



737 NON-DESTRUCTIVE TEST MANUAL

PART 4 - ULTRASONIC

AUXILIARY FUEL TANK BOND INSPECTION

1. Purpose

- A. To find disbonded skins on aluminum honeycomb panels in the auxiliary fuel tank structure. This inspection is done on the external surfaces of the tank structure. This procedure will find disbonds at both the internal and external surfaces. You do not have to remove the tank from the airplane to use this procedure.

NOTE: It is permitted to use this procedure to examine the auxiliary fuel tank panels from inside the tank if access is available.

- B. Service Bulletin Reference: 737-28-1088

2. Equipment

- A. The equipment listed below was used to prepare this procedure. Other equipment can be used if it can find the equivalent disbonds on the reference standard the same as the given equipment.

- (1) Bond Test Instrument

- (a) Sondicator S-5 with probe Part No. S-P-3 with aluminum, lucite, or phenolic tips (see Figure 4); Zetec, Inc.
 - (b) Sondicator S-1A with probe Part No. S-P-3 with aluminum, lucite, or phenolic tips (see Figure 4); Zetec, Inc.
 - (c) Sondicator S-3 with probe Part No. S-P-3 with aluminum, lucite, or phenolic tips (see Figure 4); Zetec, Inc.

- (2) Reference Standard 2001 (see Figure 2). This part is available from The Boeing Company.

- (3) Long-reach probe holder Part No. 2001P (see Figure 3); Ideal Specialty Company. This holder is made to fit the Sondicator probe, Part No. S-P-3. Other probe holders can be used.

NOTE: Refer to Part 1, 51-01-00, for the address of the equipment manufacturers.

3. Prepare for the Inspection

- A. Drain the auxiliary fuel tanks.
- B. Remove the cargo lining panels to get access to the aft end of the auxiliary tank (see Figure 1).
- C. Clean the surfaces of the inspection area. Visually examine the external surfaces of the panels to be examined for signs of cracks or stress.
- D. Make sure that the probe can reach all of the areas of the inspection within the tank.

NOTE: If a long-reach probe positioner (see Figure 3) is not available or is not long enough to reach the area of the inspection (especially in a 3-tank configuration), it may be necessary to move the auxiliary fuel tank. Use the following instructions to move the tank:

- (1) Disconnect the external plumbing and electrical connections.
- (2) Lower the tank structure.
- (3) Move the tank aft on the ball mat rollers or the equivalent.



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4. Instrument Calibration

- A. Calibrate the instrument to find the skin disbonds from the external surface of curved aluminum honeycomb panels (see Figure 2).

NOTE: The following calibration procedure will help you to find the disbonds on the external and internal surfaces of the panels.

- (1) Do the calibration procedure for the Sondicator S-5.

NOTE: It is necessary to use aluminum, lucite or phenolic probe tips with this procedure (see Figure 4).

- (a) Put Teflon tape over the aluminum probe tips to prevent damage to the tank panel skins. Lucite or phenolic tips will not need Teflon tape.
 - (b) Put the probe in the probe holder (see Figure 3).
 - (c) Put the probe on the reference standard in position A (good area on the disbond side) (see Figure 5) and balance the instrument as done in the following instructions:
 - 1) Set the amplitude control knob at 0.4.
 - 2) Turn the phase control knob in a clockwise direction until the meter gets to the maximum and then returns to zero.
 - 3) Continue to turn the phase control knob until the meter again goes to the maximum and again returns to zero.
 - 4) Continue to turn the phase control until the meter goes to 7.
 - 5) Adjust the amplitude control until the meter goes to 5.
 - (d) Move the probe in a longitudinal direction (see Figure 5) until the meters become stable. Set the meters again as given in Paragraph 4.A.(1)(c)4) and Paragraph 4.A.(1)(c)5).
 - (e) Move the probe on the reference standard into position B (the artificial disbond area). The instrument must respond with a fast movement of the amplitude meter in an upscale direction with some deflection of the phase meter.
 - (f) Put the probe on the opposite side of the reference standard in an area away from the artificial defect.
 - (g) Move the probe over the artificial defect. The instrument response must be a fast movement of the phase meter in an upscale direction. (On some reference standards, the phase meter can go in a downscale direction, with an upscale amplitude meter indication that occurs at the same time.)
- (2) Calibration procedure for the Sondicator S-1A.
- (a) Put Teflon tape over the aluminum probe tips to prevent damage to the tank panel skins. With lucite or phenolic probe tips, you do not need to use Teflon tape.
 - (b) Put the probe in the probe holder (see Figure 3).
 - (c) Put the probe on the reference standard in position A (the good area on the disbond side) and balance the instrument as referenced in the following instructions:
 - 1) Switch the display to the Y-T mode. Position the Time/Div control to display 6 to 10 complete cycles (see Figure 6).
 - 2) Position the gate marker on the third cycle. Use the phase control to do this (see Figure 6).
 - 3) Switch the display to the X-Y mode.



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- 4) Move the probe over the artificial disbond. The dot must move in an up direction. Adjust the amplitude control to make sure that there is a vertical deflection of at least five divisions. More adjustment of the phase control can be necessary to get the correct response (see Figure 7).
- 5) Put the probe on the opposite side of the reference standard in an area away from the artificial defect. Move the probe over the artificial defect. The dot must move in a down direction. (On some reference standards, the dot can move in an up direction.)
- 6) Make small adjustments to the gain and the phase control as needed to get a minimum disbond signal separation of two graduation marks with the probe over the near side disbond or the far side disbond (see Figure 7).

5. Inspection Procedures

- A. Do the Bond Inspection for the near side and the far side disbonds from the external surface of the curved panels (see Figure 1).
 - (1) Calibrate the instrument as referred to in Paragraph 4.A.(1) or Paragraph 4.A.(2).
 - (2) Put the probe and the probe holder in their positions on the panel that is to be examined (see Figure 1 and Figure 8).
 - (3) Do a scan of the external side of the panel as follows: Move the probe across the panel, in one inch increments, as shown in Figure 8.
 - (4) A fast meter deflection is a possible disbond indication. Careful inspection of the unsatisfactory area must be done again.

NOTE: Make sure that the probe stays in tight contact with the panel during the inspection.

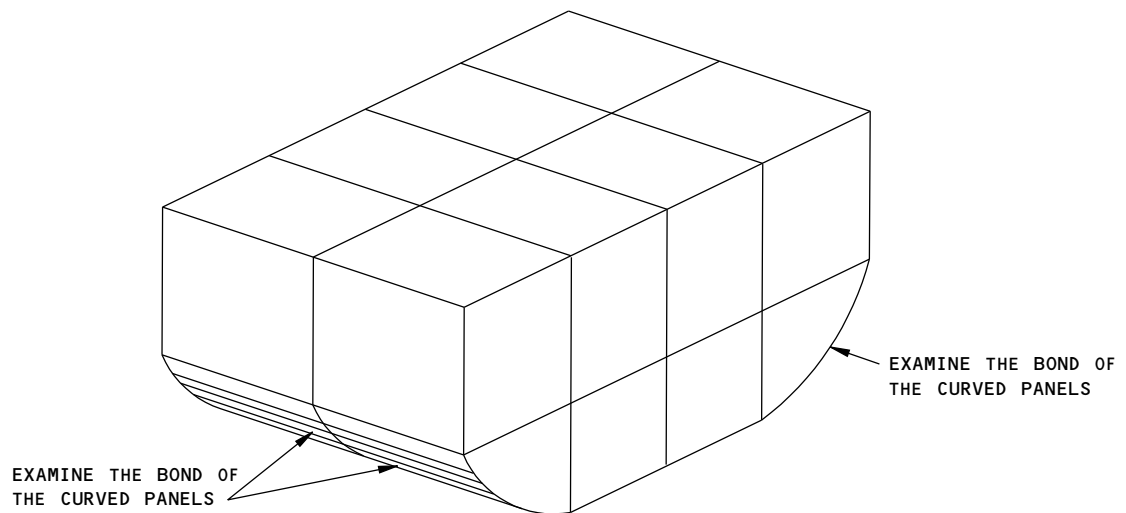
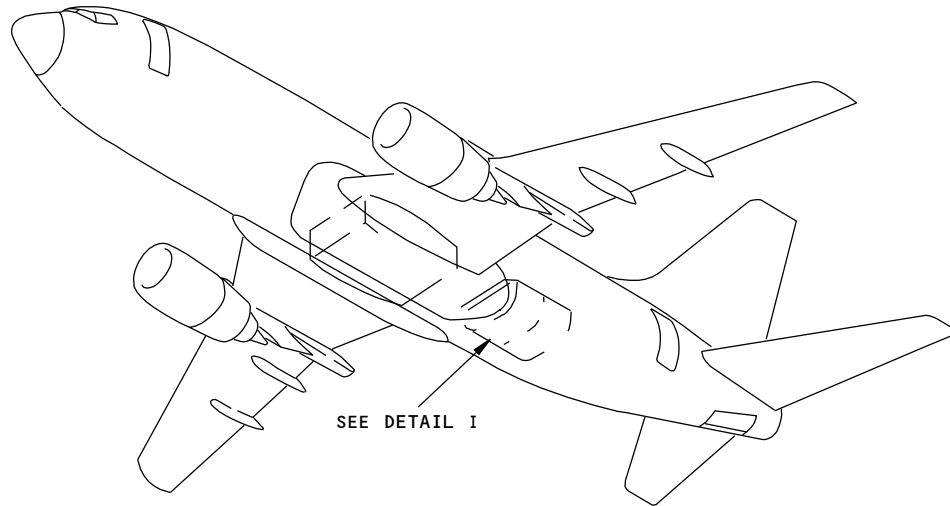
NOTE: You cannot do a scan with some instrument and probe combinations. In this case, position the probe again and again until the panel is examined.

6. Inspection Results

- A. All evidence of disbond that are indicated by a fast meter movement or dot movement, as specified in the calibration procedure is cause for the panel to be replaced.
- B. Auxiliary fuel tanks, which have a disbonded panel or panels, must be disconnected and not used until panel replacements are made.



