EFFECTIVITY
MODEL: ALL SERVICE BULLETIN REFERENCE: 707-2962 727-53-72, 737-53-1039

PART 6 - EDDY CURRENT

COUNTERSINK INSPECTION OF ALUMINUM PARTS (METER DISPLAY)

1. Purpose

   A. To find the cracks that extend across the countersink surface after the fasteners have been removed. Refer to Detail I for an illustration of a usual crack.

   B. Part 6, 53-30-00, Fig. 3 or 4 can be used as an alternative to this procedure.

2. Equipment

   A. A countersink probe which can operate between 100 and 500 KHz is necessary for this procedure. All metered instrument and probe combinations that meet the calibration requirements of this procedure can be used.

   The following equipment was used to make this procedure:

   (1) Instrument

   (a) MIZ-10B, Zetec, Inc.

   (b) Locator UH, Hocking Instruments

   (2) Probe - Countersink Probe and Collar

   (a) Use a probe that:

   1) Operates at a frequency range of 100 to 500 kHz.

   2) Has an external diameter that fits in the countersunk hole that is shown in Details IV or V or the counterbore hole that is shown in Detail VI.

   NOTE: A 100 degree countersunk probe can be used in the counterbore hole shown in Detail VI.

   (b) The probes specified below were used to prepare this procedure.

   1) CSM-100-10 (0.156 inch diameter);
   CSM-100-12 (0.187 inch diameter)
   CSM-100-14 (0.218 inch diameter)
   CSM-100-16 (0.250 inch diameter)
   NDT Engineering Corp.

   2) VM103C 5/32 (0.156 inch diameter);
   VM103C 3/16 (0.187 inch diameter)
   VM103C 7/32 (0.218 inch diameter)
   VM103C 1/4 (0.250 inch diameter)
   VM Products

(3) Reference Standard

(a) Use reference standard 194 or 194A to do 100-degree countersunk hole inspections. See Details IV or V for data about the reference standards.

(b) Use reference standard NDT194B to do 120-degree counterbore hole inspections. See Detail VI for data about the reference standard.

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

3. Preparation for Inspection

A. Remove the fasteners.

B. Make sure the inspection surface is clean.

NOTE: Be careful not to cause damage to or make the countersink larger when the fasteners are removed. Only deburr and make the surface clean.

4. Instrument Calibration

A. Start the instrument and do the initial adjustments as specified in the manufacturer's instructions.

B. Connect the probe to the instrument and set the frequency between 100 and 500 KHz.

NOTE: The reference standard and the eddy current probe must be the same size as the countersink hole that will be inspected.

C. Put the probe in the countersink hole of the reference standard with the coil installed opposite of the notch. Adjust the probe collar to keep the probe vertical to the reference standard surface. Refer to Detail II.

D. Balance the instrument and adjust the meter signal to 10 percent of the full scale.

E. Put a 0.003 to 0.005 inch (0.007 to 0.013 cm) thick nonconductive shim between the probe coil and the countersink surface of the reference standard.

NOTE: An ordinary piece of writing paper is approximately 0.003 inch thick and can be used as the nonconductive shim during the lift-off adjustments.

F. Adjust the instrument's lift-off or the phase control as specified in the manufacturer's instructions until no needle movement is monitored between the probe coil on the bare surface and when lifted off the surface with a 0.003 to 0.005 inch thick nonconductive shim.

G. Adjust the meter signal to 10 percent of the full scale as specified in par. 4.D.

H. Turn the probe until the coil is above the notch and adjust the instrument sensitivity controls to get a 40 to 60 percent of the full scale signal.

I. Recheck lift-off. If an adjustment is made, do a check of the sensitivity as specified in par. 4.H. and adjust if necessary.

NOTE: The use of an audible or a visual alarm is recommended and can increase the scan speed. Set the alarm to operate to signals that are 80 percent of the reference-standard-notch-signal amplitude.

J. Make a note of the instrument signal as the probe is turned over the notch to find the scan speed.

5. Inspection Procedure

A. Put the probe into the countersink and adjust the probe collar to hold the probe vertical to the surface.

B. Balance the instrument or adjust the meter signal to 10 percent of the full scale.

C. Scan the countersink. The probe must be turned more than 360 degrees to make sure the complete countersink is covered. Keep the probe vertical to the inspection surface during the inspection. Refer to Detail III. Keep a probe scan speed that is almost the same as when the instrument was calibrated in par. 4.

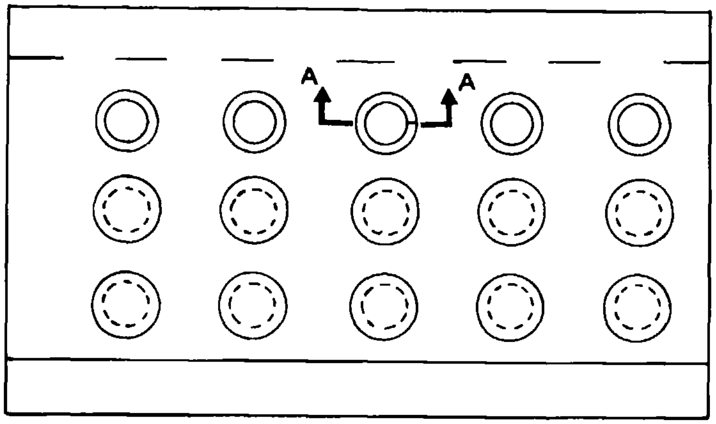
NOTE: The eddy current instrument will show cracks by a rapid meter deflection over a short-probe-scan distance. If the fastener hole is not circular, the eddy current instrument can show a slow meter change over a large-probe-scan distance. This is not a crack indication. Compare all crack indications with the reference-standard-notch signal.

D. At regular times throughout the inspection, do a check of the instrument calibration as specified in par. 4.C. thru 4.I. and adjust if necessary.

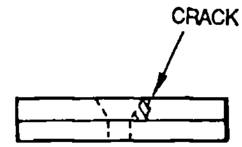
6. Inspection Results

A. All signals that are equal to or more than the reference-standard-notch signal and occur over a short scan distance are possible crack indications.

B. Part 6, 51-00-00, Fig. 4 can be used to examine the area of the crack indication.

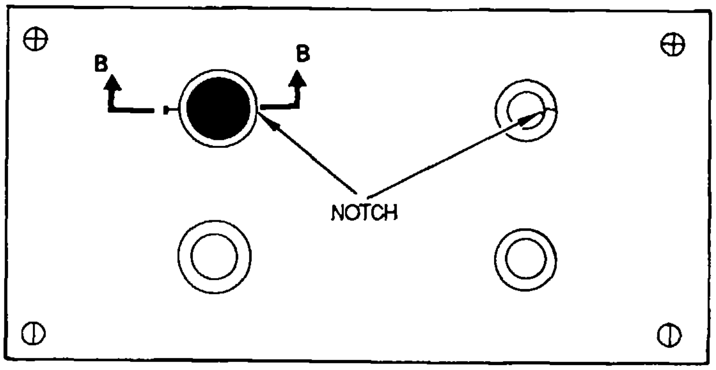


USUAL CRACK
DETAIL I

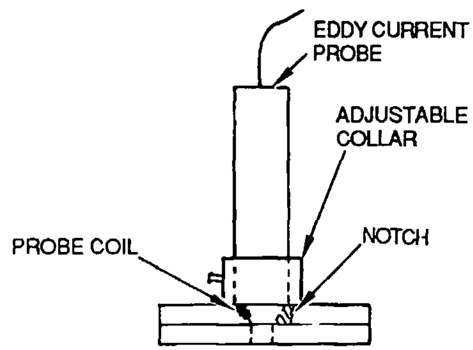


SECTION A–A

A CRACK WHICH EXTENDS FROM THE FASTENER HOLE ACROSS THE COUNTERSINK

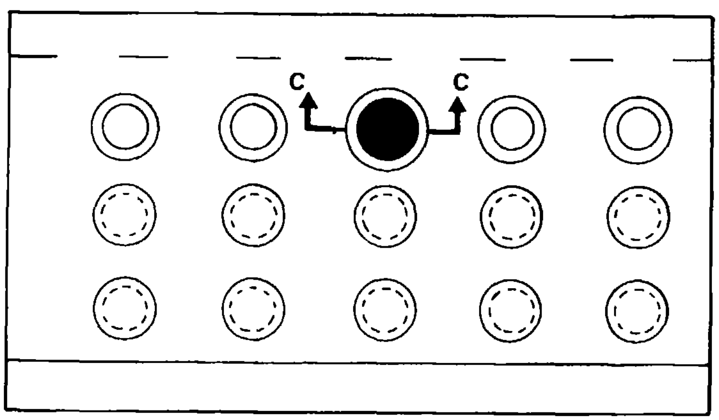


CALIBRATION - REFERENCE STANDARD
DETAIL II

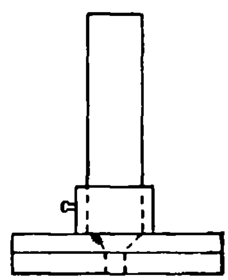


SECTION B–B

← PROBE COIL INSTALLED OPPOSITE OF THE NOTCH

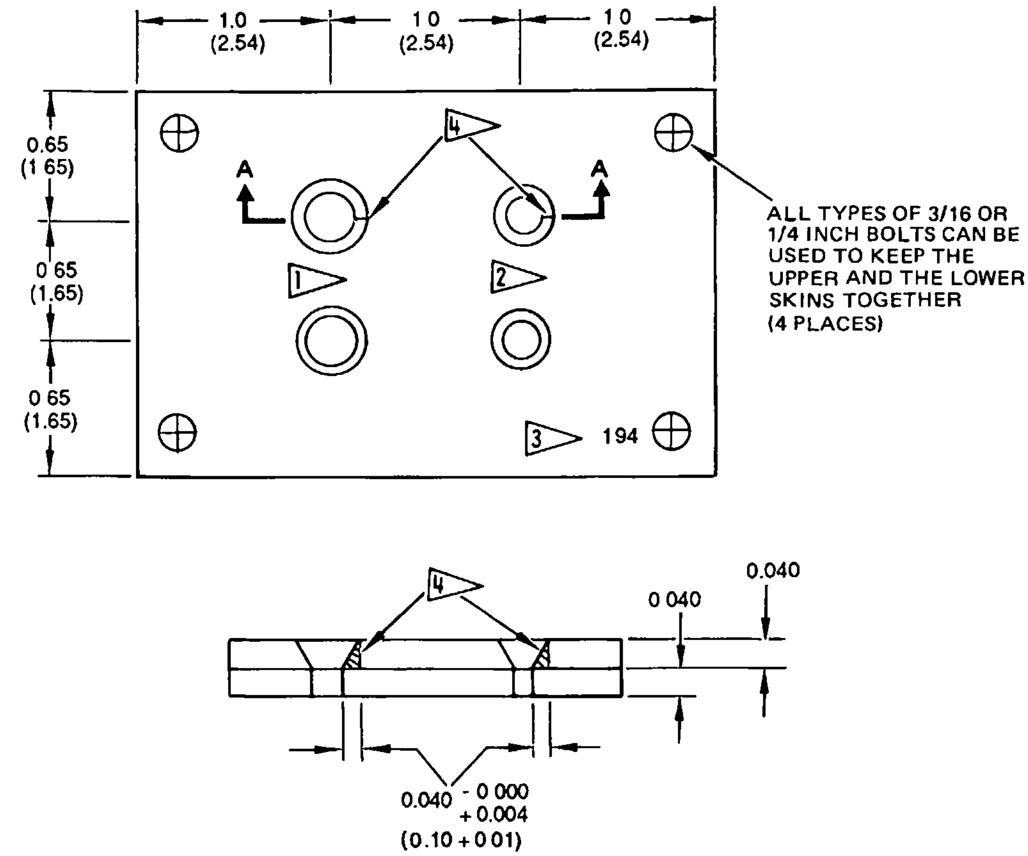


INSPECTION PROCEDURE
DETAIL III



SECTION C–C

TURN THE PROBE MORE THAN 360° TO MAKE SURE THE COMPLETE COUNTERSINK IS COVERED



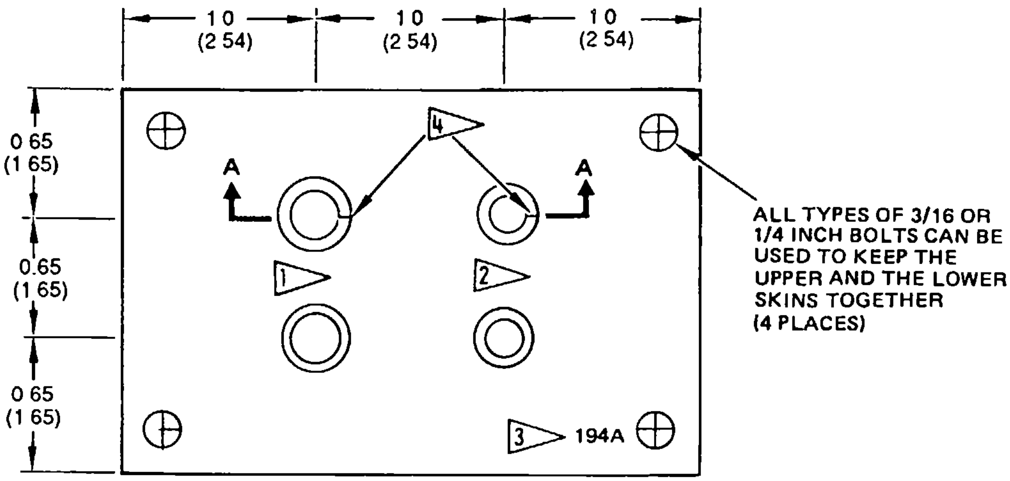
SECTION A–A

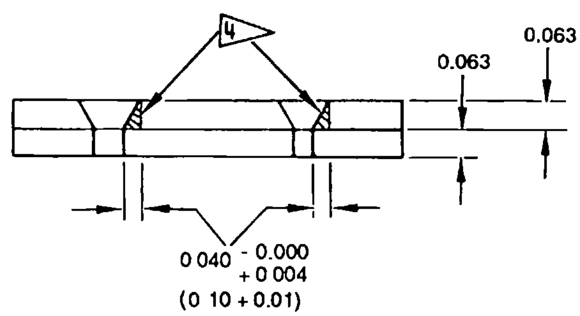
ALL DIMENSIONS ARE IN INCHES (CENTIMETERS IN PARENTHESES)
TOLERANCE: X X±0 05 (0 13) X XXX±0 005 (0 013) (UNLESS NOTED)
MATERIAL 2024 T3 OR T4 CLAD ALUMINUM

1. FOR A 3/16 INCH HOLE SIZE, DRILL A NO. 11 (0 191 INCH DIA) HOLE AND COUNTERSINK 100°–TOP SHEET
2. FOR A 5/32 INCH HOLE SIZE, DRILL A NO. 20 (0.161 INCH DIA) HOLE AND COUNTERSINK 100°–TOP SHEET
3. ETCH OR STAMP PART NUMBER 194.
4. EDM NOTCH OR EQUIVALENT 0.007 (0.018) MAXIMUM WIDTH

REFERENCE STANDARD 194

DETAIL IV





SECTION A-A

ALL DIMENSIONS ARE IN INCHES (CENTIMETERS IN PARENTHESES)
TOLERANCE X X±0 05 (0 13) X XXX±0 005 (0 013) (UNLESS NOTED)
MATERIAL 2024 T3 OR T4 CLAD ALUMINUM

