interply delaminations.

C. Examine the three inspection areas with the gimbaled transducer unlocked as follows (see Figure 1):

(1) Inspection area 1 - Put the gimbaled transducer against the outer perforated skin of the thrust reverser. See Detail 1 in Figure 2.

(2) Inspection area 2 - Put the gimbaled transducer against the outer skin of the thrust reverser.

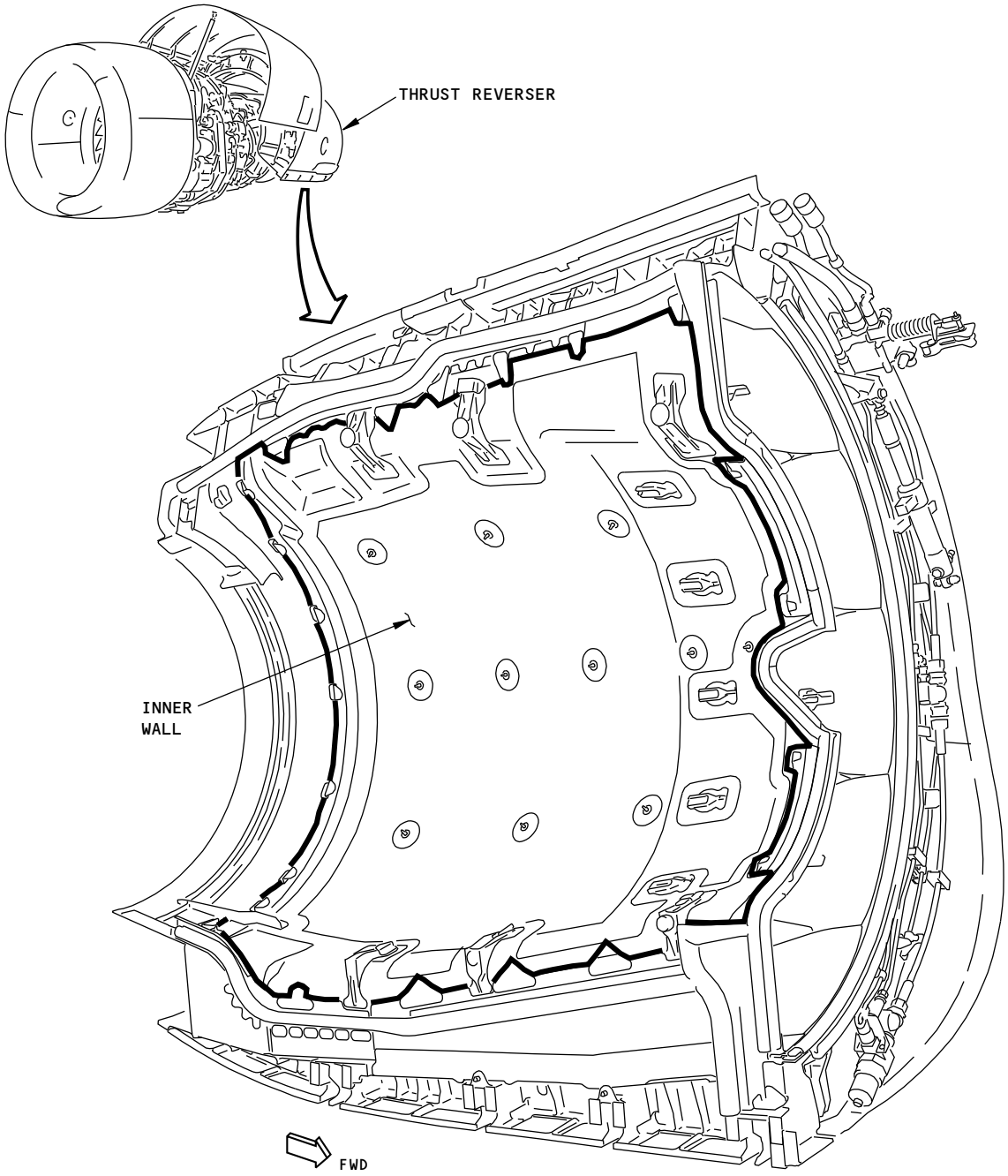
(3) Inspection area 3 - Put the gimbaled transducer against the inner wall of the bifurcation radius. See Detail 2 in Figure 2.

D. Make an analysis of the temporary mark as follows:

(1) If the temporary marks make a straight line, the straight line is an indication of a core splice area or the start of a different inspection area. Refer to the part drawings or Service Bulletin 737-78-1079.

(2) The temporary marks that do not make a straight line are possible skin-to-core disbonds or interply delamination indications.

E. To make sure the indication is a skin-to-core disbond or an interply delamination, examine the inner wall skin honeycomb areas for near side skin-to-core disbonds and delaminations as specified in Part 4, 78-30-02.



THE LEFT SIDE IS SHOWN;
THE RIGHT SIDE IS ALMOST THE SAME

NOTES:

- THE VIEW ABOVE IS WITH THE INSULATION BLANKETS REMOVED.
- THE INSPECTION AREAS ARE INSIDE THE HEAVY LINES SHOWN ABOVE.