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DETAIL I

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Areas of Inspection for Curved Panels
Figure 1

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TANKS

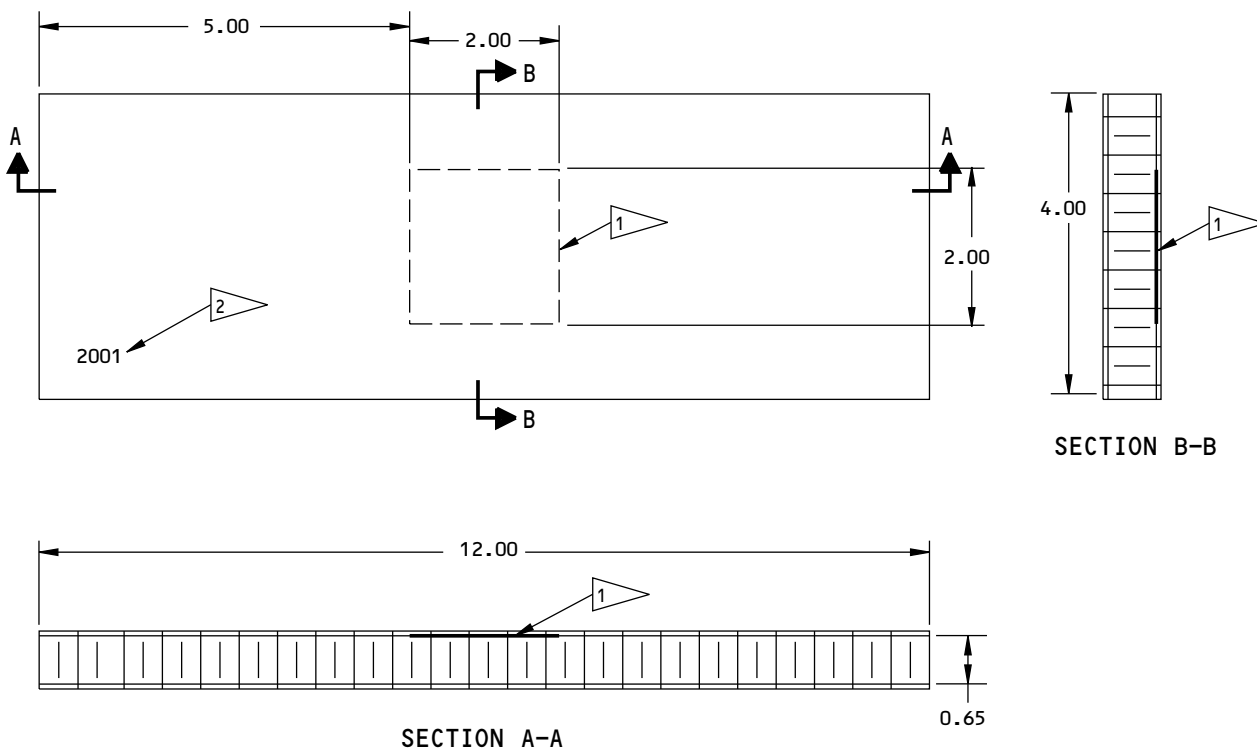
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NOTES

- ALL DIMENSIONS ARE IN INCHES
- MATERIAL: FACE SHEETS ARE 0.050 THICK 2024-T3 OR 7075-T6. 0.65 ALUMINUM HONEYCOMB CORE, BMS 4-4, TYPE 3-30N. ADHESIVE, BMS 5-51, TYPE II, CLASS 2, GRADE 15. PRIMER, BMS 5-89
- BOND AS REFERENCED IN BAC5514-551
- PART IS AVAILABLE FROM THE BOEING COMPANY
- TOLERANCE: X.XXX ± 0.001
X.XX ± 0.015
X.X ± 0.1

- 1 SIMULATED DISBOND CREATED BY 2 PLIES OF FEP 2 X 2 X 0.002 PER PLY.
- 2 ETCH 2001 AT THIS LOCATION

2157580 S0000471108_V1

Reference Standard 2001
Figure 2

EFFECTIVITY
ALL; 737 AIRPLANES WITH AUXILIARY FUEL
TANKS

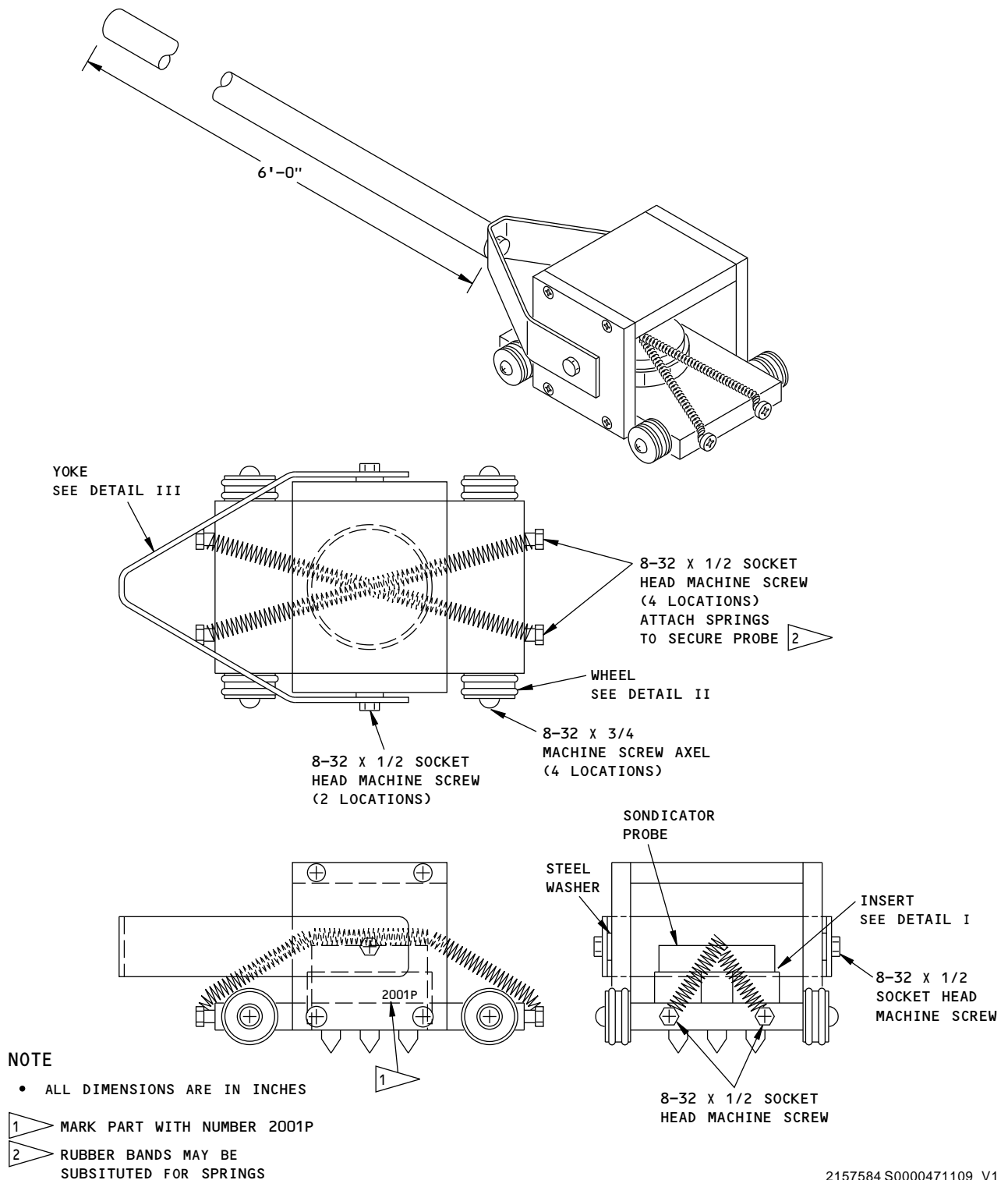
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Sondicator Probe Positioner
Figure 3 (Sheet 1 of 3)

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ALL; 737 AIRPLANES WITH AUXILIARY FUEL
TANKS

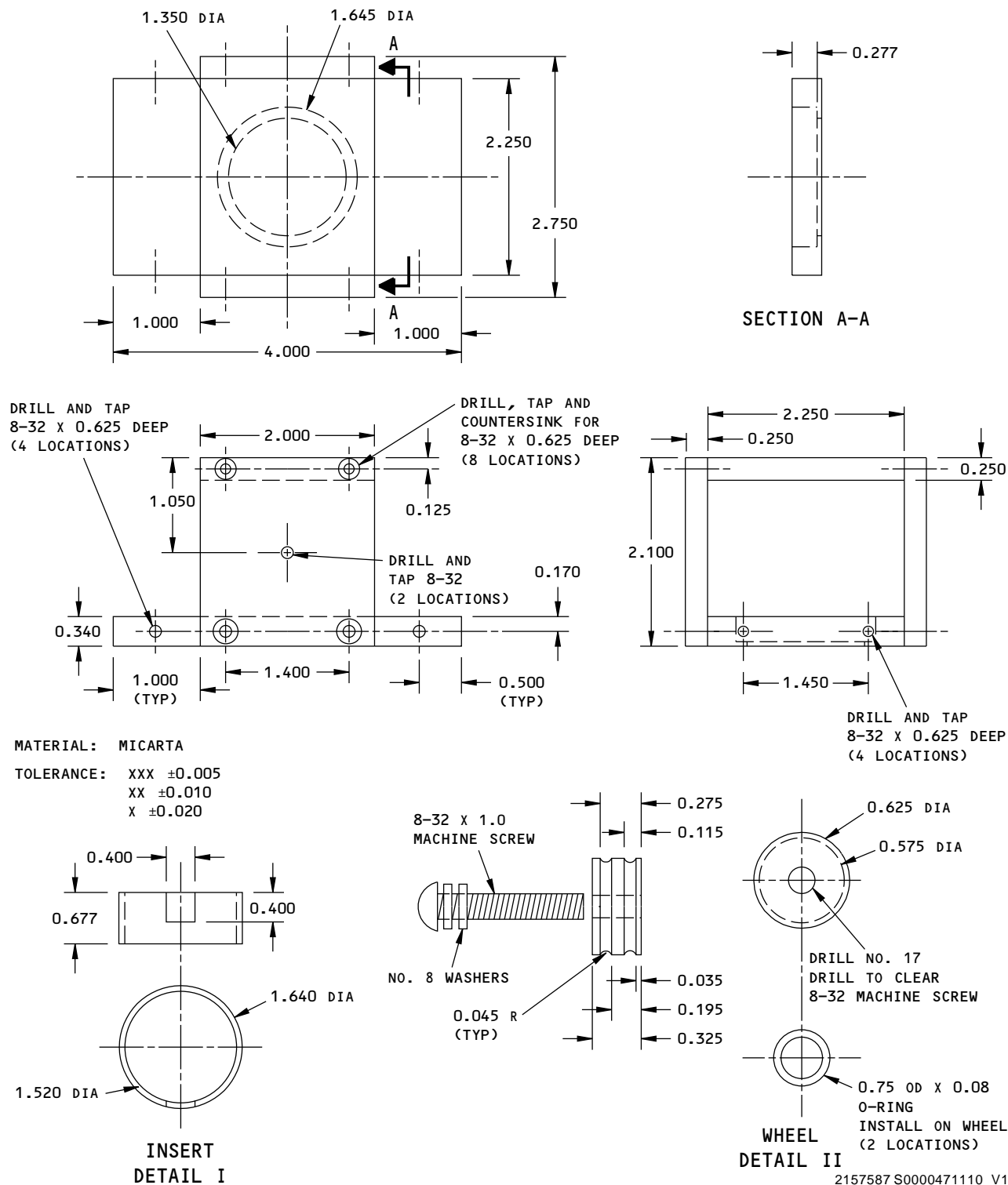
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**Sondicator Probe Positioner
Figure 3 (Sheet 2 of 3)**