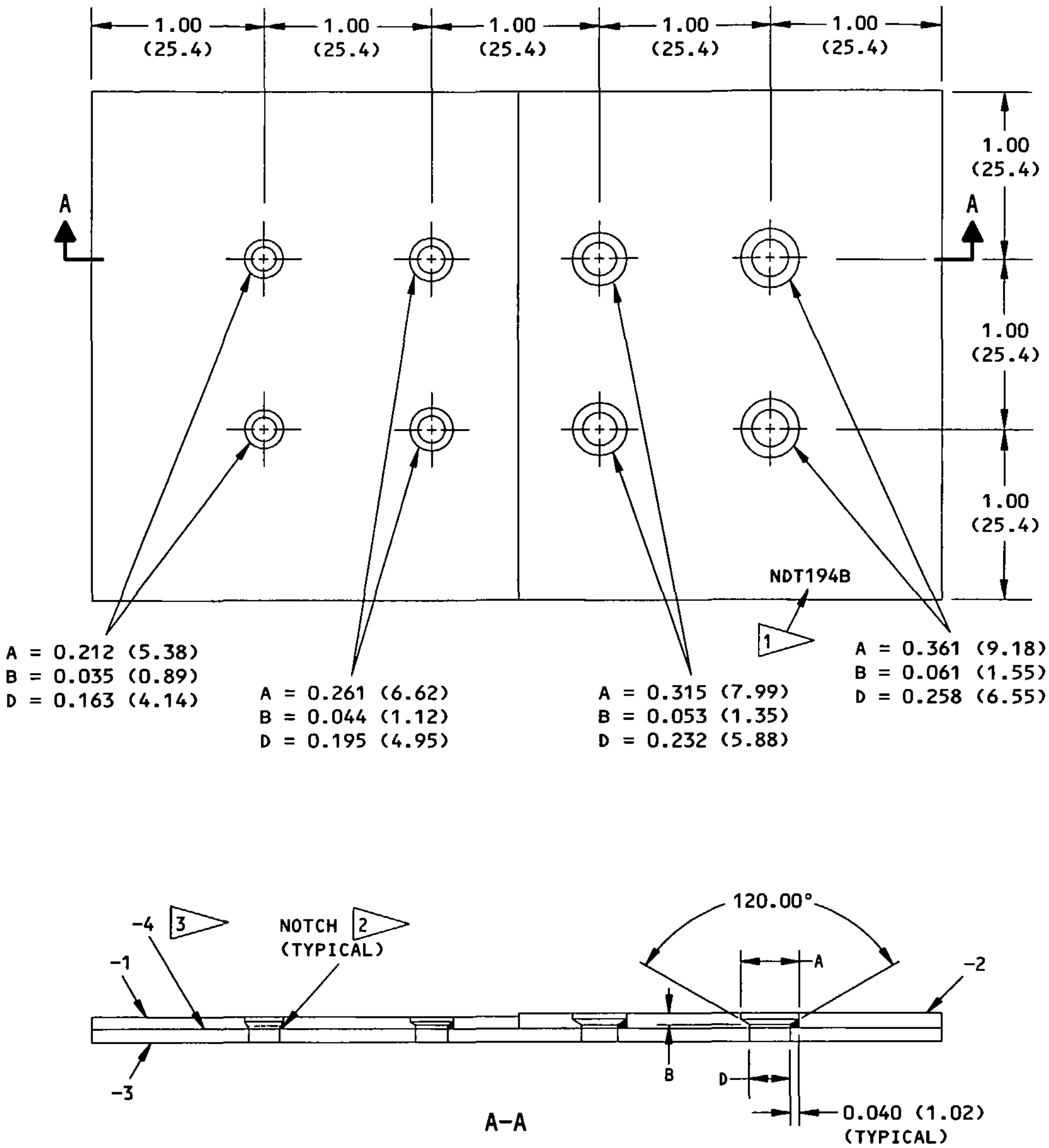
1 FOR A 1/4 INCH HOLE SIZE, DRILL A 0.250 INCH DIA HOLE AND COUNTERSINK 100°–TOP SHEET

2 FOR A 7/32 INCH HOLE SIZE, DRILL A 0.218 INCH DIA HOLE AND COUNTERSINK 100°–TOP SHEET

3 ETCH OR STAMP PART NUMBER 194A

4 EDM NOTCH OR EQUIVALENT 0 007 (0 018) MAXIMUM WIDTH

REFERENCE STANDARD 194A
DETAIL V



REFERENCE STANDARD NDT194B
DETAIL VI (SHEET 1)

NOTES:

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

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

- ANGULAR TOLERANCE: ±1.0 DEGREE
- SURFACE ROUGHNESS = 125 Ra OR BETTER.
- MATERIAL:

ID NO.	QUANTITY	DIMENSIONS	MATERIAL
-1	1	0.056 X 3.0 X 2.5 (1.42 X 76 X 64)	2024-T3 OR -T4 CLAD ALUMINUM
-2	1	0.081 X 3.0 X 2.5 (2.06 X 76 X 64)	2024-T3 OR -T2 CLAD ALUMINUM
-3	1	0.081 X 3.0 X 5.0 (2.06 X 76 X 127)	2024-T3 OR -T3 CLAD ALUMINUM
-4	1	0.010 X 3.0 X 5.0 (0.25 X 76 X 127)	ADHESIVE LAYER (USE A WATER RESISTANT ADHESIVE)

[1] ETCH OR STEEL STAMP THE NUMBER "NDT194B" ON THE REFERENCE STANDARD.

[2] EDM NOTCH: THE LENGTH OF THE NOTCH IS 0.040 (1.02) ±10% FROM THE FASTENER SHANK. THE DEPTH OF THE NOTCH IS THROUGH THE TOP LAYER. THE NOTCH WIDTH IS 0.005 ±0.002 (0.13 ±0.05). THE NOTCH MUST BE WITHIN ±0.005 (±0.10) OF THE CENTER OF THE HOLE.

[3] APPLY AN EVEN LAYER OF ADHESIVE BETWEEN THE TOP AND BOTTOM LAYERS (-1 AND -3) (-2 AND -3).

REFERENCE STANDARD NDT194B
DETAIL VI (SHEET 2)

DELETED

PART 6 - EDDY CURRENT

COUNTERSINK INSPECTION OF ALUMINUM PARTS (ROTARY PROBE)

1. Purpose

   A. To find the cracks that extend across the countersink surface with the fasteners removed. Use an impedance-plane-eddy-current instrument with a power-driven-rotating probe attachment. Refer to Detail I for an illustration of a usual crack.

   B. Part 6, 53-30-00, Fig. 1 or 4 can be used as an alternative to this procedure.

2. Equipment

   A. An impedance-plane-eddy-current instrument with a turning probe attachment is necessary for this procedure. All turning instrument and probe combinations that meet the necessary calibrations of this procedure can be used.
   The following equipment was used to make this procedure:

      (1) Instrument

         (a) Defectoscop D2.831, Foerster Instruments

         (b) AV100 SE, Hocking Instruments

      (2) Probe - Rotating Countersink Probes

         (a) Use a probe that:

            1) Operates at a frequency range of 100 to 500 kHz.

            2) Has an external diameter that fits in the countersunk hole that is shown in Details III and IV or the counterbore hole that is shown in Detail V.

               NOTE: A 100-degree countersunk probe can be used in the counterbore hole shown in Detail V. But, differences between the shape of the probe and the counterbore can cause the probe to wear very fast.

         (b) The probes specified below were used to prepare this procedure.

            1) Probe Adapter P/N AH-DR (Required if using AV100 SE Instr.)
            CSD 100-10 (0.156 inch diameter) for Defectoscope
            CSD 100-12 (0.187 inch diameter) for Defectoscope
            CSD 100-14 (0.218 inch diameter) for Defectoscope
            CSD 100-16 (0.250 inch diameter) for Defectoscope
            NDT Engineering Corp.

(3) Reference Standard

(a) Use reference standard 194 and 194A to examine 100 degree countersunk holes. See Details III and IV for data about the reference standards.

(b) Use reference standard NDT194B to examine 120 degree counterbore holes. See Detail V for data about the reference standard.

NOTE: Refer to Part 1, 51-06-00, par. 7, for information on the equipment and the reference standard manufacturers.

3. Preparation for Inspection

A. Remove the fasteners

B. Make sure that the inspection surface is clean.

NOTE: Be careful not to cause damage to or to make the countersink larger when the fasteners are removed. Only deburr and rub the surface clean.

4. Instrument Calibration

A. Turn instrument on and do the initial adjustments as specified in the manufacturer's instructions.

B. Find the countersink hole size that is to be inspected and connect the applicable probe to the instrument.

C. Set the frequency between 100 and 500 kHz.

NOTE: The reference standard and the eddy current probe must be the same size as the countersink hole that will be inspected.

D. Put the probe in the notched countersink hole of the reference standard and turn on the rotating scanner. Refer to Detail II.

E. Set the instrument timebase line to the center of the screen and adjust the phase, the sensitivity and the filters to give a signal almost the same as that in Detail VI.

F. Adjust the sensitivity to set the notch signal at 80 percent of the full screen amplitude. Refer to Detail VI.

NOTE: Keep a 3:1 or better signal-to-noise ratio during this inspection. Adjustment of the phase control and the filters possibly can decrease the noise signal.

G. Set the instrument gates so that the visual and/or audible alarms turn on when the notch signal reaches 80 percent of the reference-standard-notch response.

H. Turn the probe driver and monitor the effect of the crack orientation on screen display. Be able to identify the crack direction from the screen display.

5. Inspection Procedure

A. Turn on the rotating scanner and put the probe into the countersink hole. The scan speed must not be more than the calibration scan speed.

B. Put the probe at a small angle and make a scan inspection to keep the required signal-to-noise ratio. Refer to Detail VII.

C. Monitor the screen and make a scan inspection of the countersink hole. Make a note of all indications that are almost the same as the reference-standard-notch response.

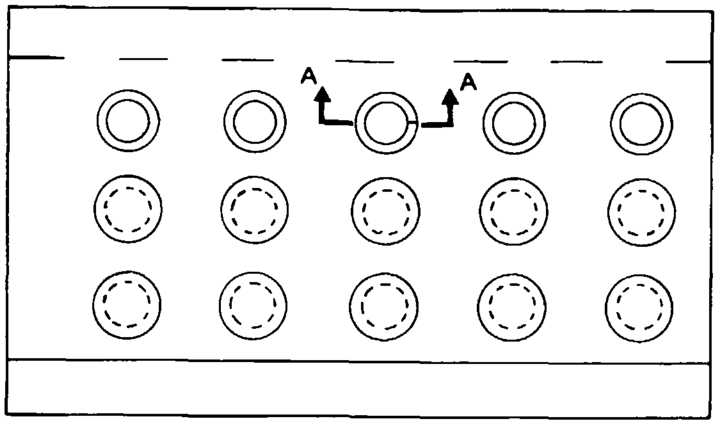
D. At regular times do a check of the instrument calibration as specified in steps 4.C. thru 4.F and adjust if necessary.

6. Inspection Results

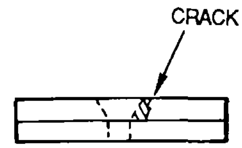
A. All signals that are equal to or more than the reference-standard-notch response are possible crack indications.

NOTE: Crack indications are usually narrow spikes that are almost the same as reference-standard-notch-response. If a wide indication is shown or the noise level is more than the maximum allowed per 4.F. Rub the countersink with Scotch-Brite. This may improve signal-to-noise ratio.

B. Part 6, 51-00-00, Fig. 4, can be used to examine the area of the crack indication.

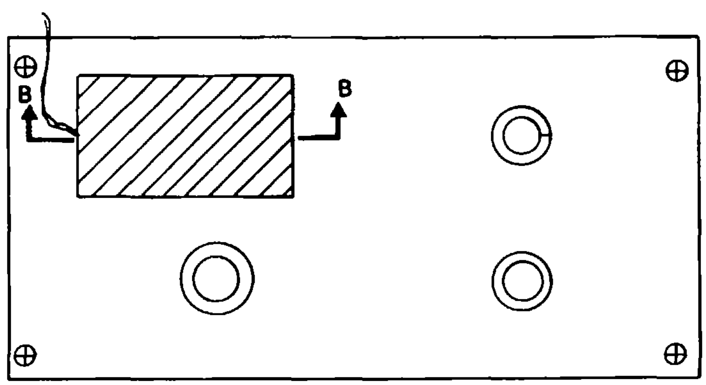


USUAL CRACK
DETAIL I

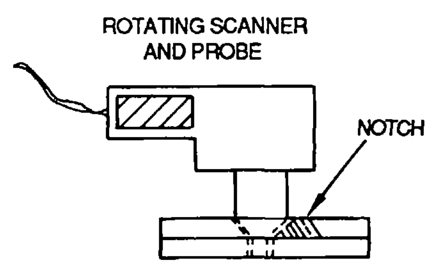


SECTION A–A

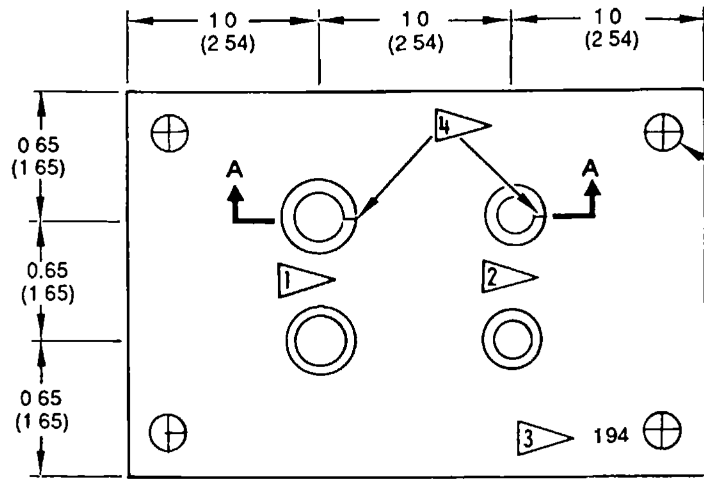
THE CRACK EXTENDS
FROM THE FASTENER HOLE
ACROSS THE COUNTERSINK

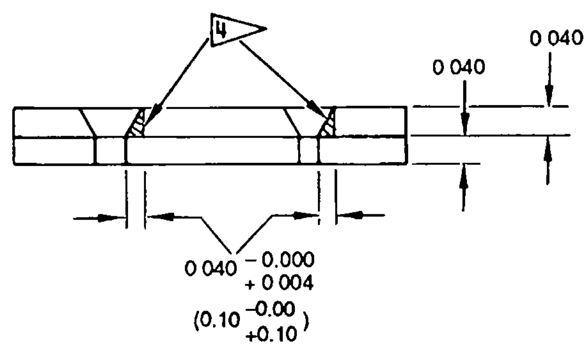


CALIBRATION -REFERENCE STANDARD
DETAIL II



SECTION B–B





SECTION A–A

ALL DIMENSIONS ARE IN INCHES (CENTIMETERS IN PARENTHESES)
TOLERANCE X X±0 05 (0 13) X XXX±0 005 (0 013) (UNLESS NOTED)
MATERIAL 2024 T3 OR T4 CLAD ALUMINUM