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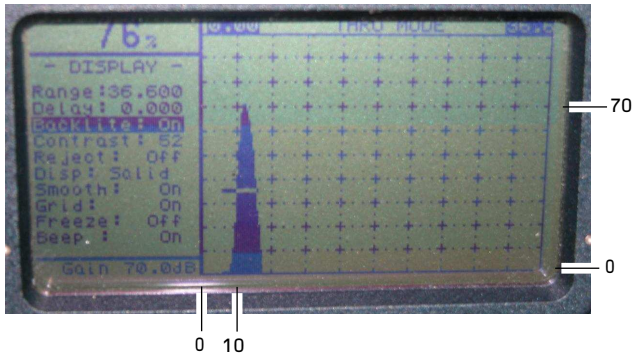
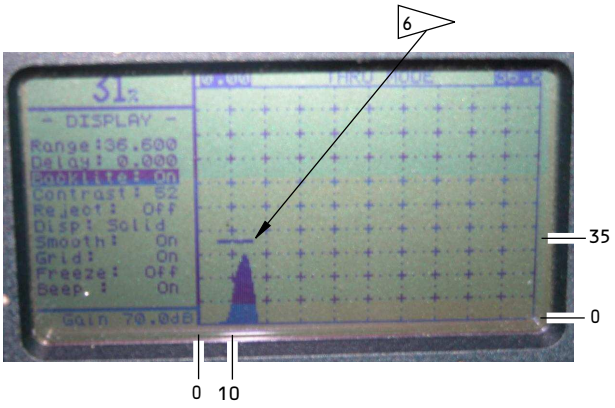
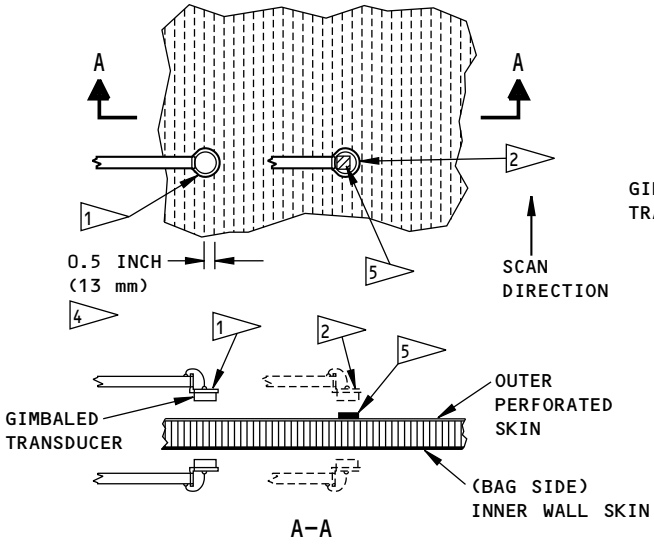
Thrust Reverser Inner Wall Inspection Areas
Figure 1



BONDED AREA SIGNAL
SCREEN DISPLAY 1

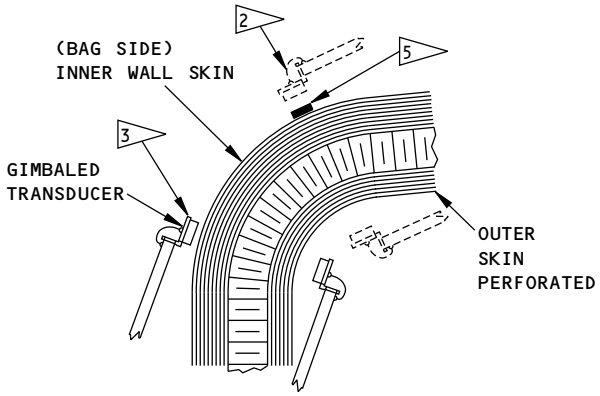


DISBOND OR INTERPLY DELAMINATION SIGNAL
SCREEN DISPLAY 2



A–A

TYPICAL TRANSDUCER LOCATION
FOR PERFORATED SKIN AREAS



TYPICAL TRANSDUCER LOCATION
FOR BIFURCATION RADIUS
DETAIL 2

NOTES:

DETAIL 1

- TYPICAL INSTRUMENT CALIBRATION FOR ALL THRUST REVERSER INSPECTION AREAS.

1> PUT THE GIMBALED TRANSDUCER ABOVE THE OUTER PERFORATED SKIN SIDE OF THE THRUST REVERSER SO THAT IT IS ADJACENT TO THE SIMULATED DEFECT. MAKE SURE THE TRANSDUCERS ARE ALIGNED.

2> SLOWLY MOVE THE TRANSDUCERS TO THE SIMULATED DEFECT AND STOP WHEN THE GIMBALED TRANSDUCER IS ABOVE THE DEFECT.

3> PUT THE GIMBALED TRANSDUCER ABOVE THE INNER WALL RADIUS OF THE THRUST REVERSER SO THAT IT IS ADJACENT TO THE SIMULATED DEFECT.

4> TYPICAL INCREMENT DISTANCE FOR ALL INSPECTION AREAS IS APPROXIMATELY 0.5 INCH (13 mm).

5> SIMULATED DEFECT 1.0 X 1.0 INCH (25 X 25 mm) - FOAM TAPE OR SHIM.

6> SET THE ALARM LEVEL TO 35% OF FULL SCREEN HEIGHT.

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Instrument Calibration
Figure 2