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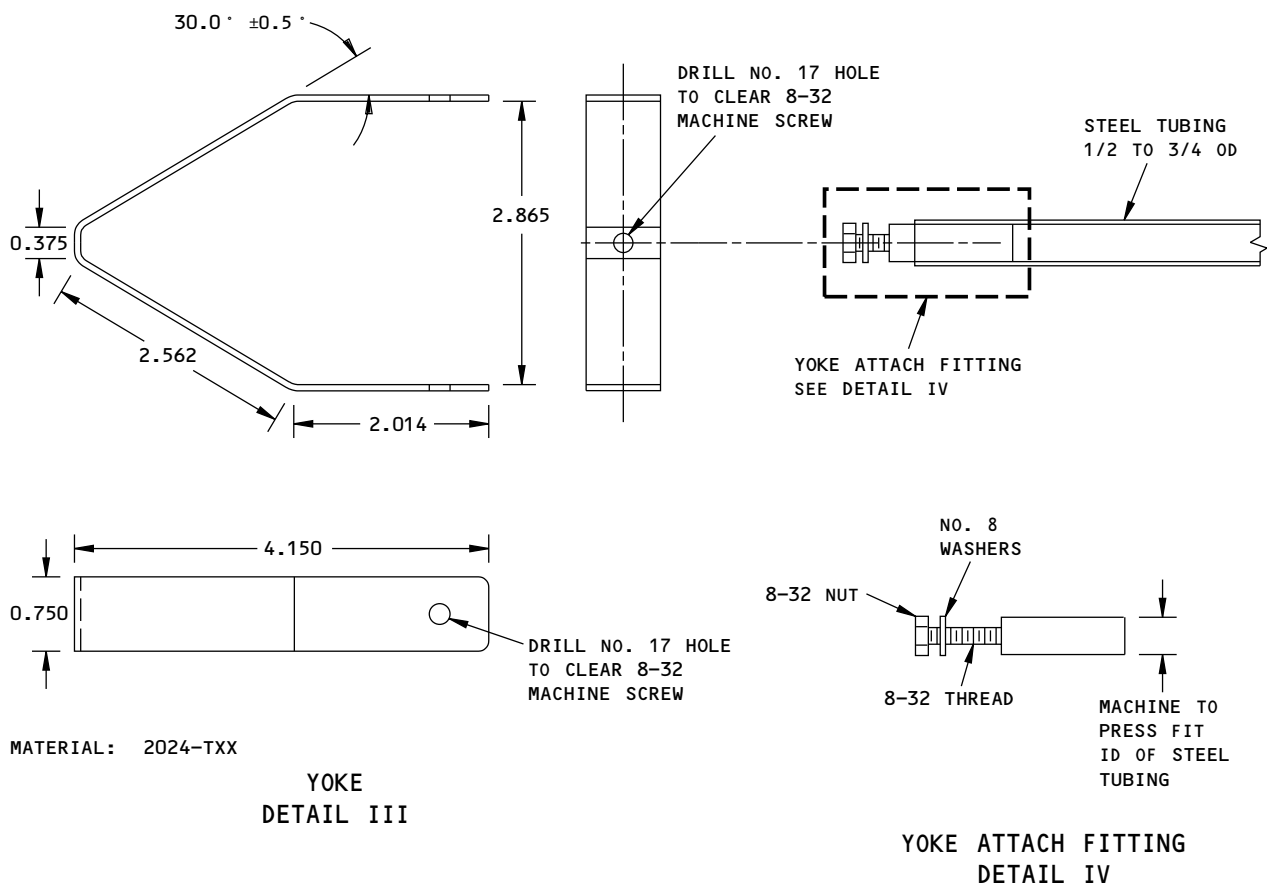
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**Sondicator Probe Positioner
Figure 3 (Sheet 3 of 3)**

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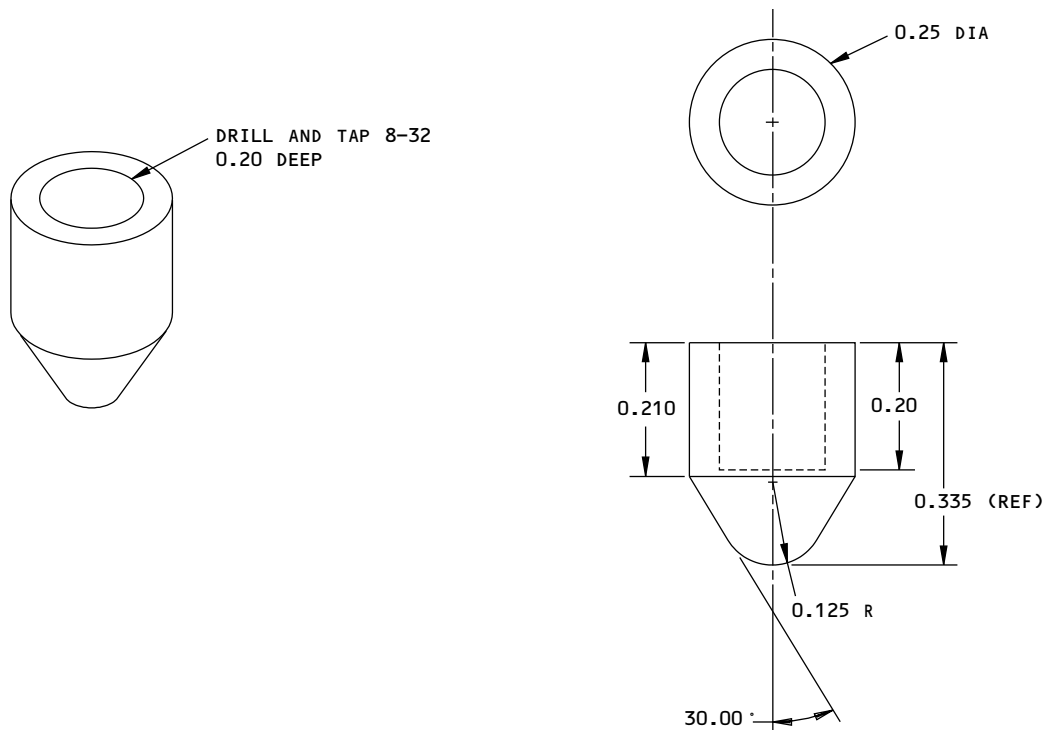
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NOTES

- ALL DIMENSIONS ARE IN INCHES
- MATERIAL: 0.25 DIA PHENOLIC
LUCITE (OPT)
2024-TXX (ANY HEAT TREAT) (OPT)
- TOLERANCE: XXX ± 0.005
XX ± 0.010
X ± 0.020

2157590 S0000471112_V1

Sondicator Probe Tip
Figure 4

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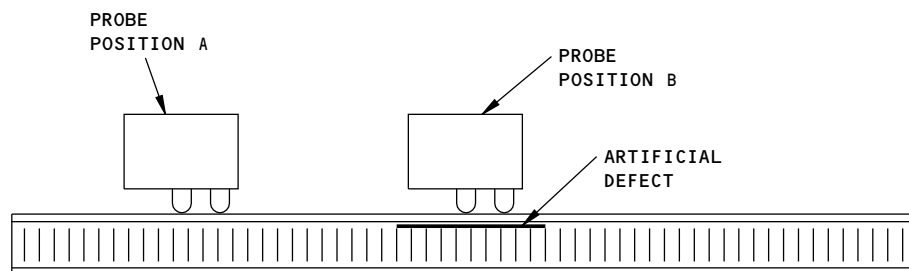
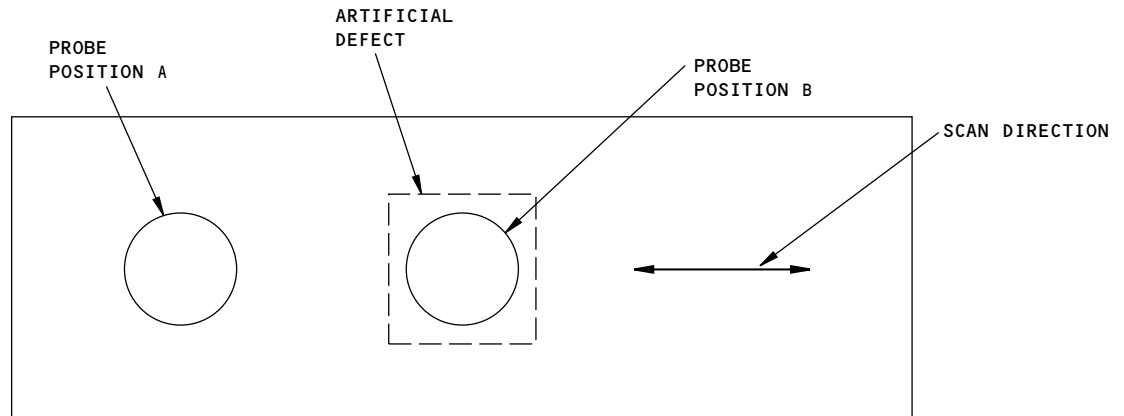
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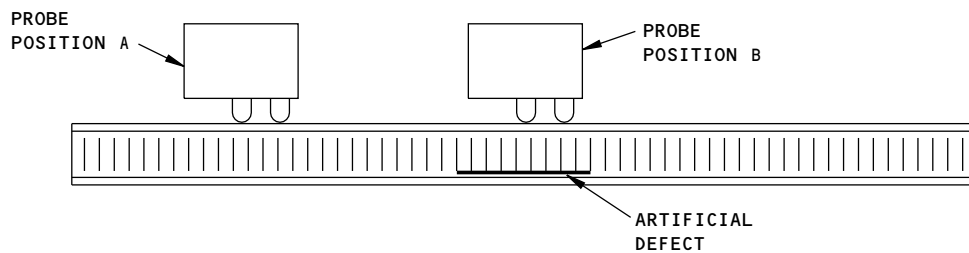
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CALIBRATE FOR NEARSIDE DEFECT