1 FOR A 3/16 INCH HOLE SIZE, DRILL A NO 11 (0,191 INCH DIA) HOLE AND COUNTERSINK 100° -TOP SHEET

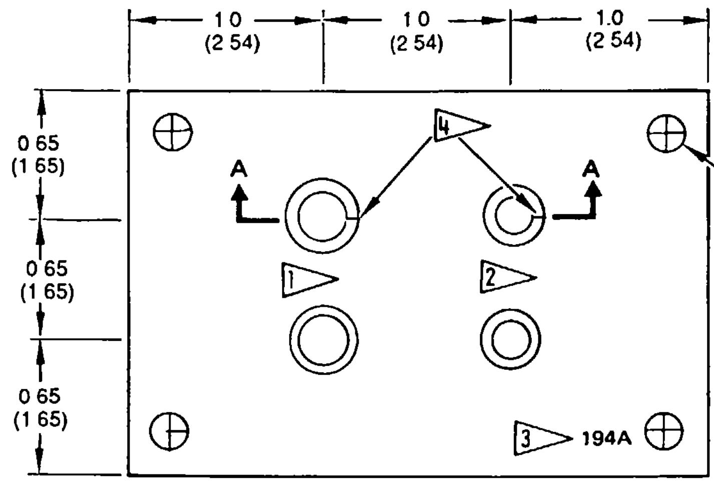
2 FOR A 5/32 INCH HOLE SIZE, DRILL A NO (0 161 INCH DIA) HOLE AND COUNTERSINK 100°-TOP SHEET

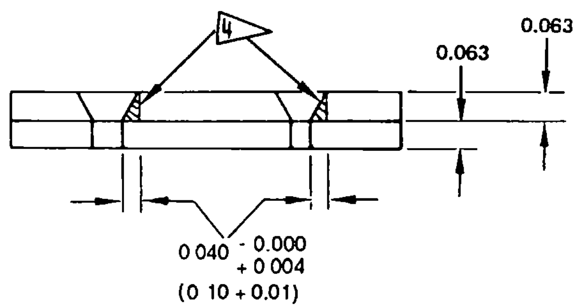
3 ETCH OR STAMP PART NUMBER 194

4 EDM NOTCH OR EQUIVALENT 0 007 (0 018) MAXIMUM WIDTH

REFERENCE STANDARD 194

DETAIL III





SECTION A–A

ALL DIMENSIONS ARE IN INCHES (CENTIMETERS IN PARENTHESES)
TOLERANCE X X±0 05 (0 13) X XXX±0 005 (0 013) (UNLESS NOTED)
MATERIAL· 2024 T3 OR T4 CLAD ALUMINUM

1 FOR A 1/4 INCH HOLE SIZE, DRILL A 0.250 INCH DIA HOLE AND COUNTERSINK 100°–TOP SHEET

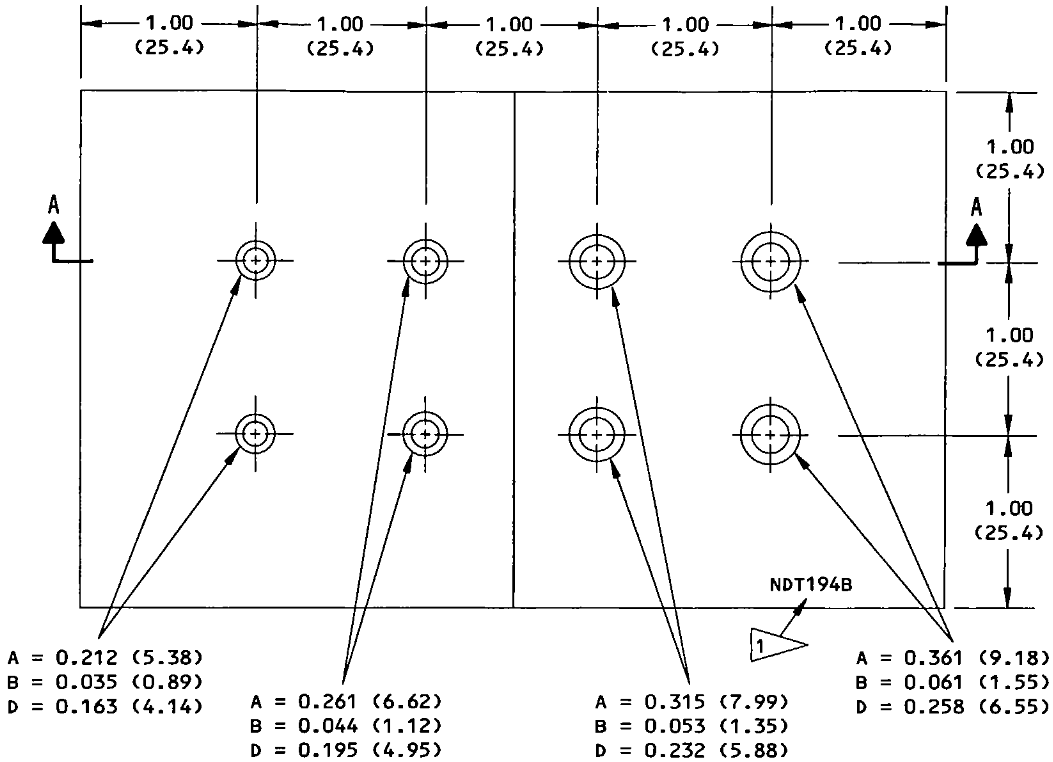
2 FOR A 7/32 INCH HOLE SIZE, DRILL A 0.218 INCH DIA HOLE AND COUNTERSINK 100°–TOP SHEET

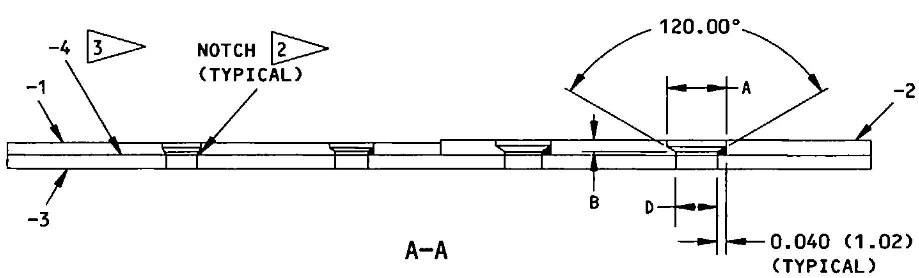
3 ETCH OR STAMP PART NUMBER 194A

4 EDM NOTCH OR EQUIVALENT 0 007 (0 018) MAXIMUM WIDTH

REFERENCE STANDARD 194A

DETAIL IV





REFERENCE STANDARD NDT194B
DETAIL V (SHEET 1)

NOTES:

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

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

- ANGULAR TOLERANCE: ±1.0 DEGREE
- SURFACE ROUGHNESS = 125 Ra OR BETTER
- MATERIAL:

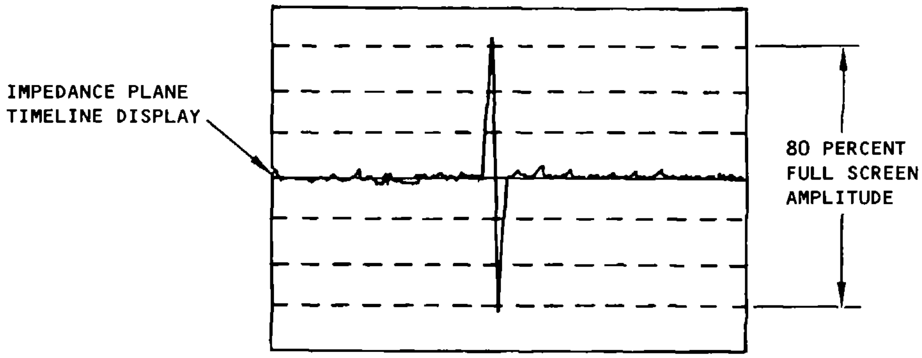
ID NO.	QUANTITY	DIMENSIONS	MATERIAL
-1	1	0.056 X 3.0 X 2.5 (1.42 X 76 X 64)	2024-T3 OR -T4 CLAD ALUMINUM
-2	1	0.081 X 3.0 X 2.5 (2.06 X 76 X 64)	2024-T3 OR -T2 CLAD ALUMINUM
-3	1	0.081 X 3.0 X 5.0 (2.06 X 76 X 127)	2024-T3 OR -T3 CLAD ALUMINUM
-4	1	0.010 X 3.0 X 5.0 (0.25 X 76 X 127)	ADHESIVE LAYER (USE A WATER RESISTANT ADHESIVE)

1 ETCH OR STEEL STAMP THE NUMBER "NDT194B" ON THE REFERENCE STANDARD.

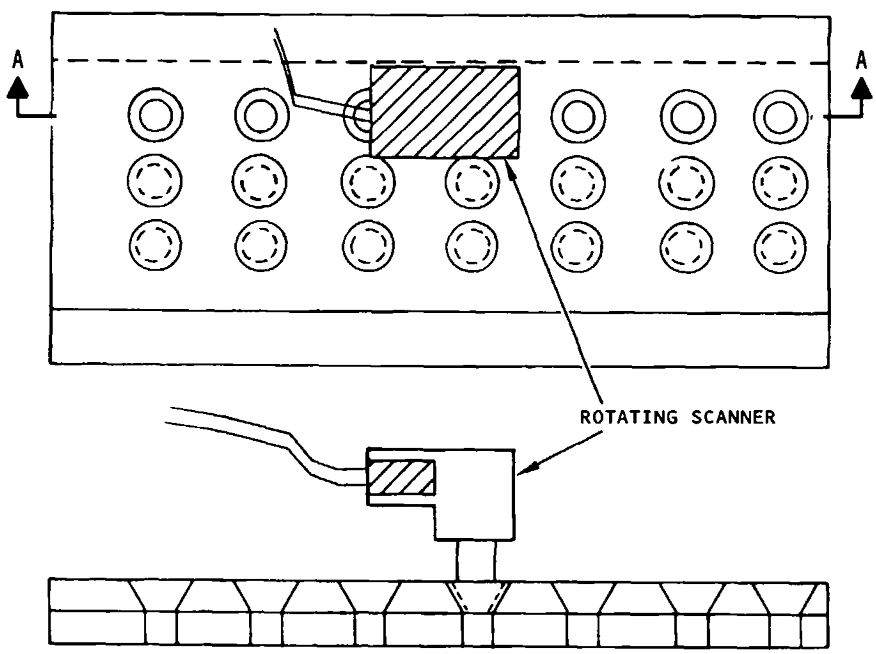
2 EDM NOTCH: THE LENGTH OF THE NOTCH IS 0.040 (1.02) ±10% FROM THE FASTENER SHANK. THE DEPTH OF THE NOTCH IS THROUGH THE TOP LAYER. THE NOTCH WIDTH IS 0.005 ±0.002 (0.13 ±0.05). THE NOTCH MUST BE WITHIN ±0.005 (±0.10) OF THE CENTER OF THE HOLE.

3 APPLY AN EVEN LAYER OF ADHESIVE BETWEEN THE TOP AND BOTTOM LAYERS (-1 AND -3) (-2 AND -3).

REFERENCE STANDARD NDT194B
DETAIL V (SHEET 2)



DETAIL VI



SECTION A-A

DETAIL VII

PART 6 - EDDY CURRENT

COUNTERSINK INSPECTION OF ALUMINUM PARTS (IMPEDANCE PLANE DISPLAY)

1. Purpose

A. To find cracks that extend across the countersink surface with the fasteners removed. Refer to Fig. 4, Detail I for an illustration of a usual crack.

B. Part 6, 53-30-00, Fig. 1 or 3 can be used as an alternative to this procedure.

2. Equipment

A. This procedure uses an impedance-plane-display eddy current instrument with a countersink probe which can operate between 100 and 500 kHz. All impedance-plane-display instrument and countersink probe combinations that meet the necessary calibration conditions of this procedure can be used.
The following equipment was used to develop this procedure:

(1) Instrument

(a) AV100L, Hocking Instruments

(b) NDT 19, Staveley Instruments

(2) Probe

(a) Use a probe that:

1) Operates at a frequency range of 100 to 500 kHz.

2) Has an external diameter that fits in the countersunk hole that is shown in Details III or IV counterbore hole that is shown in Detail V.

NOTE: A 100 degree countersunk probe can be used in the counterbore hole shown in Detail V.

(b) The probe specified below were used to help prepare this procedure.

1) CSM-100-10 (0.156 inch diameter)
CSM-100-12 (0.187 inch diameter)
CSM-100-14 (0.218 inch diameter)
CSM-100-16 (0.250 inch diameter)
NDT Engineering Corporation

2) VM103C 5/32 inch (0.156 inch diameter)
VM103C 3/16 inch (0.187 inch diameter)
VM103C 7/32 inch (0.218 inch diameter)
VM103C 1/4 inch (0.250 inch diameter)
VM Products

(3) Reference Standard

(a) Use reference standard 194 and 194A to examine 100 degree countersunk holes. See Details III or IV for data about the reference standard.

(b) Use reference standard NDT194B to examine 120 degree counterbore holes. See Detail V for data about the reference standard.

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

3. Preparation for Inspection

A. Remove the fasteners.

B. Make sure inspection surface is clean.

NOTE: Be careful not to cause damage to or to make the countersink larger when the fasteners are removed. Only deburr and rub the surface clean.

4. Instrument Calibration

A. Get the correct probe and set the instrument frequency between 100 and 500 kHz.

NOTE: The reference standard and the eddy current probe must be the same size as the countersink hole that will be inspected.

B. Put the probe in the countersink hole of the reference standard with the coil installed opposite of the notch. Adjust the probe collar to keep the probe 90 degrees to the reference standard surface. Refer to Detail II.

C. Balance the instrument and adjust the instrument controls until the "flying dot" is in the center of the screen.

D. Adjust the phase rotation control until the "flying dot" moves horizontally and to the left side of the screen when the probe coil is lifted off of the reference standard surface. Refer to Detail V.

E. Turn the probe coil over the notch and adjust the instrument sensitivity to cause a crack indication signal with a 20-degree-minimum-angle separation from the horizontal lift-off and a two division minimum horizontal or vertical separation from the instrument balance point. Refer to Detail V.

NOTE: Adjustment of the instrument's X/Y ratio or independent vertical gain controls can make the crack signal angle better. A signal from the calibration notch must not be greater than the horizontal or vertical limits of the screen.

F. Do a check of the lift-off again. If an adjustment is made, do a check of the sensitivity as specified in step 4.E. and adjust again if necessary.

G. Make a note of the instrument signal as the probe is turned over the notch to find the maximum or best scan speed.

NOTE: The use of an audible or visual alarm is recommended and can increase the scan speed. Set the alarm to operate to signals that are 80 percent of the reference standard notch signal.

5. Inspection Procedure

A. Put the probe into the countersink and adjust the probe collar to keep the probe vertical to the surface.

B. Balance the instrument and if necessary, adjust the "flying dot" to the calibration reference position.

C. Scan the countersink. The probe must be turned more than 360 degrees to make sure the complete countersink is covered. Keep the probe vertical to the inspection surface during the inspection. Refer to Detail VII. Keep a scan speed that is almost the same as the calibration scan speed.

NOTE: The eddy current instrument will find cracks by a rapid deflection over a short probe scan distance that is almost the same as the reference standard signal. For some fastener holes that are out of round, the eddy current instrument can show a slow upward "flying dot" movement over a large-probe-scan distance. This is not a crack indication.