CALIBRATE FOR FAR SIDE DEFECT

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Instrument Calibration - Sondicator Probe Shown
Figure 5

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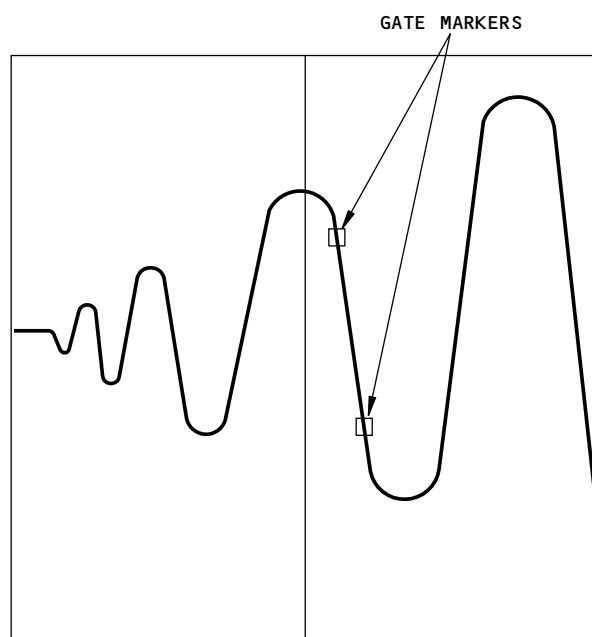
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Y-T Mode
Figure 6

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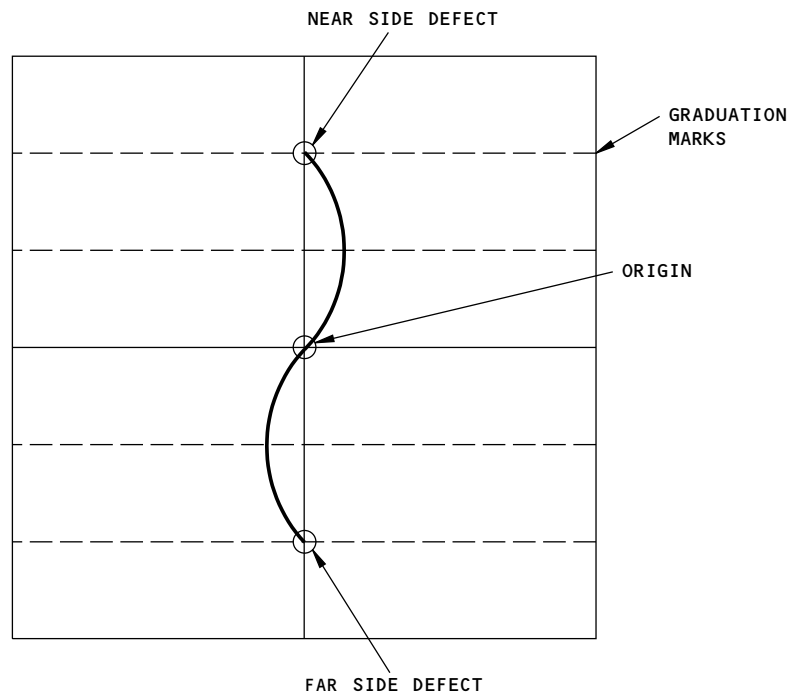
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X-Y Mode
Figure 7

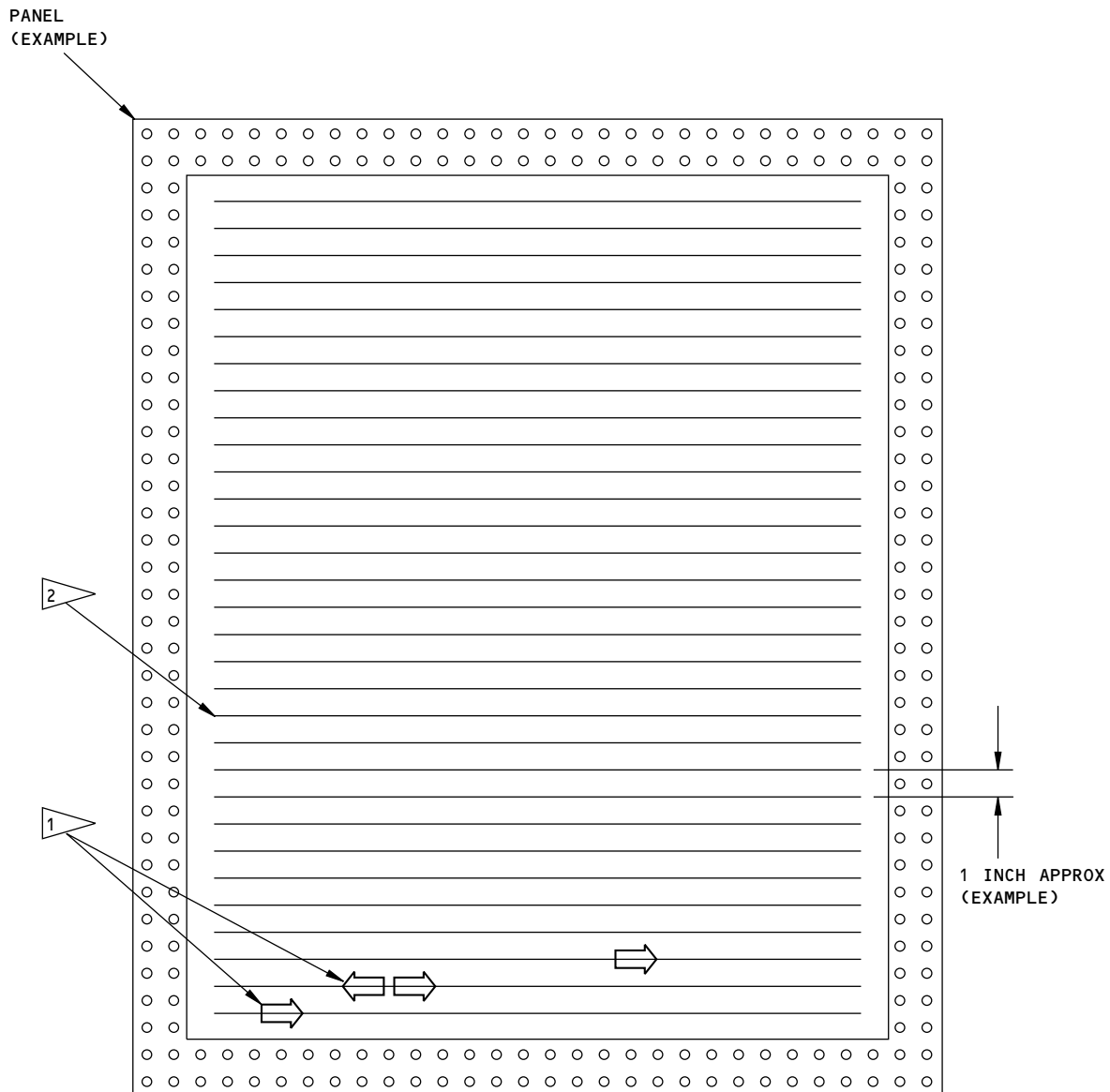
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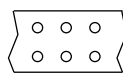


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-  AREA OF FASTENERS;
AREA OF FASTENERS IS NOT EXAMINED
DURING THIS PROCEDURE.
-  PROBE TRAVEL DIRECTION IS OPTIONAL
-  LINES SHOW PROBE LINES OF TRAVEL

2157594 S0000471116_V1

Procedure and Area to do a Scan of a Panel
Figure 8

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PART 4 - ULTRASONIC

AUXILIARY FUEL TANK BOND INSPECTION - INTERNAL AND EXTERNAL SURFACES

1. Purpose

- A. To find disbonded skins on the aluminum honeycomb panels of the auxiliary fuel tanks. This inspection is done with a single-sided ultrasonic bond test procedure on both the internal and external surfaces of the fuel tank. This procedure will find near side disbonds 2 x 2 inches in area on the honeycomb panel face sheet. It is not necessary to remove the tank from the aircraft, but it is necessary to remove the bladder cell. The curved panels on the sides of the tank need no inspection with this procedure if they were examined before as referred to in Part 4, 28-10-01.
- B. Service Bulletin Reference: 737-28-1088

2. Equipment

- A. The equipment listed below was used to prepare this procedure. Other equipment can be used if equivalent disbond indications can be shown on the reference standard.
 - (1) Bond Test Instrument
 - (a) Sondicator S-5 with probe Part No. S-P-3 or S-3 with standard probe tips; Zetec, Inc.
 - (b) Sondicator S-2B with probe Part No. S-P-3 or S-3 with standard probe tips; Zetec, Inc.

NOTE: Do not use aluminum, lucite or phenolic tips with this inspection because they can give irregular results.
 - (2) Reference Standard 2005
 - (a) See Figure 2. This part is available from The Boeing Company.
 - (3) Long-Reach Probe Positioner Part No. 2001P; Ideal Specialty, Inc.
 - (a) See Figure 4. This positioner is made to fit the Sondicator probe, Part No. S-P-3 or S-3. It is possible to make a change to the probe positioner if other probes are used.

NOTE: Most of the panels can have this inspection done on them without the use of the probe positioner.

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

3. Prepare for the Inspection

- A. Drain the auxiliary fuel tanks.
 - B. Remove the cargo lining panels to get access to the aft end of the auxiliary tank.
 - C. Remove the bladder cell as referred to by the 737 Maintenance Manual, 28-14-21.
 - D. Clean the surfaces of the inspection area. Visually examine the internal and external surfaces of the panels for signs of cracks or stress. See Figure 1.
 - E. Make sure that the probe can reach all of the areas of the inspection for the tank.
- NOTE:** If a long-reach probe positioner is not available or is too short, move the auxiliary tank if necessary as follows:
- (1) Disconnect the external plumbing and electrical connections.
 - (2) Lower the tank structure.
 - (3) Move the tank aft on ball mat rollers or the equivalent.



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4. Instrument Calibration

NOTE: The calibration procedures that follow will find nearside disbonds on the surfaces of the panels.

A. Calibration procedure for the Sondicator S-2B and S-5.

NOTE: Make sure that the probe tips are on tight and in good condition.