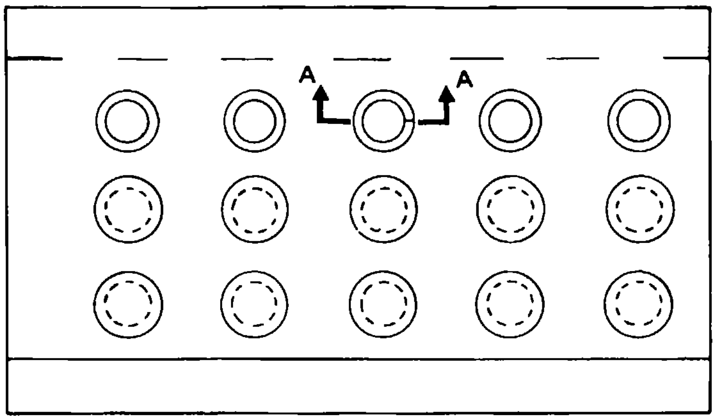
D. Compare all crack indications with the reference-standard-notch signal.

E. At regular times during the inspection, do a check of the instrument calibration as specified in steps 4.B. thru 4.G. and adjust if necessary.

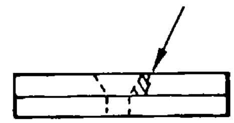
6. Inspection Results

A. A signal with a pattern which is almost the same as and is equal to or greater than the reference-standard-notch signal, which occurs over a short-probe-scan distance, is a possible crack indication and more inspection is necessary.

B. Part 6, 51-00-00, Fig. 4 can be used to make sure the indication is a crack.

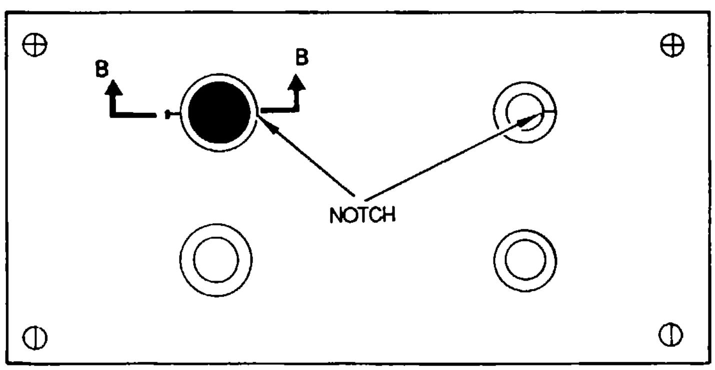


USUAL CRACK
DETAIL I

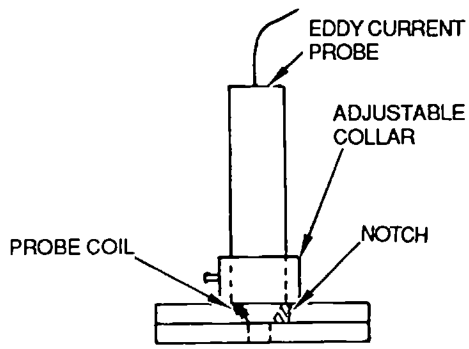


SECTION A–A

A CRACK WHICH EXTENDS FROM THE FASTENER HOLE ACROSS THE COUNTERSINK



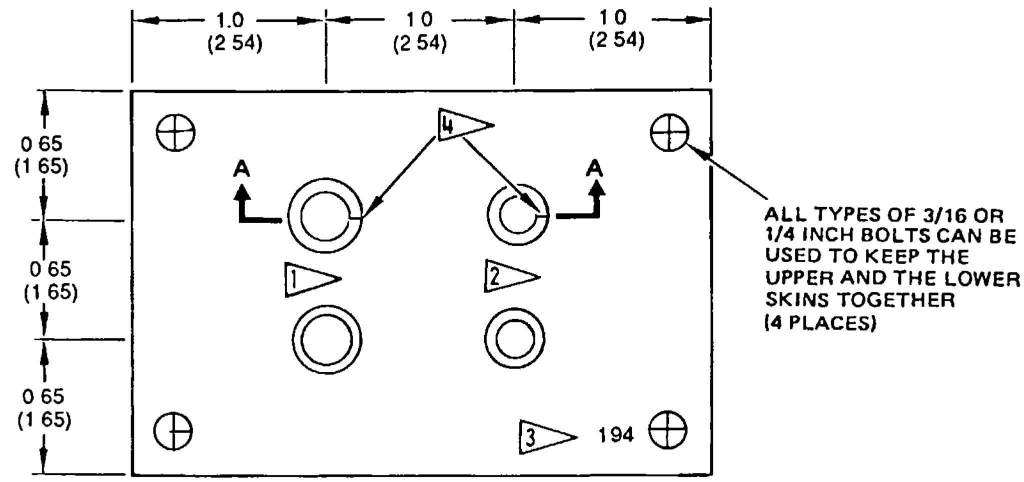
CALIBRATION - REFERENCE STANDARD
DETAIL II

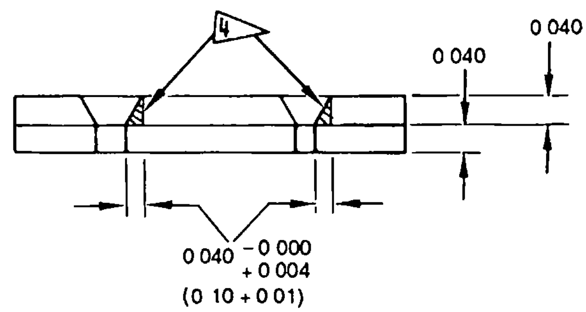


SECTION B–B

PROBE COIL INSTALLED OPPOSITE OF THE NOTCH

A84778





SECTION A–A

ALL DIMENSIONS ARE IN INCHES (CENTIMETERS IN PARENTHESES)
TOLERANCE X X±0 05 (0 13) X XXX±0 005 (0 013) (UNLESS NOTED)
MATERIAL 2024 T3 OR T4 CLAD ALUMINUM

1 FOR A 3/16 INCH HOLE SIZE, DRILL A 0.191 INCH DIA HOLE AND COUNTERSINK 100°-TOP SHEET

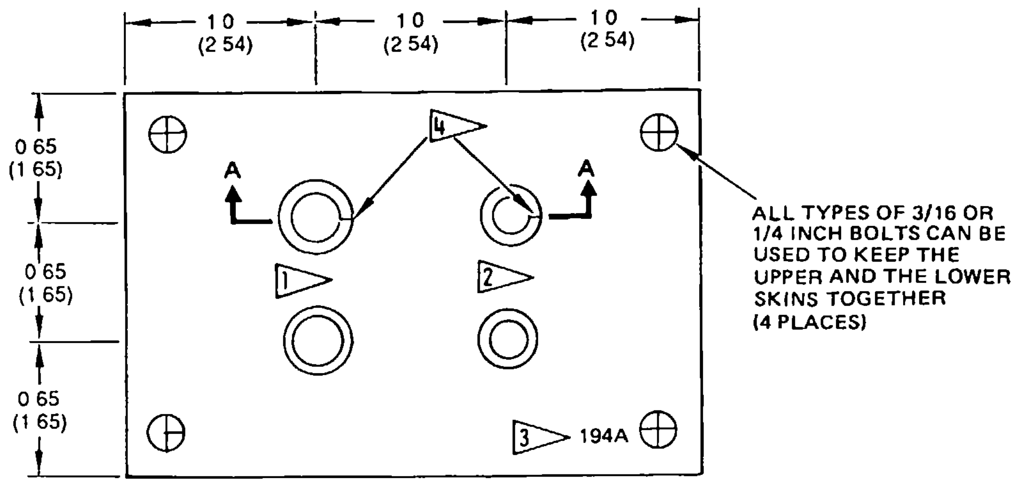
2 FOR A 5/32 INCH HOLE SIZE, DRILL A 0.161 INCH DIA HOLE AND COUNTERSINK 100°-TOP SHEET

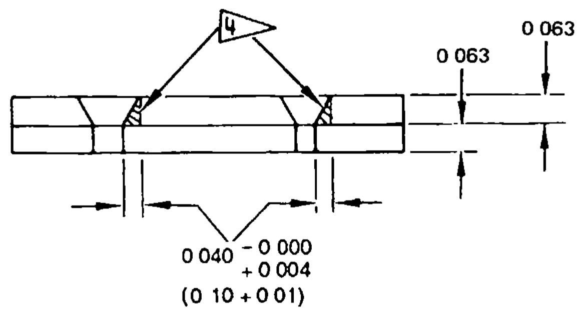
3 ETCH OR STAMP PART NUMBER 194

4 EDM NOTCH OR EQUIVALENT 0 007 (0 018) MAXIMUM WIDTH

REFERENCE STANDARD 194

DETAIL III





SECTION A–A

ALL DIMENSIONS ARE IN INCHES (CENTIMETERS IN PARENTHESES)
TOLERANCE X X±0 05 (0 13) X XXX±0 005 (0 013) (UNLESS NOTED)
MATERIAL 2024 T3 OR T4 CLAD ALUMINUM

1 FOR A 1/4 INCH HOLE SIZE, DRILL A 0.250 INCH DIA HOLE AND COUNTERSINK 100° TOP SHEET

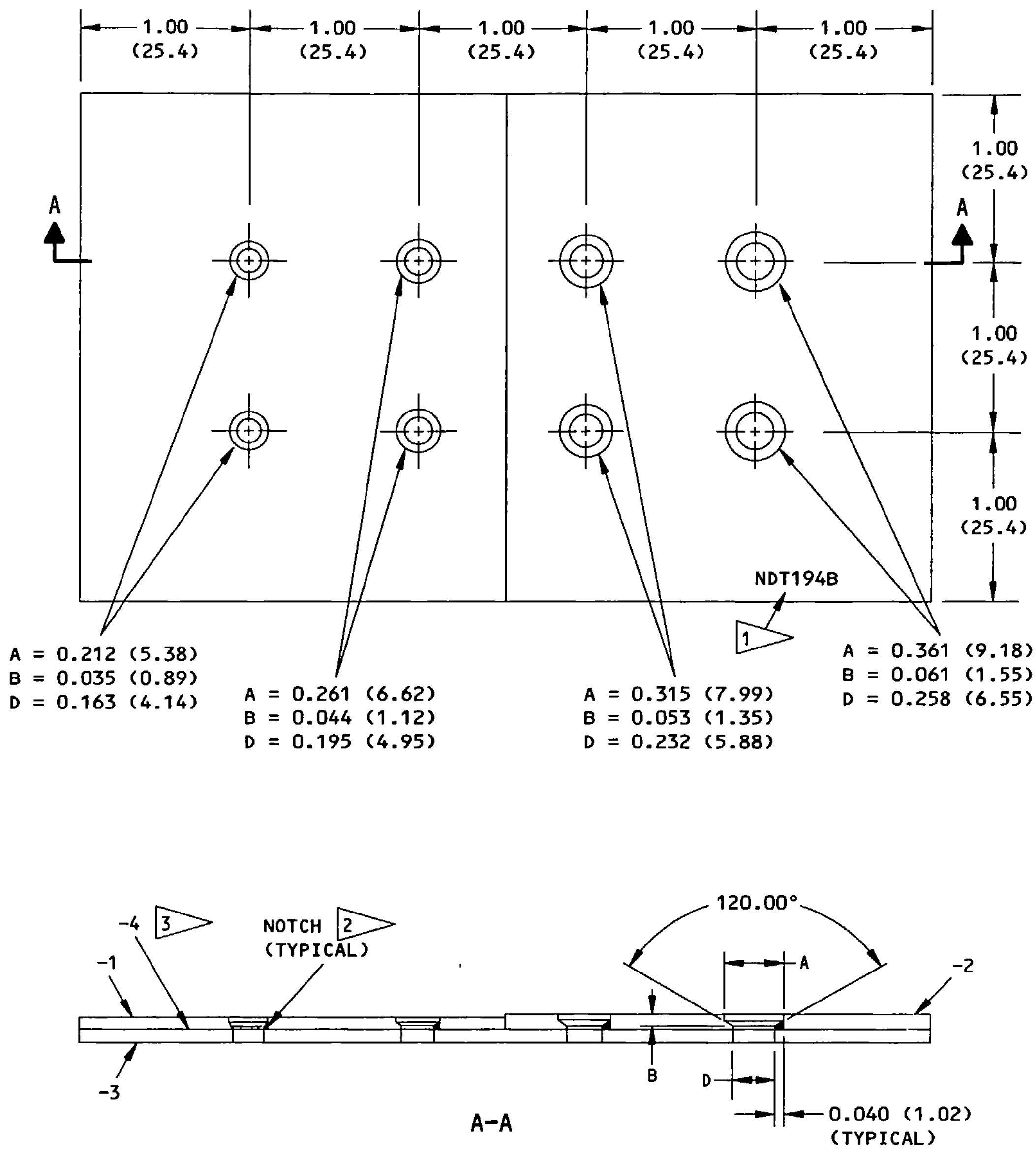
2 FOR A 7/32 INCH HOLE SIZE, DRILL A 0 218 INCH DIA HOLE AND COUNTERSINK 100° TOP SHEET

3 ETCH OR STAMP PART NUMBER 194A

4 EDM NOTCH OR EQUIVALENT 0 007 (0 018) MAXIMUM WIDTH

REFERENCE STANDARD 194A

DETAIL IV



REFERENCE STANDARD NDT194B
DETAIL V (SHEET 1)

NOTES:

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

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

- ANGULAR TOLERANCE: ±1.0 DEGREE
- SURFACE ROUGHNESS = 125 Ra OR BETTER
- MATERIAL:

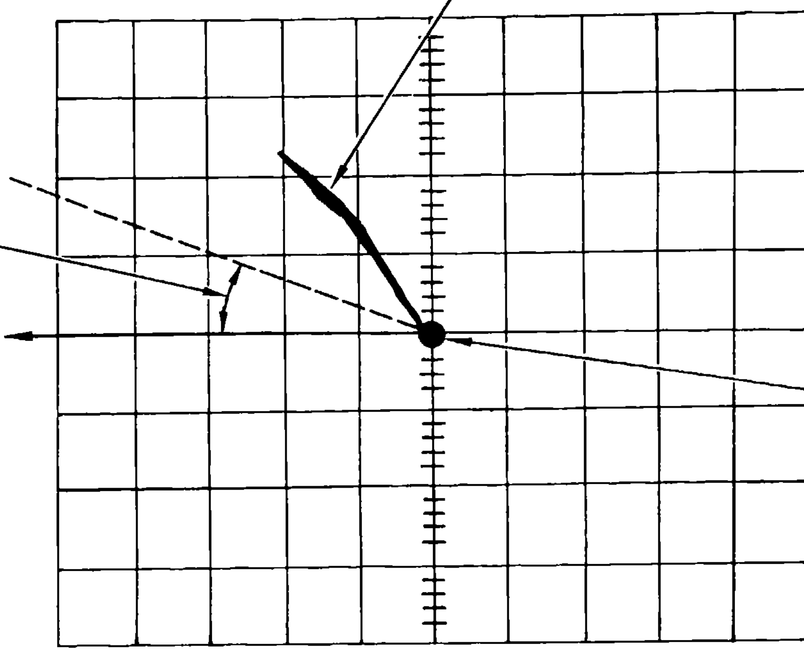
ID NO.	QUANTITY	DIMENSIONS	MATERIAL
-1	1	0.056 X 3.0 X 2.5 (1.42 X 76 X 64)	2024-T3 OR -T4 CLAD ALUMINUM
-2	1	0.081 X 3.0 X 2.5 (2.06 X 76 X 64)	2024-T3 OR -T2 CLAD ALUMINUM
-3	1	0.081 X 3.0 X 5.0 (2.06 X 76 X 127)	2024-T3 OR -T3 CLAD ALUMINUM
-4	1	0.010 X 3.0 X 5.0 (0.25 X 76 X 127)	ADHESIVE LAYER (USE A WATER RESISTANT ADHESIVE)

[1] ETCH OR STEEL STAMP THE NUMBER "NDT194B" ON THE REFERENCE STANDARD.