- (1) Put the probe in the long-reach probe positioner, if the positioner is to be used. See Figure 4.
- (2) Set the amplitude dial between 2.0 and 5.0 and set the phase dial to 0.0.

NOTE: Start with amplitude dial at 2.0. If the instrument cannot be calibrated at this setting, then increase the amplitude dial setting within the above range.

- (3) Put the probe on a bonded (good) area on the reference standard. See Figure 3, Position 1.
- (4) Slowly turn the phase dial clockwise and look for an upscale needle movement on the phase meter.
- (5) Continue to turn the phase dial clockwise and look for a sudden decrease in the phase needle.
- (6) Continue to turn the phase dial clockwise and look for an increase and then one more sudden decrease in the phase needle. When this sudden decrease occurs, stop the phase dial turns.
- (7) Quickly move the probe rearward and forward within a two-inch area on a good area of the reference standard. See Figure 3, Position 1.
NOTE: The fast probe movement is not to be done during the inspection. It is done during the calibration only to help remove disbond indications that show in a good area.
- (8) Monitor the phase meter while you do the above step. If the phase meter moves more than 10 percent full scale, then move the probe and slowly turn the phase dial clockwise at the same time.
- (9) When the phase needle movement is less than 10 percent full scale, then stop the dial turns and the movement of the probe.
- (10) Slowly do a scan with the probe over the disbond area on the standard. See Figure 3, Position 2.
- (11) Look for a sudden upscale movement of the phase needle of 70 percent full scale or greater.
- (12) A phase needle movement of 70 percent full scale or greater must be shown. If this is not done, then calibrate the instrument again at a different amplitude setting on the dial.

NOTE: The amplitude meter is to be ignored during the calibration and inspection.

5. Inspection Procedure

- A. Calibrate the instrument as referred to in Paragraph 4.A.
- B. Put the probe on the location on the panel that the inspection is to be done. (Use the probe positioner only if necessary). See Figure 1 and Figure 5.
- C. Do a scan of the two sides on the panel as follows: Move the probe across the panel, in one inch increments, as shown in Figure 5.
- D. Fast upscale phase meter movements are possible disbond indications. The indications must show as in the calibration. Carefully do an inspection again on the area that showed an indication.
- E. Do a calibration check after every panel is examined to make sure the equipment is calibrated as in Paragraph 4.

6. Inspection Results

- A. A fast upscale meter movement, as shown in the calibration procedure is a disbond indication.

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- B. Auxiliary fuel tanks, which have disbonded panel(s), must be disconnected and not used until panel replacements are made.

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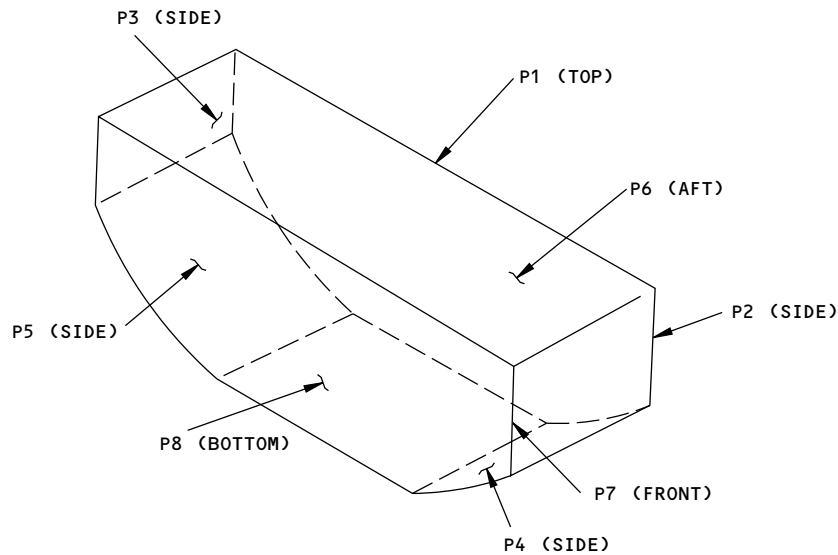
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NOTES

- DO AN INSPECTION ON ALL HONEYCOMB PANELS ON BOTH THE INTERNAL AND EXTERNAL SURFACES OF THE TANK FOR SIGNS OF DISBONDING.
- YOU DO NOT NEED TO DO AN INSPECTION ON CURVED PANELS P4 AND P5 IF AN INSPECTION WAS DONE BEFORE WITH THE USE OF PART 4, 28-10-01.
- IT IS NOT NECESSARY TO DISASSEMBLE THE TANKS TO DO THE INSPECTION. BLADDER CELL REMOVAL IS NECESSARY.

390 GALLON TANK

2157595 S0000471121_V2

Bond Inspection Areas
Figure 1 (Sheet 1 of 3)

EFFECTIVITY
ALL; 737 AIRPLANES WITH AUXILIARY FUEL
TANKS

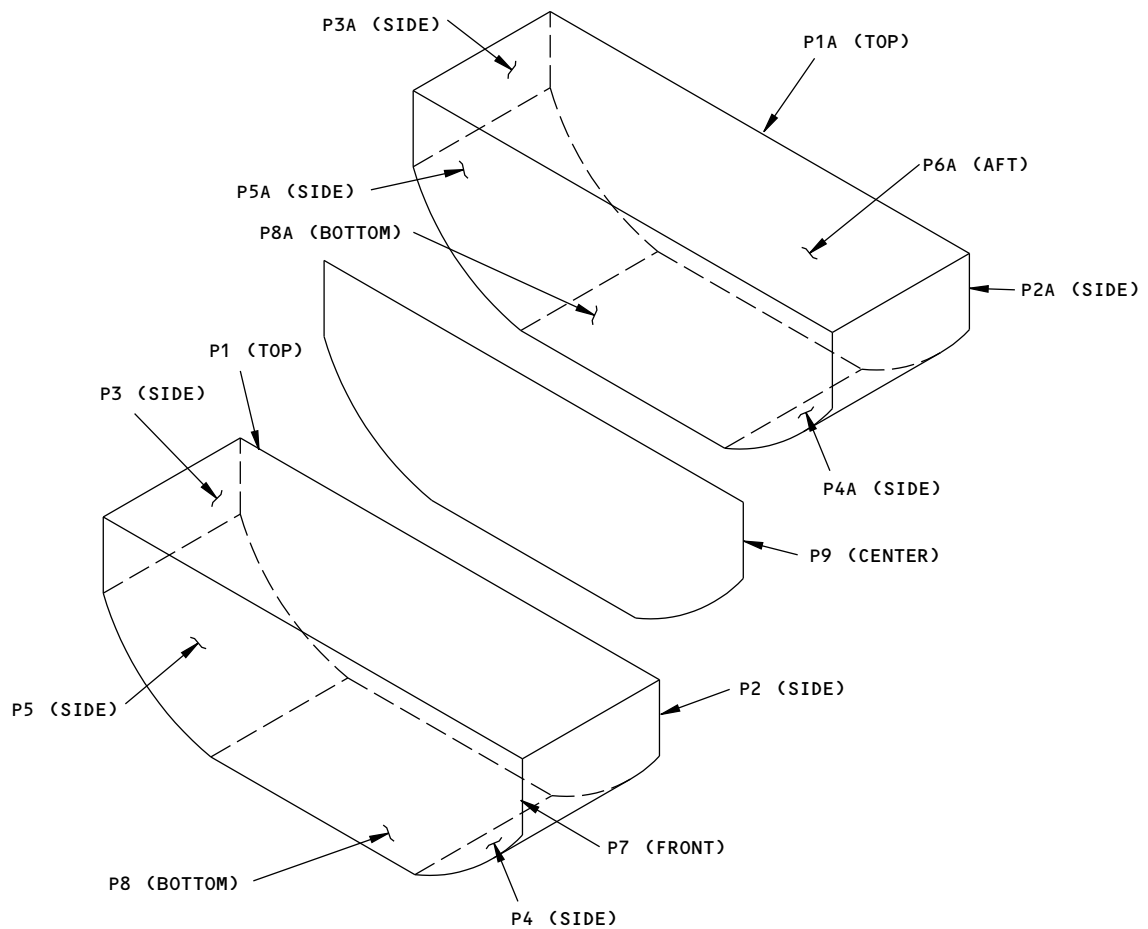
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NOTES

- DO AN INSPECTION ON ALL HONEYCOMB PANELS ON BOTH THE INTERNAL AND EXTERNAL SURFACES OF THE TANK FOR SIGNS OF DISBONDING. DO NOT DO AN INSPECTION ON PARTITION PANEL P9.
- YOU DO NOT NEED TO DO AN INSPECTION ON CURVED PANELS P4, P4A, P5, AND P5A IF AN INSPECTION WAS DONE BEFORE WITH THE USE OF PART 4, 28-10-01.
- IT IS NOT NECESSARY TO DISASSEMBLE THE TANKS TO DO THE INSPECTION. BLADDER CELL REMOVAL IS NECESSARY.

810 AND 860 GALLON TANK

2157596 S0000471122_V2

**Bond Inspection Areas
Figure 1 (Sheet 2 of 3)**

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ALL; 737 AIRPLANES WITH AUXILIARY FUEL
TANKS