[2] EDM NOTCH: THE LENGTH OF THE NOTCH IS 0.040 (1.02) ±10% FROM THE FASTENER SHANK. THE DEPTH OF THE NOTCH IS THROUGH THE TOP LAYER. THE NOTCH WIDTH IS 0.005 ±0.002 (0.13 ±0.05). THE NOTCH MUST BE WITHIN ±0.005 (±0.10) OF THE CENTER OF THE HOLE.

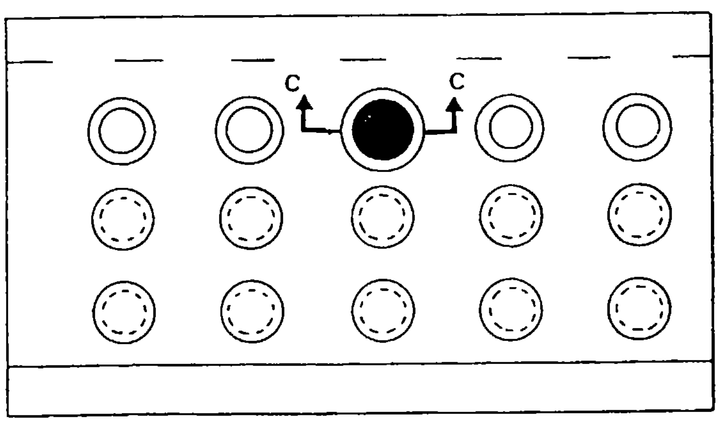
[3] APPLY AN EVEN LAYER OF ADHESIVE BETWEEN THE TOP AND BOTTOM LAYERS (-1 AND -3) (-2 AND -3).

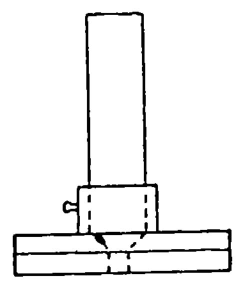
REFERENCE STANDARD NDT194B
DETAIL V (SHEET 2)



GENERAL IMPEDANCE PLANE RESPONSE
FROM REFERENCE STANDARD

DETAIL VI





SECTION C–C

ROTATE PROBE BEYOND 360° TO MAKE SURE OF COMPLETE INSPECTION COVERAGE

INSPECTION PROCEDURE

DETAIL VII

A84786

PART 6 - EDDY CURRENT

INSPECTION OF EXTERNAL FUSELAGE REPAIRS

1. Purpose

To find cracks in fuselage skins or the skins of a lap splice which are covered by external aluminum repairs. The thickness of the repair must be in one of the thickness ranges specified in Table I.

2. Equipment

A. Instruments - It is necessary to use an impedance plane instrument to do this procedure. The instruments that follow were used to help prepare this procedure:

(1) Nortec, NDT 19

(2) Nortec, NDT 19e

(3) Zetec, MIZ-20A

(4) Hocking, Phasec 1.1SD

B. Probes - Use flat, shielded spot probes to do this procedure. Probes with small diameters are recommended for use on thin repair materials (See Table I). The probes that follow were used to help prepare this procedure.

PROBE NUMBER	DIAMETER (inches)	PROBE TYPE	FREQUENCY RANGE	MANUFACTURER
P905-40-5K	0.25	DIFFERENTIAL	3 kHz to 9 kHz	NDT ENGINEERING
SPO-5327	0.31	REFLECTION	700 Hz to 80 kHz	STAVELEY/NORTEC
SPO-5328	0.44	REFLECTION	500 Hz to 60 kHz	STAVELEY/NORTEC
RS1005-2/TF	0.50	REFLECTION	1 kHz to 40 kHz	NDT ENGINEERING
SPO-5330	0.62	REFLECTION	100 Hz to 20 kHz	STAVELEY/NORTEC

Use a probe that can operate at the necessary inspection frequency. The necessary inspection frequency is specified in Table I and changes when the thickness of the material above the skin to be examined changes.

CAUTION: IN SOME INSPECTION AREAS, DIFFERENT MATERIAL THICKNESSES CAN OCCUR ABOVE THE SKIN TO BE EXAMINED (AS A RESULT OF THE REPAIR). IT IS IMPORTANT THAT YOU USE THE CORRECT FREQUENCY AND REFERENCE STANDARD FOR THE THICKNESS OF MATERIAL THAT IS ABOVE THE SKIN TO BE EXAMINED. FAILURE TO USE THE CORRECT FREQUENCY AND REFERENCE STANDARD WILL DECREASE THE SENSITIVITY OF THE INSPECTION AND THE CRACKS WILL NOT ALWAYS BE FOUND.

C. Reference Standard - Make the applicable reference standards as specified in Detail I and Table I.

NOTE: Reference standards ANDT1049 thru ANDT1057 replace reference standards NDT1006 thru NDT1014. If you have reference standards NDT1006 thru NDT1009, it is not necessary to replace them with ANDT1049 thru ANDT1052 if they have Alodined rivets. See Table I, flagnote 2.

3. Preparation for Inspection

A. Clean the inspection area. If necessary, remove paint from the inspection area if the fastener heads cannot be seen or if the probe cannot be easily moved around the fastener.

4. Instrument Calibration

A. Do a check in the repair area to find:

(1) The thickness of the material above the skin to be examined and

(2) The type of fasteners that are used.

B. Refer to Detail I and Table I with the data of par. 4A to identify the necessary reference standard to use during the inspection.

NOTE: Two reference standards are necessary to do the inspection of some repairs, for example lap splices, because of changes in the thickness of the repair. The thickness of the material above the inspection skin must be in the thickness range that is specified in Table I for the reference standard.

C. Get a flat surface probe that can operate at the frequency identified in Table I.

NOTE: Use the smallest diameter probe possible that will give a smooth scan inspection around the fastener and the best separation of notch signal from the edge effect signal.

D. Set the instrument frequency in the range specified in Table I for the applicable inspection conditions.

E. If the inspection area is painted, put a shim that is not conductive on top of the reference standard. Use a shim that is approximately 0.003 inch (0.08 mm) of the thickness of the paint.

F. Put the probe on the reference standard at probe position 1 adjacent to the same type of fastener as in the repair. See Detail II.

G. Balance the instrument.

H. Set the balance point in the lower center of the screen display as shown in Detail III.

I. Adjust the phase control so that the lift-off signal moves horizontally to the left as shown in Detail III.

J. Move the probe to probe position 2 on the reference standard as shown in Detail II.

K. Adjust the position of the probe to get a maximum signal from the notch in the reference standard.

L. If necessary adjust the frequency to get approximately a 90-degree separation between the lift-off line and the notch signal. See Detail III for an example of a calibration screen display.

NOTE: If you adjust the frequency, do par. 4.F. thru 4.K. again.

M. Adjust the gain to get a signal that is 40 percent of full screen height as shown in Detail III. Use a vertical to horizontal ratio of 1 to 1.

N. Put the probe at probe position 3 on the reference standard as shown in Detail II and balance the instrument.

O. Move the probe around each side of the fastener to the edge of the reference standard until you see the edge effect signal. Monitor the location of the probe above the notch (probe position that gives the maximum signal) and when you first see the edge effect signal, to identify the limits of the inspection around the fastener.

NOTES: (1) Separation of the notch signal from the edge effect signal will decrease as the thickness of the repair material increases. See Detail IV for examples of screen displays of reference standards ANDT1055 and ANDT1057.

(2) It can be possible to increase the separation of the notch signal from the edge effect signal. A change to a smaller diameter probe can help increase the separation. Use a probe that will operate in the frequency range in Table I, if one is available and do par. 4.K. thru 4.O. again. See Detail V for examples of screen displays of reference standard ANDT1057.

P. If the repair has an edge that is square (not beveled), move the probe from the fastener location to the square edge of the reference standard. Compare this signal to the signals from a beveled edge and the notch.

Q. If flush-head fasteners (aluminum or steel) are used, move the probe so it is on the fastener and compare the edge effect signal to the notch signal.

R. If the screen display dot is not stable when a high instrument gain is necessary for the calibration, change the vertical to horizontal gain ratio. Decrease the horizontal gain to help keep the dot more stable. If a change of the vertical to horizontal gain ratio is made, do par. 4.F. thru 4.Q. again.

NOTE: If you decrease the horizontal gain, make sure there is sufficient separation of the notch signal from the edge effect signal. Try not to use more than a 2 to 1 vertical to horizontal gain ratio.

5. Inspection Procedure

A. Put the probe on the repair surface adjacent to and above the fastener head for the fastener type to be examined.

B. Balance the instrument.

C. Do a scan slowly around the fastener and monitor the instrument screen display at the same time. During the scan:

(1) For protruding-head fasteners, keep the probe adjacent to the fastener head during the scan.

(2) For flush-head fasteners, use a circle template to keep the probe an equal distance from the flush-head fastener during the scan

(3) For fasteners close to the edge, move the probe around to the edge of the skin panel until the edge effect signal goes off the screen display.

(4) Make a mark at the locations where you get a signal that is 20 percent or more of full screen height and looks almost the same as the notch signal from the reference standard.

D. Frequently do a calibration test of the instrument as follows:

NOTE: Do not adjust the gain.

(a) Put the probe on the reference standard to get the maximum signal from the notch. Make sure to put the probe adjacent to the fastener on the reference standard that is the same type as the inspection

(b) Compare the signal you got from the notch during calibration with the signal you get now.

(c) If the signal from the notch in the reference standard has changed 10 percent or more from the signal you got during calibration, do the calibration and inspection again for all of the fasteners examined since the last calibration test.

6. Inspection Results

A. Signals that are 20 percent or more of full screen height and look almost the same as the notch signal from the reference standard are signs of possible cracks

B. Compare the signals to the signals you got from the reference standard.

C The types of conditions that can occur during the inspection are as follows:

(1) A crack on the lower edge of the fastener hole near the edge of the repair.

(a) If a crack occurs on the lower edge of the fastener hole near the edge of the repair, the signal will go up as the probe is moved above the crack but will not go down to the baseline because of the edge effect condition from the repair. See Detail VI for an example of a crack signal that is near an edge.

NOTE: The separation of the crack signal from the edge effect signal will be more with the inspection on thin repair materials As the thickness of the repair material increases, the separation of the crack signal from the edge effect signal will decrease Be careful when you examine near the edge of the repair

(2) A subsurface edge effect signal from a repair cut-out in the skin (below the repair material).

(a) If an inspection is necessary for fasteners near a repair cut-out, it is possible to get a subsurface edge effect signal from the edge of the cut-out in the skin. This condition can occur if there is not a sufficient amount of edge margin.

(b) Be careful when you examine fasteners that are near the edge of a cut-out because a crack can occur near the edge. Monitor the location of the probe around each fastener, because an edge effect condition will usually occur at the same location.

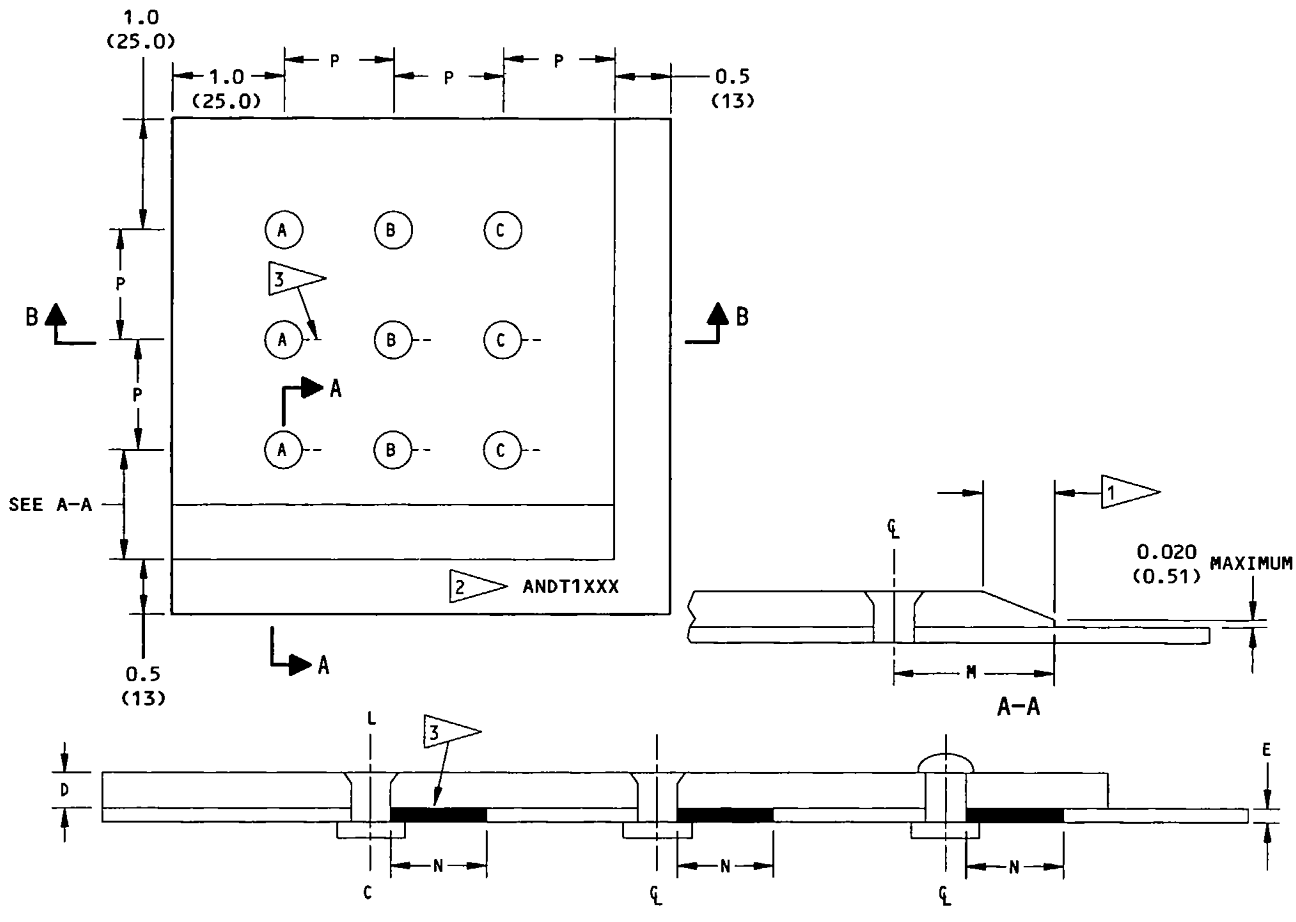
(3) Space (gap) between skins.

(a) This condition can cause the balance point to go up. The balance point signal will go up slowly during the scan as the space between the skins increases.

(4) A thickness change of the material below the inspection skin.

(a) If the thickness of the material below the inspection skin changes, it can cause the balance point to change. Do a check of the balance point signal regularly and balance the instrument as necessary.

D. If you want to make sure of the results, do the fastener hole inspection procedure specified in Part 6, 51-00-00, Figure 16. If you can get access to the inside surface of the skin, do the surface inspection procedure specified in Part 6, 53-30-00, Figure 6.