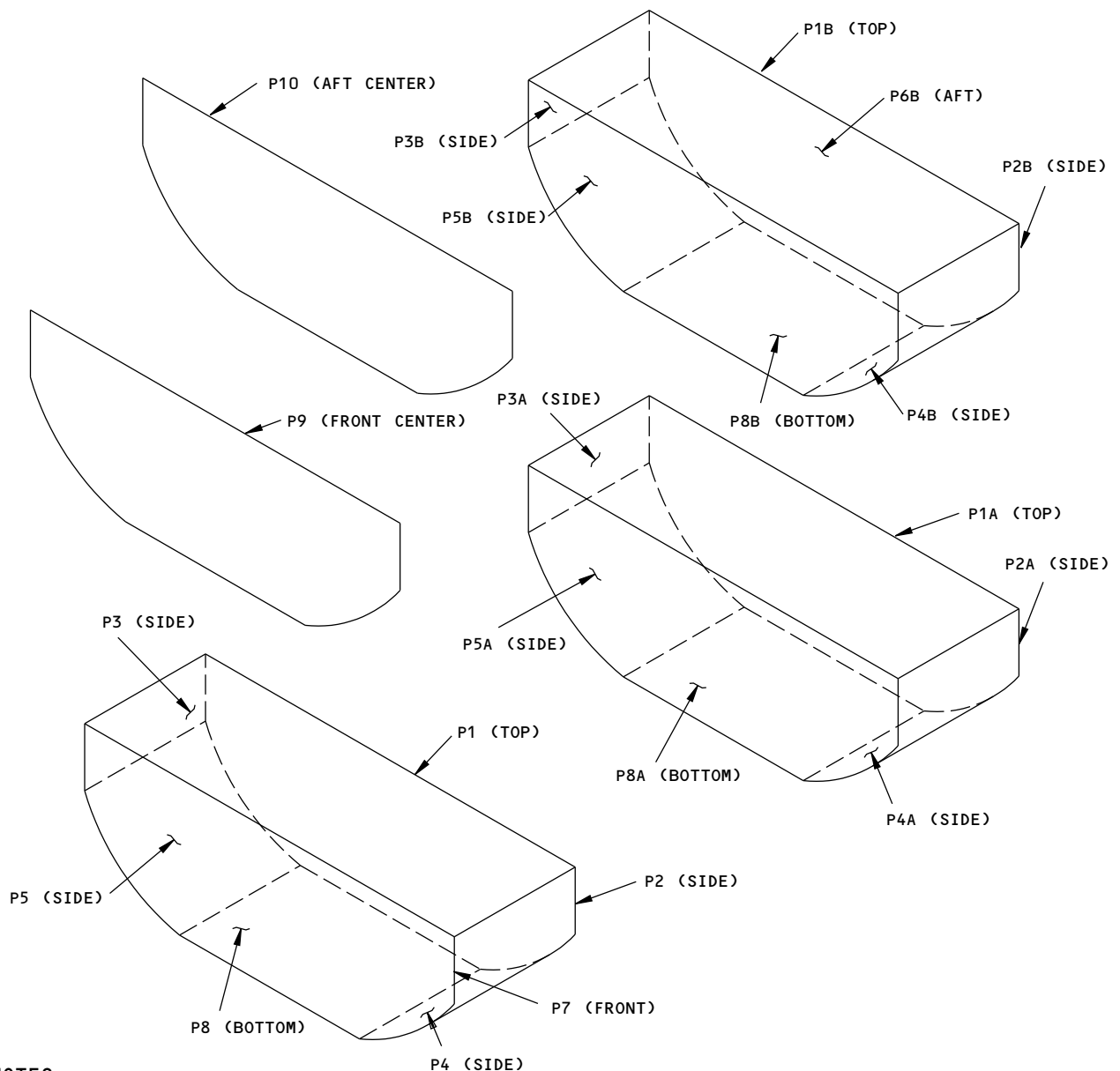
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NOTES

- DO AN INSPECTION ON ALL HONEYCOMB PANELS ON BOTH THE INTERNAL AND EXTERNAL SURFACES OF THE TANK FOR SIGNS OF DISBONDING. DO NOT DO AN INSPECTION ON PARTITION PANELS P9 AND P10.
- YOU DO NOT NEED TO DO AN INSPECTION ON CURVED PANELS P4, P4A, P4B, P5, P5A AND P5B IF AN INSPECTION WAS DONE BEFORE WITH THE USE OF PART 4, 28-10-01.
- IT IS NOT NECESSARY TO DISASSEMBLE THE TANKS TO DO THE INSPECTION. BLADDER CELL REMOVAL IS NECESSARY.

1070 GALLON TANK

2157597 S0000471123_V2

**Bond Inspection Areas
Figure 1 (Sheet 3 of 3)**

EFFECTIVITY
ALL; 737 AIRPLANES WITH AUXILIARY FUEL TANKS

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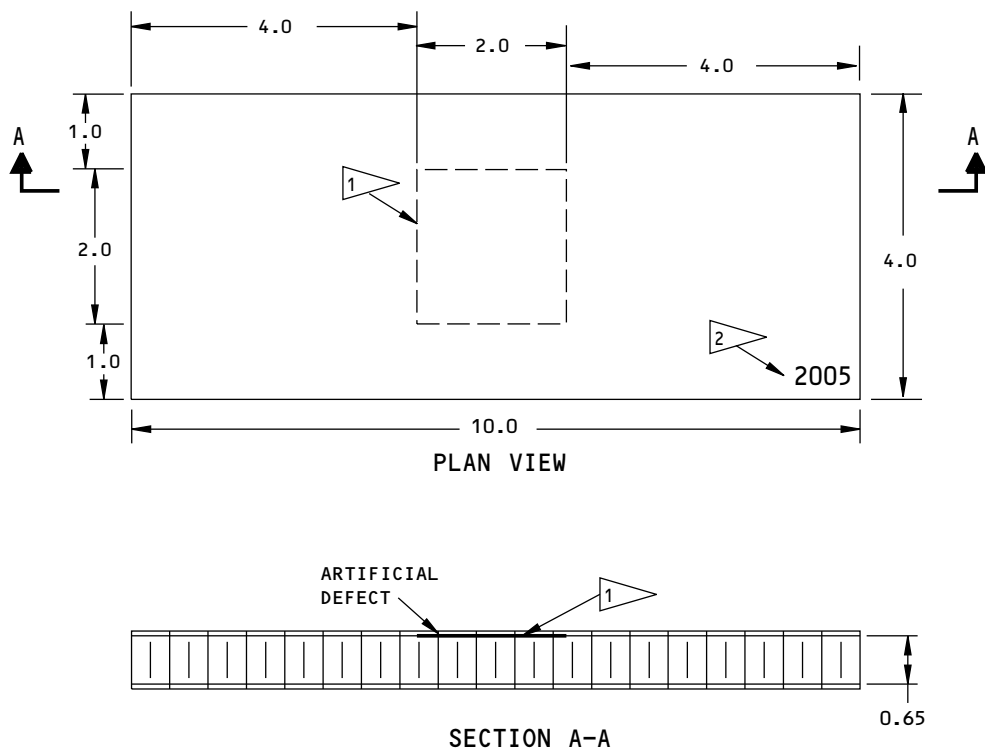
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NOTES

- ALL DIMENSIONS ARE IN INCHES
- MATERIAL: FACE SHEETS ARE 0.071 \pm 0.003 INCH THICK, 2024-T3 OR 7075-T6 ALUMINUM. 0.065 ALUMINUM CORE, BMS 4-4, TYPE 3-30N. ADHESIVE - BMS 5-51, TYPE II, CLASS 2, GRADE 15. ADHESIVE PRIMER - BMS 5-89
- BOND PER BAC5514-551
- TOLERANCE: X.XXX \pm 0.001
X.XX \pm 0.015
X.X \pm 0.1

- 1 SIMULATED DISBOND CREATED BY 2 PLIES OF FEP 2 X 2 X 0.002 PER PLY.
- 2 ETCH 2005 AT THIS LOCATION

2157599 S0000471124_V1

Reference Standard 2005
Figure 2

EFFECTIVITY
ALL; 737 AIRPLANES WITH AUXILIARY FUEL
TANKS

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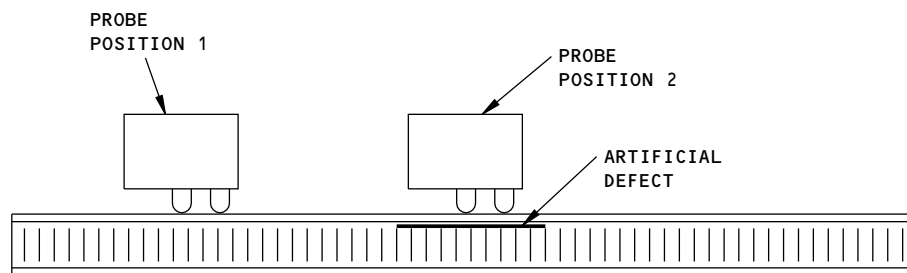
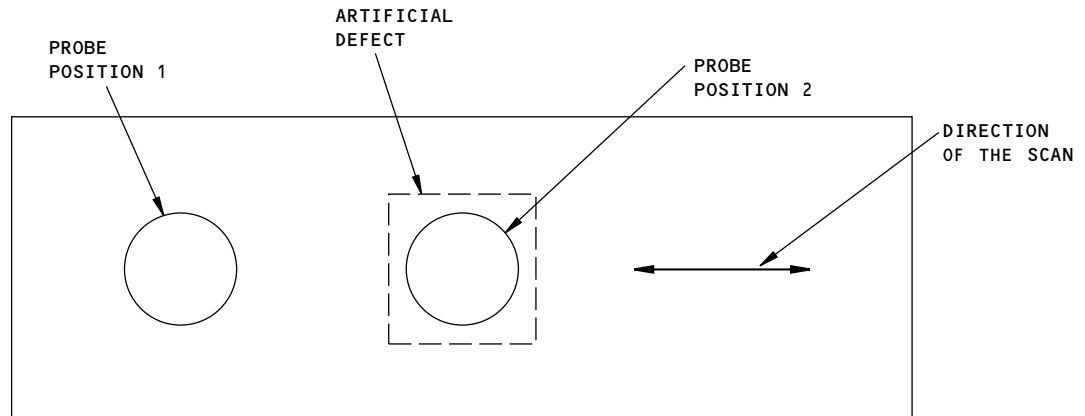
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CALIBRATE FOR NEAR SIDE DEFECT

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Instrument Calibration - Probe Locations
Figure 3

EFFECTIVITY
ALL; 737 AIRPLANES WITH AUXILIARY FUEL
TANKS

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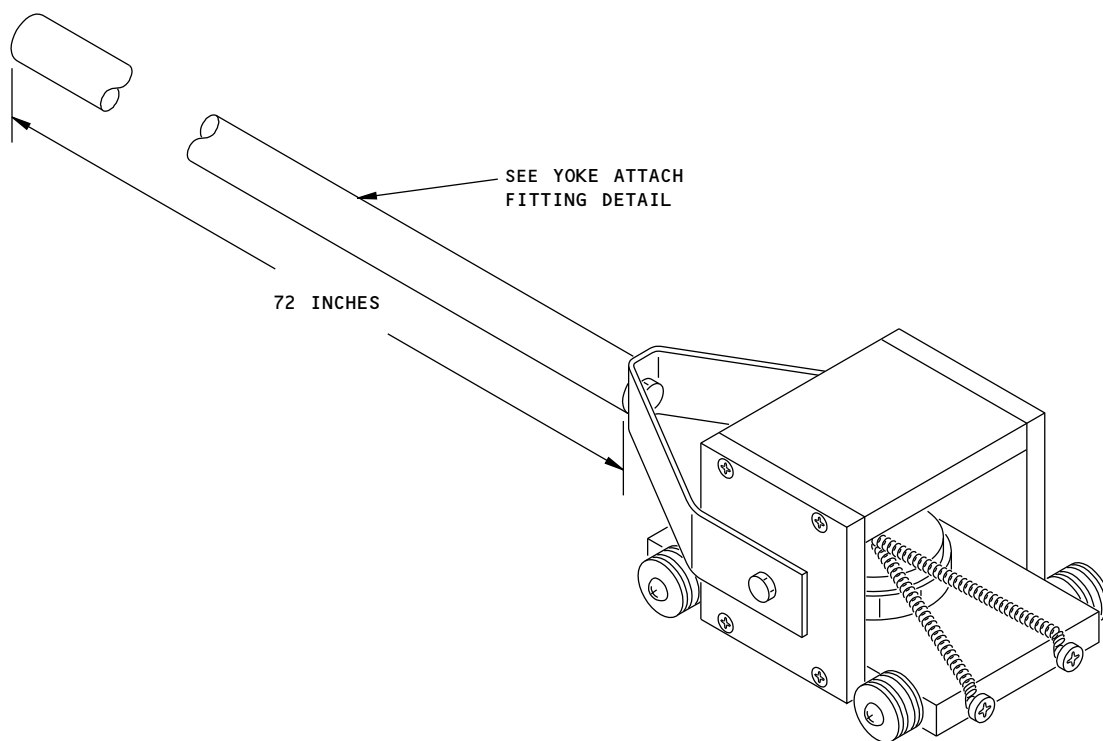
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2157602 S0000471126_V1