NOTES:

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

INCHES	MILLIMETERS
X.XXX = ±0.005	X.XX = ±0.1
X.XX = ±0.025	X.X = ±0.5
X.X = ±0.050	X = ±1

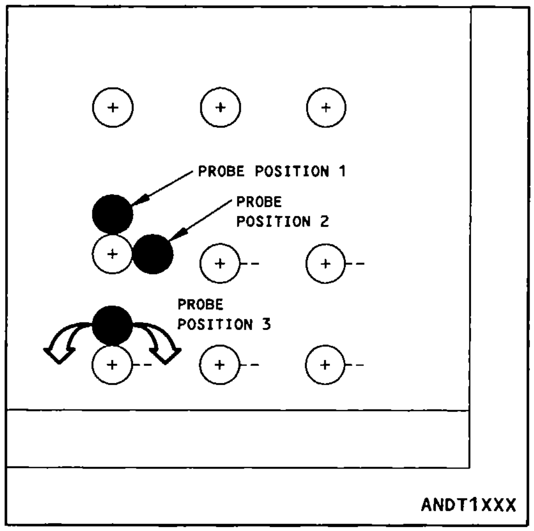
- SEE TABLE I FOR THE REFERENCE STANDARD SPECIFICATIONS AND DIMENSIONS IDENTIFIED IN THIS FIGURE AS LETTERS A THRU E, M, N AND P.
- MATERIAL: USE BARE OR CLAD 2024-T3 OR T4 OR 7075-T6.
- BE CAREFUL WHEN YOU INSTALL THE RIVETS. THE BOTTOM PIECE CAN BECOME DAMAGED IF INSTALLED TOO TIGHT.

1 THE CHAMFER WIDTH IS 0.16 INCH FOR ANDT1049 THRU ANDT1052, ANDT1056 AND ANDT1077; 0.10 INCH FOR ANDT1053; 0.13 INCH FOR ANDT1054; 0.14 INCH FOR ANDT1055; 0.20 INCH FOR ANDT1057 AND ANDT1015.

2 ETCH OR STAMP THE PART NUMBER ANDT1XXX AS SPECIFIED IN TABLE I. PUT A LETTER "A" IN FRONT OF THE REFERENCE STANDARD NUMBER TO SHOW THAT IT HAS ALODINED RIVETS. REFER TO TABLE I, FLAGNOTE 2.

3 REFERENCE NOTCH. SIX LOCATIONS. MAKE THE NOTCH LESS THAN 0.030 (0.76) WIDE LENGTH - SEE TABLE I DIMENSION N.

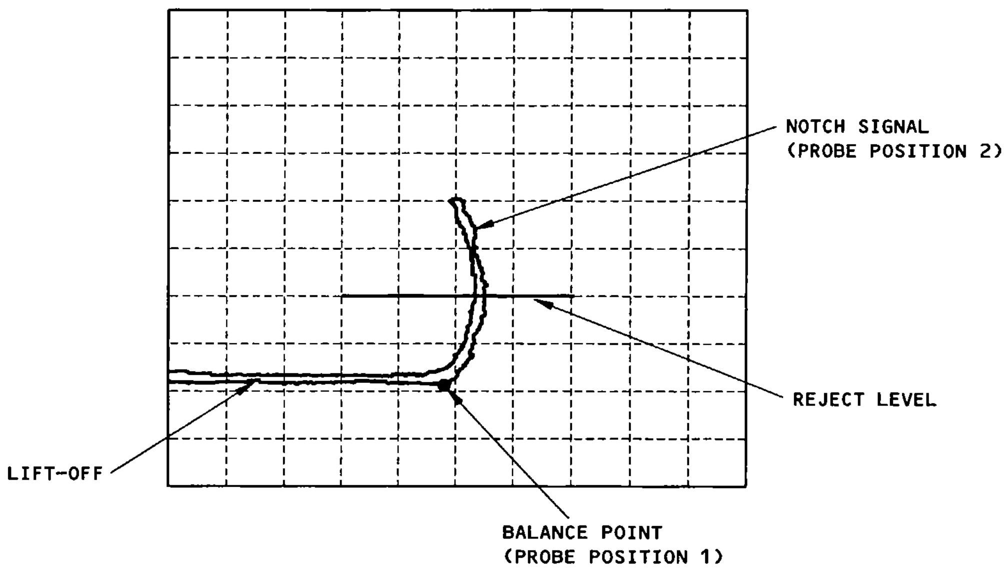
REFERENCE STANDARDS ANDT1015, ANDT1049 THRU ANDT1057 AND ANDT1077
DETAIL I



NOTES:

- PROBE POSITIONS 1 THRU 3, ARE THE PROBE POSITIONS DURING INSTRUMENT CALIBRATION FOR ALL FASTENER TYPES.
- THE SCREEN DISPLAY IN DETAIL III IS AN EXAMPLE OF THE CALIBRATION SIGNALS AT PROBE POSITIONS 1 AND 2. THE NOTCH SIGNAL CAN LOOK DIFFERENT WITH DIFFERENT PROBES AND INSTUMENTS.

PROBE POSITIONS ON THE REFERENCE STANDARD DURING INSTRUMENT CALIBRATION
DETAIL II

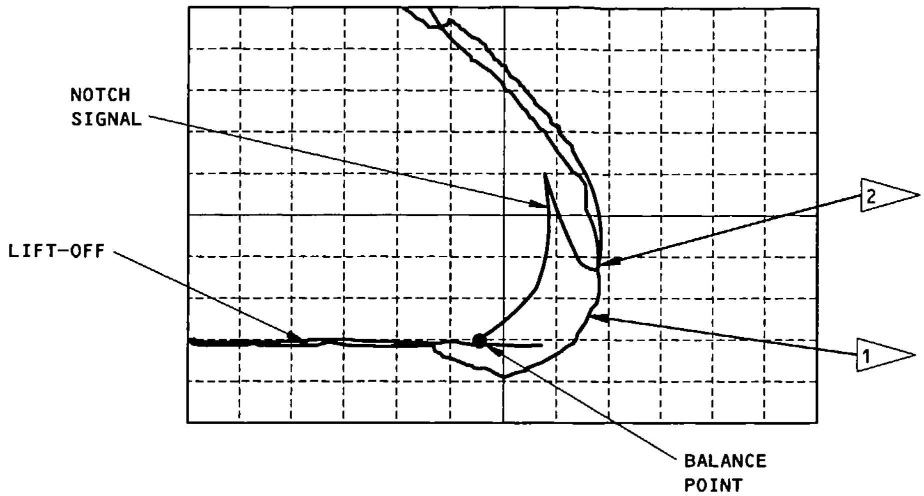


NOTES

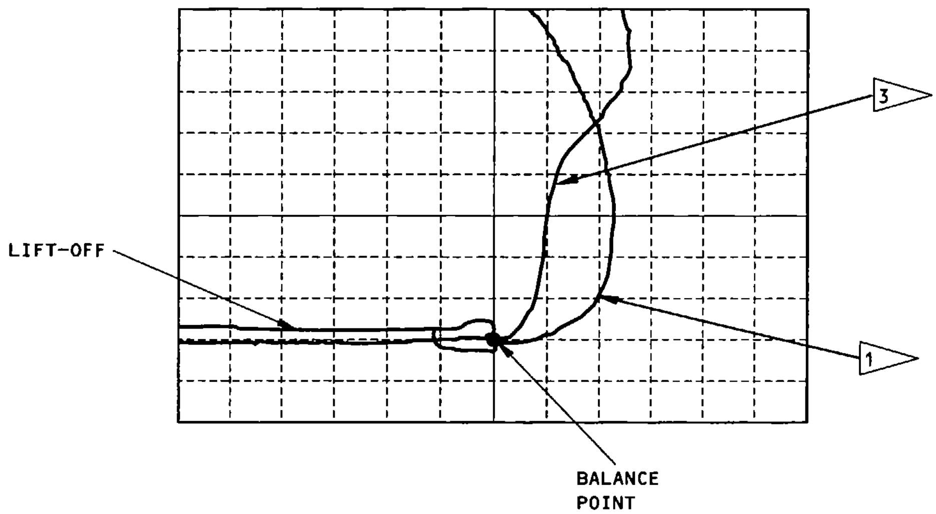
- THIS SCREEN DISPLAY IS AN EXAMPLE OF THE CALIBRATION SIGNALS WHEN THE PROBE IS AT PROBE POSITIONS 1 AND 2 (AS SHOWN IN DETAIL II). THE NOTCH SIGNAL CAN LOOK DIFFERENT WITH DIFFERENT PROBES AND INSTRUMENTS.

CALIBRATION SCREEN DISPLAY
DETAIL III

B08692



REFERENCE STANDARD ANDT1055 WITH PROBE
NUMBER SPO-5330



REFERENCE STANDARD ANDT1057 WITH PROBE
NUMBER SPO-5330

NOTES:

- THE SCREEN DISPLAYS ABOVE ARE SIGNALS WITH THE PROBE ADJACENT TO THE TYPE "C" FASTENER (SEE TABLE I).

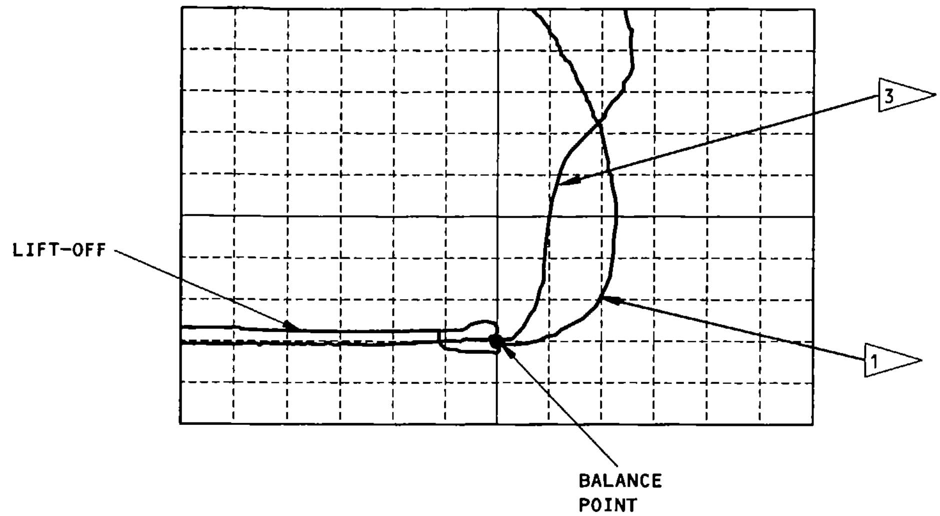
[1] EDGE EFFECT SIGNAL FROM THE SIDE OF THE FASTENER WITH NO NOTCH.

[2] START OF THE EDGE EFFECT SIGNAL FROM THE SIDE OF THE FASTENER WITH THE NOTCH.

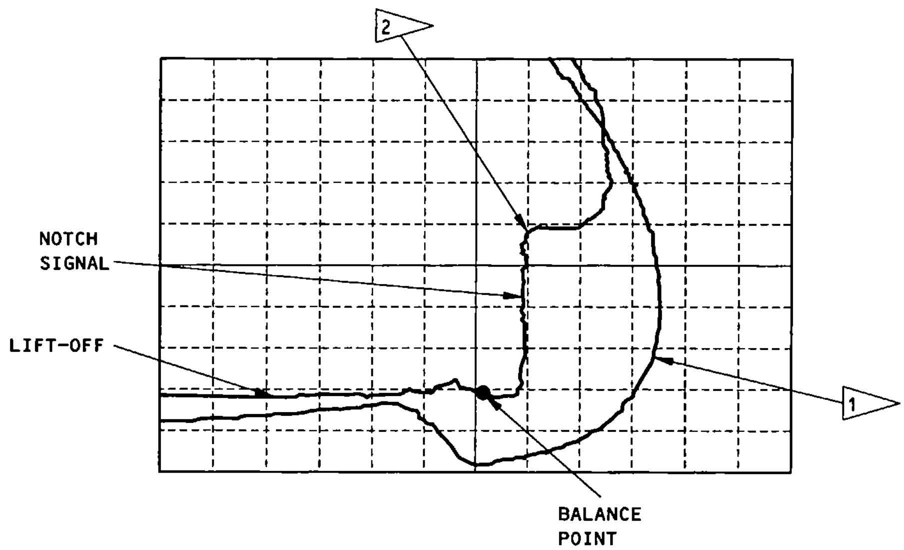
[3] NOTCH SIGNAL WITH THE EDGE EFFECT SIGNAL.

SCREEN DISPLAY EXAMPLES TO SHOW THE SEPARATION BETWEEN THE NOTCH SIGNAL AND THE EDGE EFFECT SIGNAL WITH AN INCREASE OF REPAIR MATERIAL
DETAIL IV

F77479



REFERENCE STANDARD ANDT1057 WITH
PROBE NUMBER SPO-5330



REFERENCE STANDARD ANDT1057 WITH
PROBE NUMBER RS1005-2/TF

NOTES:

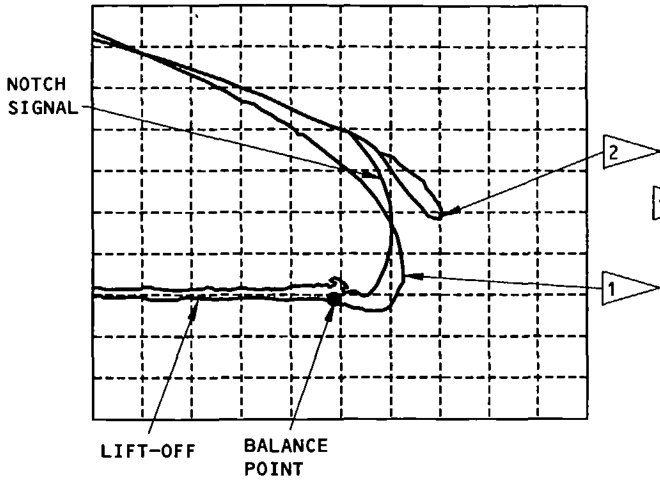
- THE SCREEN DISPLAYS ABOVE ARE SIGNALS WITH THE PROBE ADJACENT TO THE TYPE "C" FASTENER (SEE TABLE I).

1 EDGE EFFECT SIGNAL FROM THE SIDE OF THE FASTENER WITH NO NOTCH.

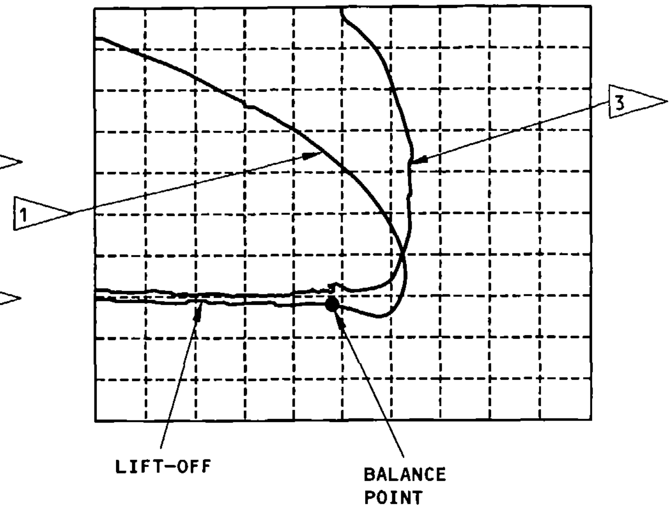
2 START OF THE EDGE EFFECT SIGNAL FROM THE SIDE OF THE FASTENER WITH THE NOTCH.