Sondicator Probe Positioner Assembly
Figure 4 (Sheet 1 of 5)

EFFECTIVITY
ALL; 737 AIRPLANES WITH AUXILIARY FUEL
TANKS

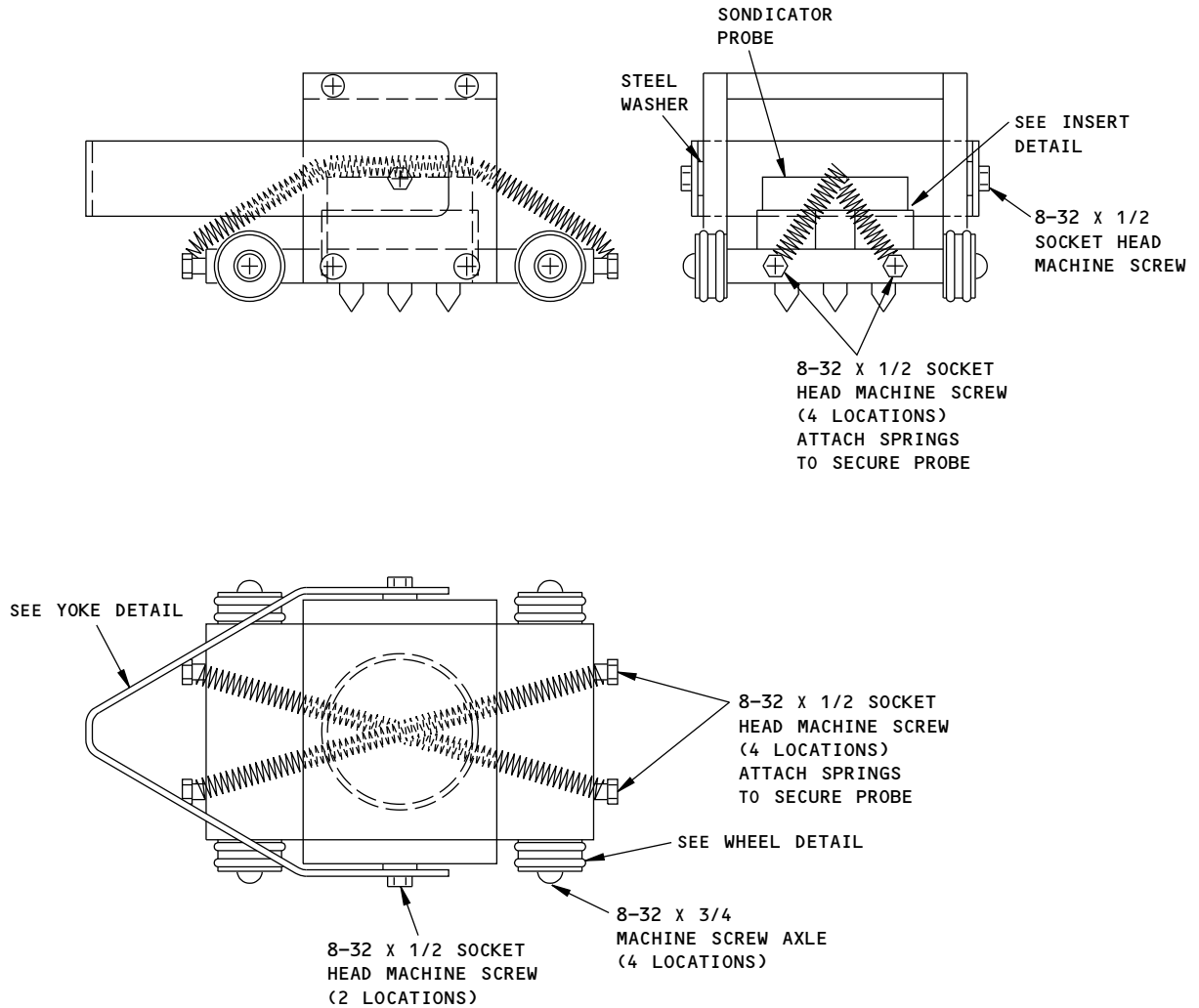
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737
NON-DESTRUCTIVE TEST MANUAL



2157603 S0000471127_V1

Sondicator Probe Positioner Assembly
Figure 4 (Sheet 2 of 5)