3 NOTCH SIGNAL WITH THE EDGE EFFECT SIGNAL.

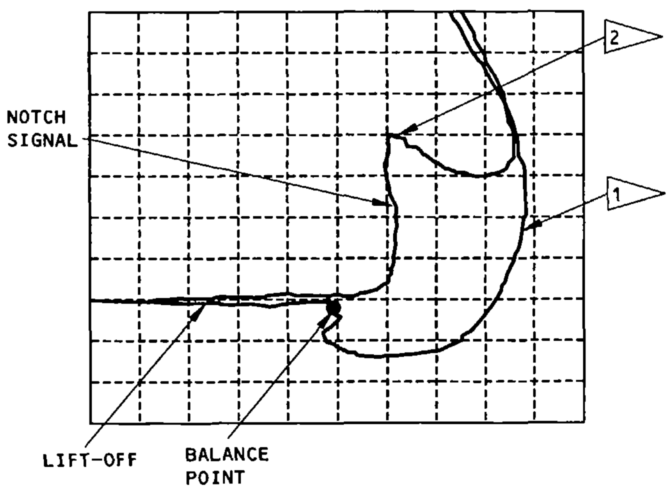
SCREEN DISPLAY EXAMPLES TO SHOW THE SEPARATION BETWEEN THE NOTCH SIGNAL AND THE EDGE EFFECT SIGNAL WITH A CHANGE TO A SMALLER DIAMETER PROBE
DETAIL V



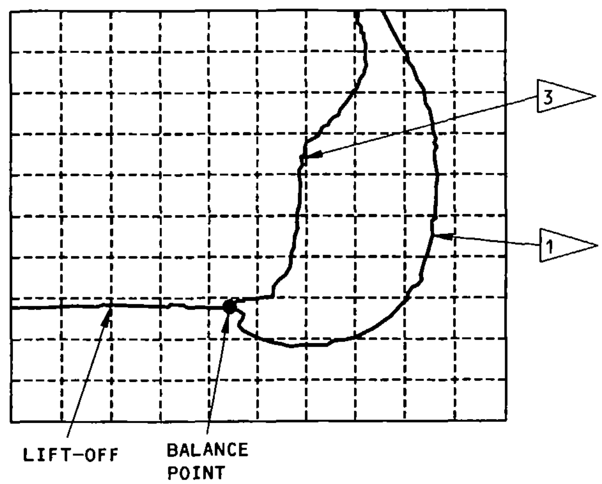
SIGNALS AT PROBE POSITION 3 ON REFERENCE STANDARD ANDT1052



TEST PIECE THAT IS THE SAME AS REFERENCE STANDARD ANDT1052 WITH A 0.25 (6) LONG NOTCH AT THE LOWER EDGE OF THE FASTENER HOLE



SIGNALS AT PROBE POSITION 3 ON REFERENCE STANDARD ANDT1056



TEST PIECE THAT IS THE SAME AS REFERENCE STANDARD ANDT1056 WITH A 0.55 (14) LONG NOTCH

NOTES:

- ALL DIMENSIONS ARE IN INCHES (MILLIMETERS ARE IN PARENTHESES)
- THE SCREEN DISPLAYS ABOVE ARE SIGNALS WITH THE PROBE ADJACENT TO THE TYPE "C" FASTENER (SEE TABLE I).

1 EDGE EFFECT SIGNAL FROM THE SIDE OF THE FASTENER WITH NO NOTCH.

2 START OF THE EDGE EFFECT SIGNAL FROM THE SIDE OF THE FASTENER WITH THE NOTCH

3 NOTCH SIGNAL WITH THE EDGE EFFECT SIGNAL

Screen Display Examples to Compare the Notch Signal at Probe Position 3 to a Notch at the Lower Edge of the Fastener Hole Near the Edge of the Repair
DETAIL VI

F77587

THICKNESS RANGE OF MATERIAL ABOVE INSPECTION SKIN	REFERENCE STANDARD NUMBER	MINIMUM AIRPLANE SKIN THICKNESS	INSPECTION FREQUENCY (KhZ)	REFERENCE NOTCH LENGTH N	REFERENCE STANDARD REPAIR THICKNESS D	REFERENCE STANDARD SKIN THICKNESS E	EDGE MARGIN M	FASTENER SPACING P	FASTENER TYPE [1] A	FASTENER TYPE [1] [2] B	FASTENER TYPE [1] [2] C
0.040 AND LESS	ANDT1049	0.032	6.0-9.0	0.25	0.040	0.040	0.39	1.0	BACB30FN5	BACR15CE5D	BACR15ET7D
0.041-0.050	ANDT1050	0.036	5.0-7.0	0.25	0.050	0.040	0.39	1.0	BACB30FN5	BACR15CE5D	BACR15ET7D
0.051-0.056	ANDT1077	0.036	4.0-6.0	0.25	0.056	0.040	0.39	1.0	BACB30FN5	BACR15CE5D	BACR15ET7D
0.057-0.075	ANDT1051	0.036	2.0-4.0	0.25	0.071	0.040	0.45	1.3	BACB30FN6	BACR15CE6D	BACR15BB8D
0.076-0.090	ANDT1052	0.036	1.0-3.0	0.25	0.089	0.040	0.45	1.3	BACB30FN8	BACR15CE8D	BACR15BB8D
0.091-0.110	ANDT1053	0.050	0.9-2.0	0.30	0.11	0.050	0.57	1.4	BACB30FN8	BACR15CE8D	BACR15BB8D
0.111-0.125	ANDT1054	0.063	0.9-1.5	0.35	0.125	0.063	0.57	1.4	BACB30FN8	BACR15CE8D	BACR15BB8D
0.126-0.160	ANDT1055	0.071	0.8-1.0	0.45	0.16	0.071	0.63	1.75	BACB30FN8	BACR15CE8D	BACR15BB8D
0.161-0.200	ANDT1056	0.080	0.5-0.7	0.55	0.20	0.080	0.63	1.75	BACB30FN8	BACR15CE8D	BACR15BB8D
0.201-0.220	ANDT1057	0.100	0.4-0.6	0.65	0.22	0.100	0.63	1.75	BACB30FN8	BACR15CE8D	BACR15BB8D
0.221-0.250	ANDT1015	0.100	0.3-0.5	0.8	0.25	0.100	0.65	1.75	BACB30FN8	BACR15CE8D	BACR15BB8D

ALL DIMENSIONS ARE IN INCHES

[1] OR EQUIVALENT

[2] THESE RIVETS MUST HAVE A CONVERSION COATED (ALODINED) FINISH. TO MAKE SURE THE FINISH IS ALODINE, REFER TO PART 1, 51-06-01. INSTALL THE RIVETS AS SPECIFIED IN PART 1, 51-01-04.

NOTE: REFERENCE STANDARDS ANDT1049 THRU ANDT1057 REPLACE NDT1006 THRU NDT1014. IF YOU HAVE REFERENCE STANDARDS NDT1006 THRU NDT1009, IT IS NOT NECESSARY TO REPLACE THEM WITH ANDT1049 THRU ANDT1052 IF THEY HAVE ALODINED RIVETS. SEE FLAGNOTE 2.

REFERENCE STANDARD SPECIFICATIONS
TABLE I

B08694

PART 6 - EDDY CURRENT

SUBSURFACE CRACK INSPECTION OF FAYING SURFACES

1. Purpose:

   A. This procedure uses medium frequency eddy currect (MFEC) to do an inspection for subsurface cracks that:

      (1) Are adjacent to fastener holes

      (2) Are near the external surface of the first layer of aluminum fuselage structures

      (3) Start at the internal (faying) surface

   B. This procedure can be used to find:

      (1) Cracks that start at fastener holes and move out in a radial direction

      (2) Cracks that start away from the fastener hole and are along side the hole (eyebrow cracks)

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. Instruments

      (1) Use an impedance plane instrument that:

         (a) Has an impedance plane display.

         (b) Operates in a frequency range of 10 to 30 kHz.

      (2) The instruments identified below were used to prepare this procedure:

         (a) NDT 19; Staveley Instruments

         (b) MIZ 22; Zetec Inc.

B. Probes

(1) Use a probe that can operate in a frequency range of 30 to 50 kHz.

(2) If you make an order for a probe, make sure to give the instrument or connector type.

(3) The probes identified below were used to prepare this procedure:

(a) MT-30/50K; NDT Engineering Corp.

(b) P/50-100K/A/0.0/3; Staveley Instruments

(c) LS905-50B; NDT Engineering Corp.

C. Reference Standards

(1) Use reference standard ANDT4126. See Detail I for data about the reference standard.

3. Preparation for Inspection:

A. Identify the location of the inspection areas.

B. Get access to the inspection areas.

C. Remove loose paint, dirt, and sealant from the surfaces of the inspection area.

D. Make the inspection surfaces smooth if they are rough.

4. Instrument Calibration:

A. Set the frequency between 30 and 50 kHz.

B. If the inspection area is painted, put a non-conductive shim on top of the reference standard. The thickness of the non-conductive shim must be within ± 0.003 inch (0.08 mm) of the paint thickness.

C. Put the probe on reference standard ANDT4126 at position 1, Detail II, on the side of the reference standard opposite the fastener heads (see Detail II).

D. Balance the instrument.

E. Adjust the instrument phase to get a lift-off signal that moves horizontally to the left as shown in Detail II.

F. Adjust the horizontal gain or vertical to horizontal gain ratio to get a lift-off signal of less than 20% of full screen width when the probe is lifted off the reference standard 0.003 inch (0.08 mm) (one sheet of paper is approximately 0.003 inch, 0.08 mm).

G. Move the balance point to the position shown in Detail II.

H. Move the probe above the reference standard notch at probe position 2 as shown in Detail II.

NOTE: This notch is used to calibrate the equipment to do an inspection for cracks along the side of the fastener hole.

I. Adjust the instrument gain to get a signal amplitude of 80 percent of full screen height as shown in Detail II.

J. It will be necessary to use a different frequency between 10 and 30 kHz and do paragraphs 4.E. thru 4.I. again if:

(1) The signal to noise ratio is less than 3:1 or,

(2) The notch signal is not vertical to the lift-off line.

K. Move the probe above the reference standard notch at probe position 3 as shown in Detail II. This notch causes a radial crack signal to occur on the screen display. Monitor the signal as you move the probe above the notch. The radial crack signal must occur in the shaded area shown in Detail II.

5. Inspection Procedure:

A. Put the probe on the inspection surface adjacent to a fastener.

NOTE: After the instrument is calibrated from the tail side of a fastener, the inspection can be done from the head or the tail side of a fastener. Refer to the document that specified to use this procedure to identify the correct inspection surface.

B. Balance the instrument.

C. Do a scan of the inspection area as follows:

(1) Use a scan pattern that will permit you to find subsurface cracks that are 0.25 inch (6.4 mm) or more in length. Detail III shows a possible scan pattern.

(a) Use the end of the fastener as a probe guide and do the scan completely around the fastener.

(b) Make a second scan completely around the fastener with the probe moved a distance of 0.25 inch (6.4 mm) from the fastener.

(2) Keep the probe vertical to the part surface to decrease the balance point movement.

(3) Frequently do a check of the instrument/probe calibration during the inspection as follows:

(a) Put the probe on the reference standard to get a signal from the notch.

(b) Compare the signal you got from the notch during calibration with the signal you get now.

(c) If the signal has changed 10% or more, do the calibration and inspection again on all areas examined since the last calibration check.

(4) Monitor all areas for fast upscale signals that are almost the same as the signals you got from the reference standard notches.

6. Inspection Results

A. Indications of possible cracks are as follows:

(1) Signals more than 40 percent of the display.

(2) Fast upscale signals that occur when the probe is moved a small angular distance (signals such as those you got during calibration).

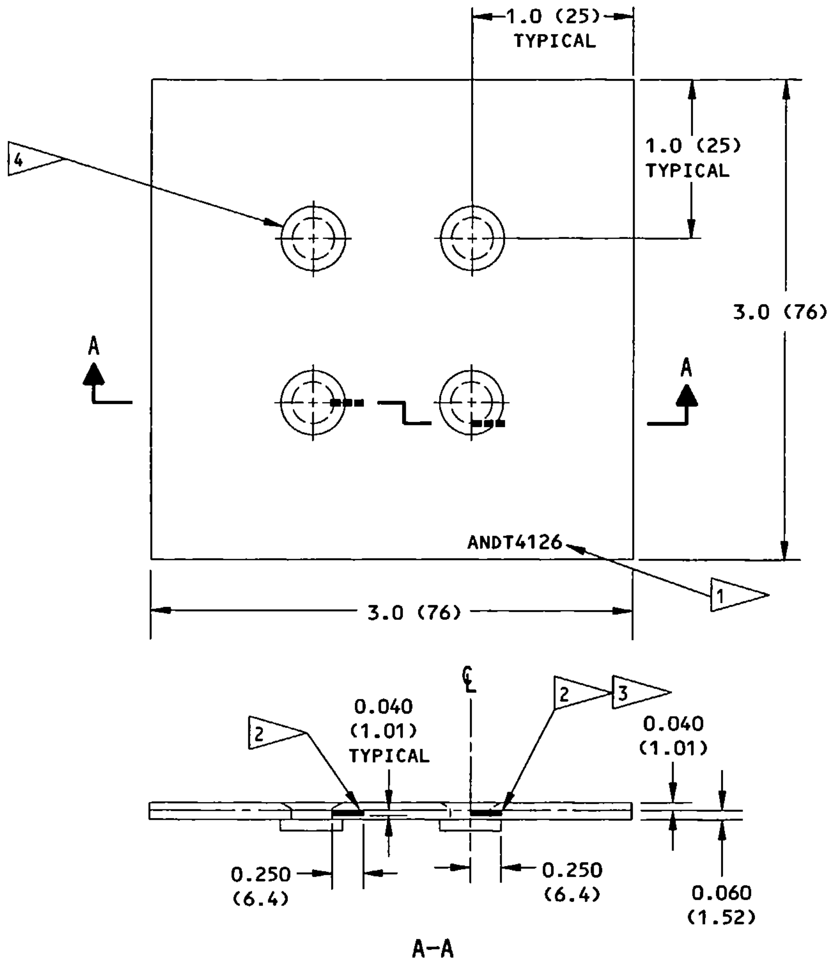
B. Some cracks follow a circumferential path around the fastener and do not always end at the fastener hole. These type of cracks cause a fast upscale signal that will keep the same signal amplitude as the probe is moved around the fastener head for the length of the crack.

C. To find the length, or the ends, of a crack, do a scan across the length of the crack until a signal does not occur.

D. You can do more examination to make sure a crack signal is the result of a crack as follows:

(1) For cracks that start at fastener holes, use a high frequency inspection procedure as specified in the "Fastener Hole Inspection" column of Table I (see Detail IV).

(2) To examine the external side of the fuselage, use a low frequency eddy current procedure as specified in the "Repair Inspection" column of Table I (see Detail IV).



NOTES:

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

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

  ANGULAR: = ±1.0 DEGREE
- SURFACE ROUGHNESS = 125 R_a OR BETTER
- MATERIAL: 2024-T3, T4

[1] ETCH OR STEEL STAMP "ANDT4126" ON THE REFERENCE STANDARD. PUT A LETTER "A" IN FRONT OF THE REFERENCE STANDARD NUMBER TO SHOW THAT IT HAS ALODINED RIVETS. SEE FLAGNOTE 4.