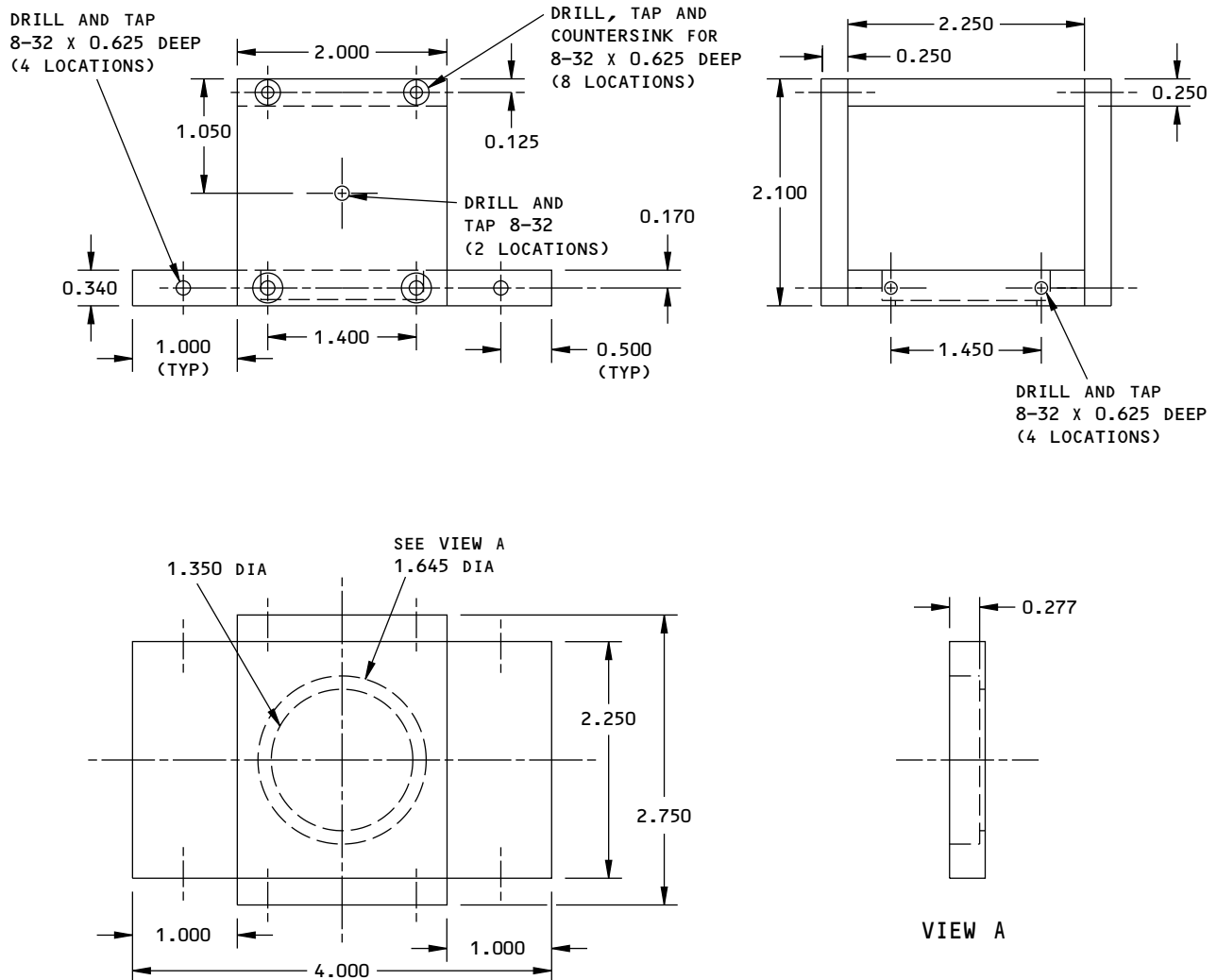
EFFECTIVITY
ALL; 737 AIRPLANES WITH AUXILIARY FUEL TANKS

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NOTES

- ALL DIMENSIONS ARE IN INCHES
- MATERIAL: MICARTA
- TOLERANCE: XXX ± 0.005
XX ± 0.010
X ± 0.020

2157605 S0000471128_V1

**Sondicator Probe Positioner Assembly
Figure 4 (Sheet 3 of 5)**

EFFECTIVITY
ALL; 737 AIRPLANES WITH AUXILIARY FUEL
TANKS

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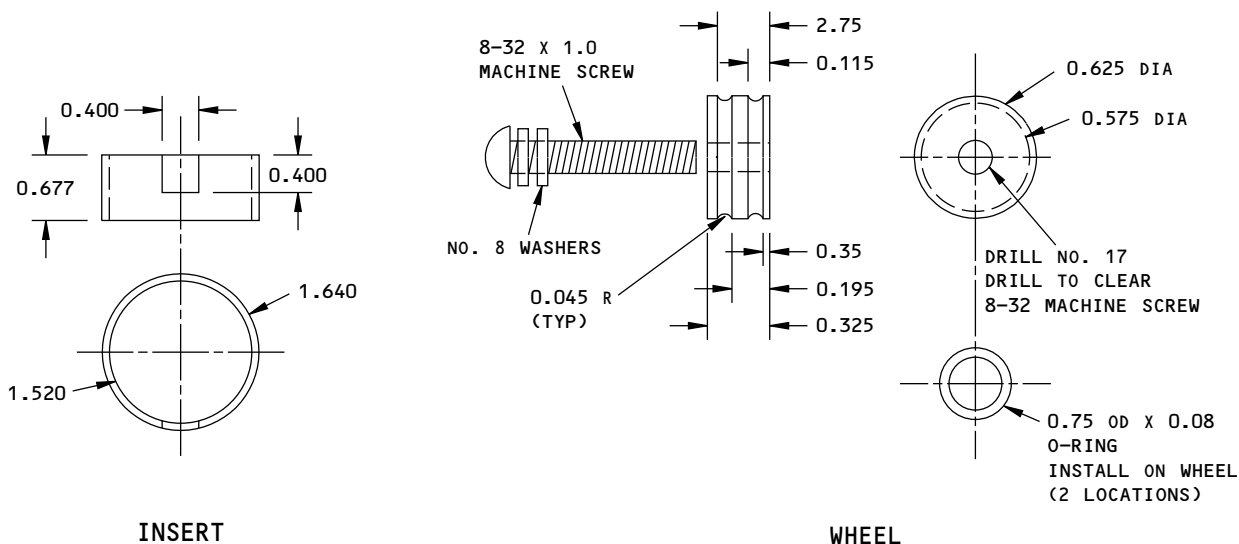
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NON-DESTRUCTIVE TEST MANUAL



NOTES

- ALL DIMENSIONS ARE IN INCHES
- MATERIAL: MICARTA
- TOLERANCE: XXX ± 0.005
XX ± 0.010
X ± 0.020

2157606 S0000471129_V1

Sondicator Probe Positioner Assembly
Figure 4 (Sheet 4 of 5)

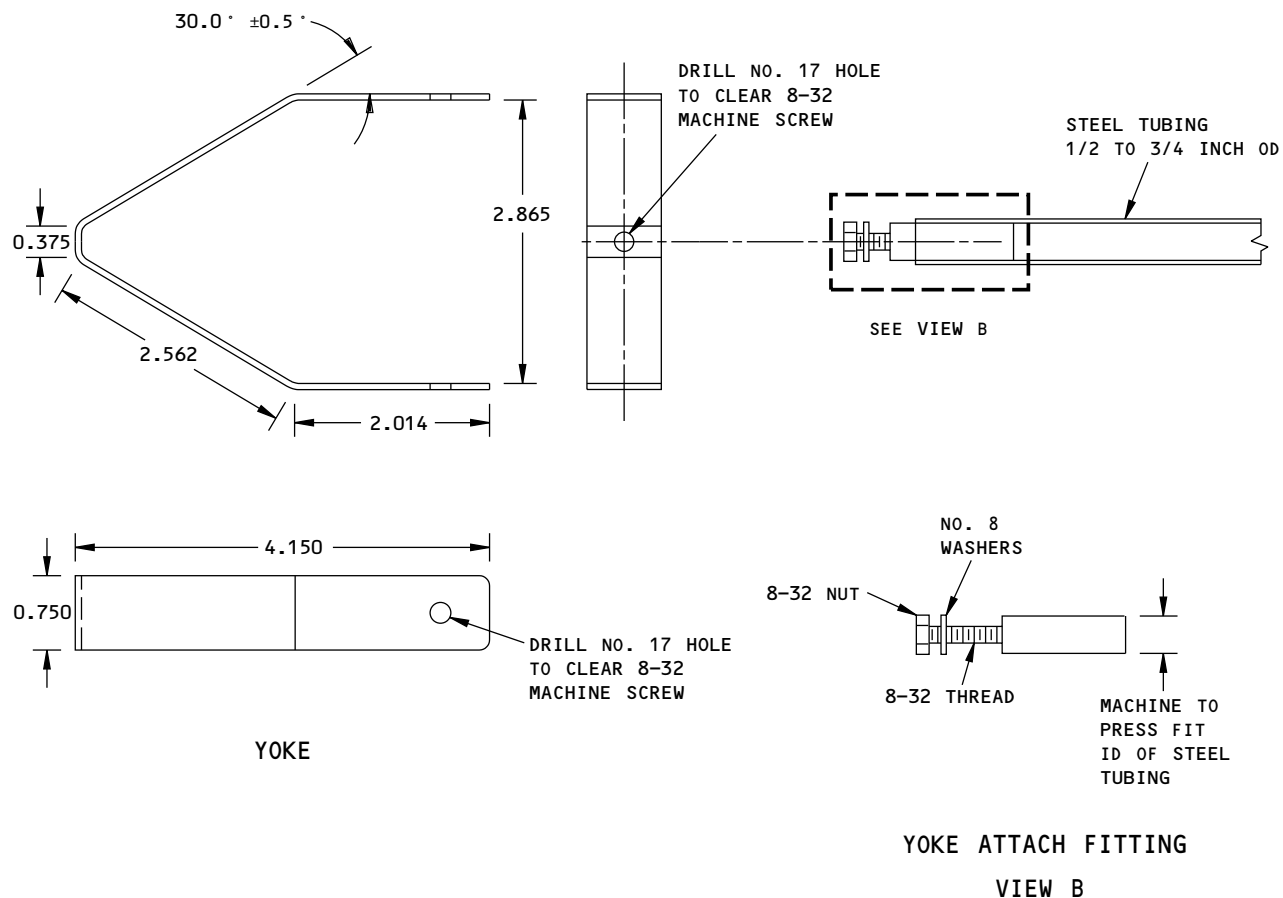
EFFECTIVITY
ALL; 737 AIRPLANES WITH AUXILIARY FUEL
TANKS

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NOTES

- ALL DIMENSIONS ARE IN INCHES
- MATERIAL: 2024-TXX
- TOLERANCE: XXX ±0.005
XX ±0.010
X ±0.020

2157607 S0000471130_V1

Sondicator Probe Positioner Assembly
Figure 4 (Sheet 5 of 5)

EFFECTIVITY
ALL; 737 AIRPLANES WITH AUXILIARY FUEL
TANKS

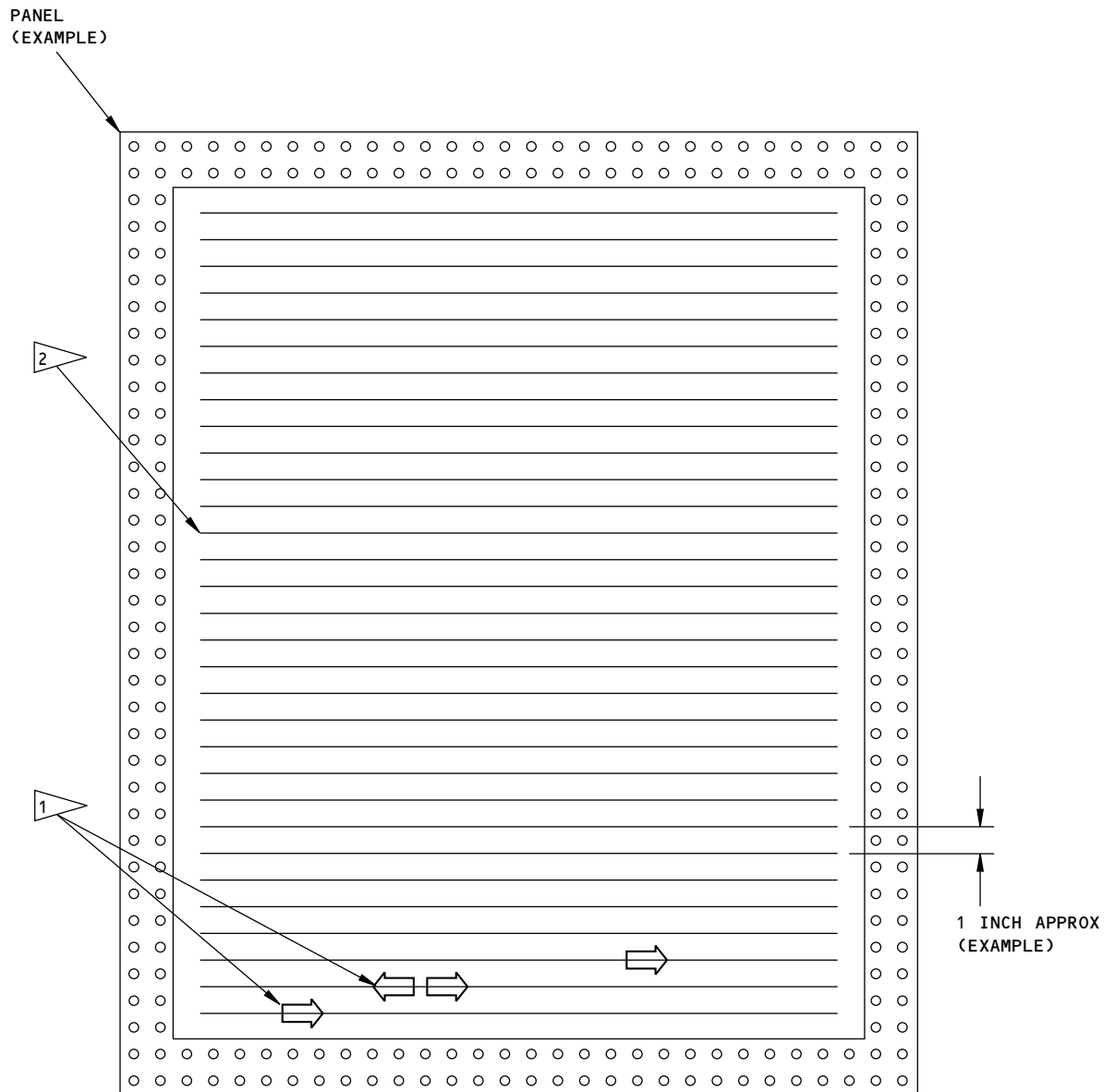
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
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 AREA OF FASTENERS;
 AREA OF FASTENERS IS NOT EXAMINED
 DURING THIS PROCEDURE.


 PROBE TRAVEL DIRECTION IS OPTIONAL


 LINES SHOW PROBE LINES OF TRAVEL

2157610 S0000471131_V1

Procedure and Area to do a Scan of a Panel
Figure 5

EFFECTIVITY
ALL; 737 AIRPLANES WITH AUXILIARY FUEL TANKS

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