[2] EDM NOTCH: PUT THE NOTCH ADJACENT TO THE HOLE EDGE WITHIN ±0.005 (±0.10)

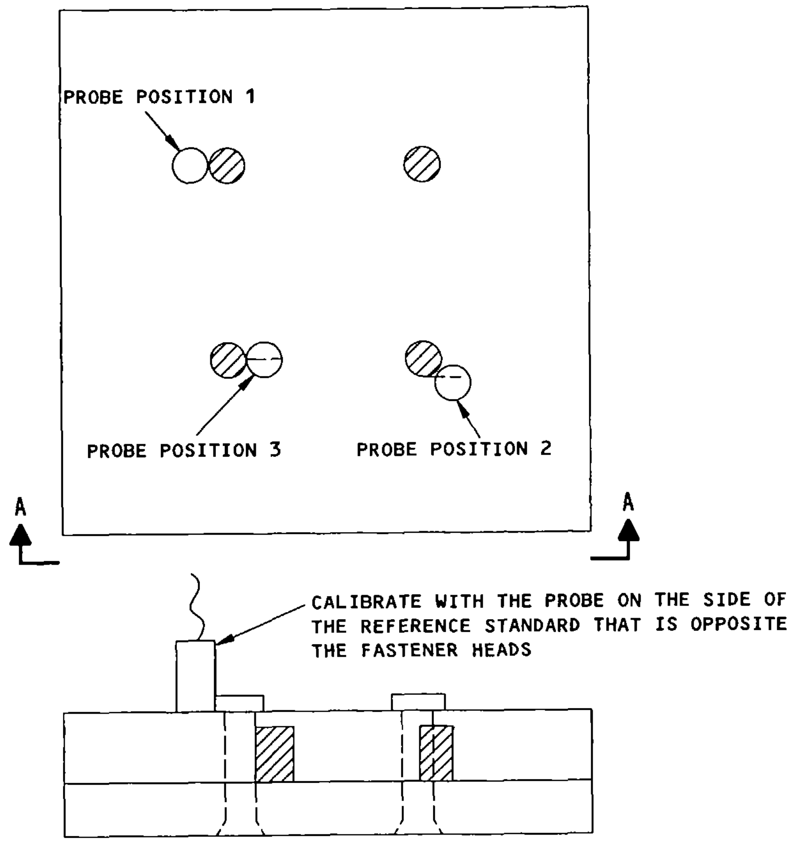
NOTCH DIMENSIONS AND TOLERANCES:

DEPTH: 0.040 (1.01) ±10% AS SHOWN
WIDTH: 0.025 (0.75) MAXIMUM
LENGTH: 0.250 (6.4)

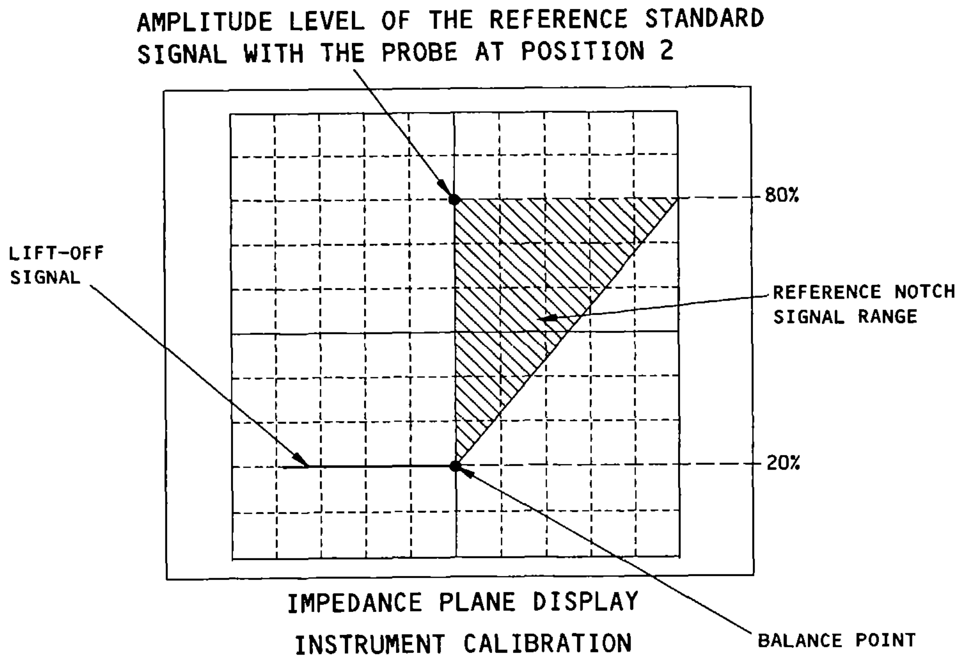
[3] THIS NOTCH STARTS AT THE HOLE CENTERLINE AND IS TANGENT TO THE HOLE

[4] FASTENERS: BACR15CE6 OR EQUIVALENT (4 LOCATIONS). RIVETS MUST HAVE A CONVERSION COATED (ALODINED) FINISH. TO MAKE SURE THE FINISH IS ALODINE, REFER TO PART 1, 51-06-01. INSTALL RIVETS AS SPECIFIED IN PART 1, 51-01-04.

REFERENCE STANDARD ANDT4126
DETAIL I



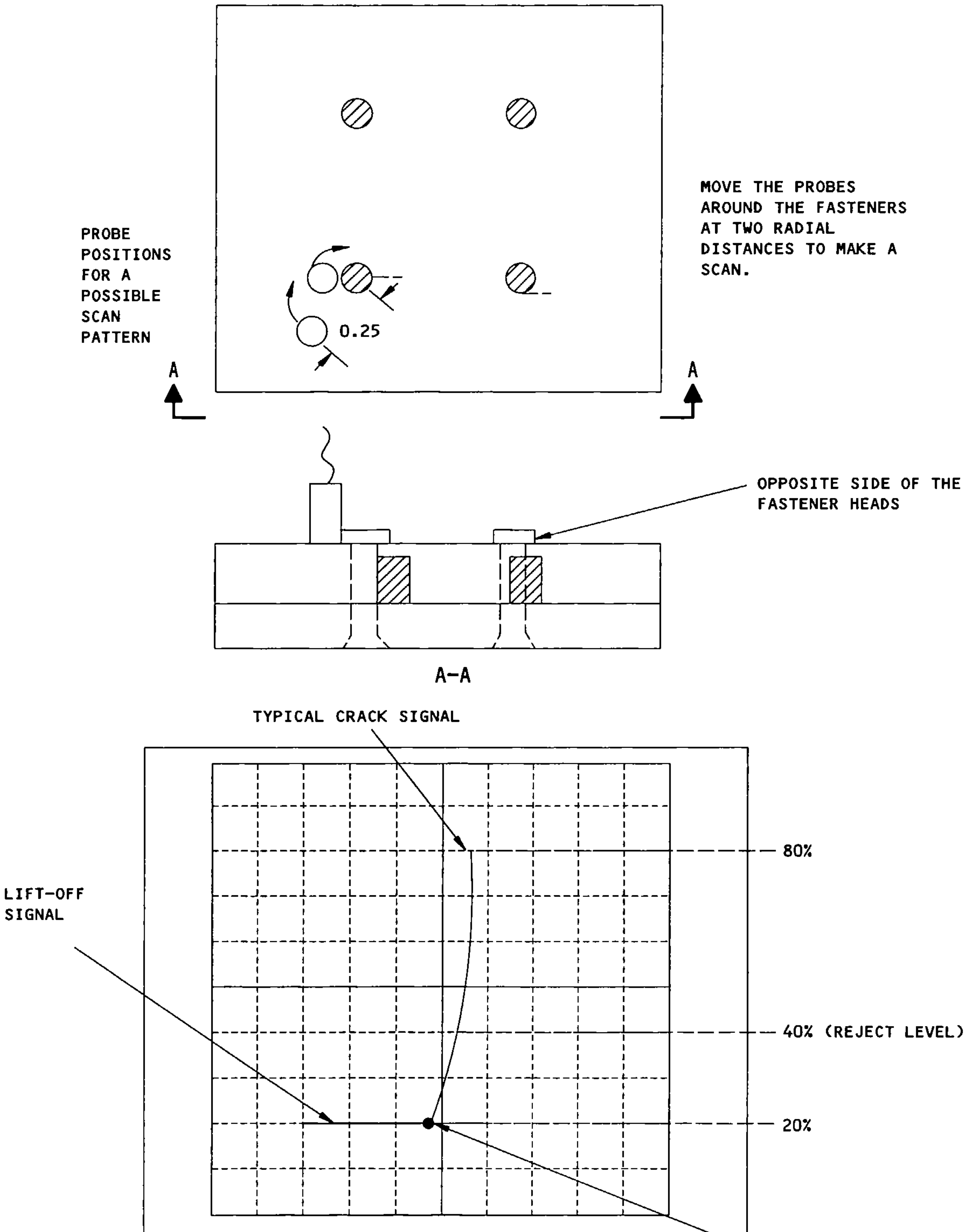
VIEW A-A



IMPEDANCE PLANE DISPLAY

INSTRUMENT CALIBRATION
DETAIL II

E59344



IMPEDANCE PLANE DISPLAY

INSPECTION SCAN PATTERN AND DEFECT INDICATIONS
DETAIL III

E59390

AIRPLANE MODEL	FASTENER HOLE INSPECTION		REPAIR INSPECTION
	MANUAL PROBE	ROTATING PROBE	
707	PART 6 51-00-00 FIGURE 11	PART 6 51-00-00 FIGURE 16	PART 6 53-30-00 FIGURE 5
727	PART 6 51-00-00 FIGURE 11	PART 6 51-00-00 FIGURE 16	PART 6 53-30-00 FIGURE 5
737	PART 6 51-00-00 FIGURE 11	PART 6 51-00-00 FIGURE 16	PART 6 53-30-00 FIGURE 5
747	PART 6 51-00-00 FIGURE 11	PART 6 51-00-00 FIGURE 16	PART 6 53-30-00 FIGURE 5
757	PART 6 51-00-11	PART 6 51-00-16	PART 6 53-00-06
767	PART 6 51-00-11	PART 6 51-00-16	PART 6 53-00-06

TABLE I
CRACK INSPECTION PROCEDURES

DETAIL IV

PART 6 - EDDY CURRENT
SUBSURFACE CRACKS THAT START AT THE FAYING SURFACES OF THE AIRPLANE SKINS - INTERNAL INSPECTION

1. Purpose

   A. Use this procedure to do an inspection to find subsurface cracks in the inboard skin, at the fastener rows of the lap splice and fuselage repairs. Detail I shows the inspection as it is done on the lower fastener row of the lap splice.

   B. This procedure examines the fuselage inboard skin with the probe on the internal surface of the skin. This procedure examines a skin thickness range of 0.036 inches (0.91 mm) to 0.120 inches (3.05 mm) and uses Medium Frequency Eddy Current (MFEC).

   C. This procedure uses a spot probe that is not fully shielded to look for cracks that:

      (1) Are as much as 3 times longer than they are deep.

      (2) Are adjacent to the fastener hole.

      (3) Start at the outboard surface of the inboard skin panel (faying surface).

2. Equipment

   A. General

      (1) Use inspection equipment that can be calibrated on the reference standard as specified in par. 4.

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

   B. Instrument

      (1) Use an eddy current instrument that:

         (a) Has an impedance plane or a meter display.

         (b) Operates at a frequency between 10 and 30 kHz.

      (2) The instruments specified below were used to help prepare this procedure.

         (a) Miz, 10A/B (Meter display); Zetec, Inc

         (b) Phasec 2200 (Impedance display); Hocking/Krautkramer

         (c) Nortec 1000/2000 (Impedance display); Staveley, Inc.

         (d) NDT 19e (Impedance display); Staveley, Inc

C. Probes

(1) Use a spot probe with these properties:

NOTE: A reflection type probe is recommended.

(a) Use a probe with an end diameter of no larger than 0.190 inch (4.83 mm) and a probe height of no more than 0.50 (12.7 mm).

(b) Operates at a frequency between 10 and 30 kHz.

(c) Is at a right angle.

(d) During a probe scan around a reference standard fastener without a notch, the balance point signal must not change more than 5% of full screen height (FSH). Calibration paragraph 4.H. will test the probe for this property.

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

NOTE: Probes different from those identified below can be used if they have the properties identified in Paragraph 2.C. (1) above.

(a) NEC-1084; NDT Engineering

(b) SPO 6464; Staveley, Inc.

(c) SPC-4TF-105-1R; EC/NDT Company.

D. Reference Standards

(1) To examine a skin thickness range between 0.036 inch (0.91 mm) to 0.120 inch (3.05 mm), four reference standards are necessary.

(2) Use the reference standards that follow for the applicable thickness range to examine:

(a) ANDT1079 to examine the thickness range of 0.036 inch (0.91 mm) to 0.045 inch (1.14 mm)

(b) ANDT1080 to examine the thickness range of 0.046 inch (1.17 mm) to 0.055 inch (1.40 mm)

(c) ANDT1081 to examine the thickness range of 0.056 inch (1.42 mm) to 0.067 inch (1.70 mm)

(d) ANDT1082 to examine the thickness range of 0.068 inch (1.73 mm) to 0.120 inch (3.05 mm)

(3) See Detail II for the data about the reference standards.

(4) Reference standards NDT10XX can be used to make reference standards ANDT10XX if you remove the anodized rivets from NDT10XX and install Alodine rivets as specified in Detail II.

3. Preparation for Inspection

A. Remove all the necessary interior panels and insulation blankets to get access to the inside surface of the inboard skin.

B. Remove loose material and sealant from the inspection surface. It is not necessary to remove the corrosion inhibiting compound if it is evenly coated and at a thickness of 0.010 inches (0.25 mm) or less.

C. If tape is used on the probe, make sure that it is on the tip of the coil, not on the outside edges. It is critical that the probe be as near as possible to the fastener. Tape on the outside edge of the probe can cause the distance to change between the probe and the fastener, if the tape is not applied correctly.

4. Instrument Calibration

A. Determine the skin thickness from the Structural Repair Manual (SRM), Service Bulletin, or other sources for calibration. See the Instrument Calibration Table below for the calibration specifications that identify:

(1) The skin thickness range.

(2) The reference standard to use for the skin thickness range.

(3) The instrument frequency to use.

Skin thickness range to be examined	0.036 inch (0.91 mm) to 0.045 inch (1.14 mm)	0.046 inch (1.17 mm) to 0.055 inch (1.40 mm)	0.056 inch (1.42 mm) to 0.067 inch (1.70 mm)	0.068 inch (1.73 mm) to 0.120 inch (3.05 mm)
Reference standard to use	ANDT1079	ANDT1080	ANDT1081	ANDT1082
Instrument frequency to use	25 kHZ	20 kHZ	15 kHZ	10 kHZ

Instrument Calibration Table

B. Put the probe at probe position 1 (adjacent to the machined fastener head) of the applicable reference standard and fastener. See Detail III.

C. Balance the instrument.

D. If an impedance plane display instrument is used, adjust the vertical gain 14 to 20 dB higher than the horizontal gain or between 5:1 and 10:1 vertical to horizontal gain ratio.

NOTE: The gain ratios in par. 4.D. are necessary to keep the balance point on the screen during the scan. Changes in the thickness of the finish can cause the balance point to move off of the screen display.

E. Set the lift-off as follows:

(1) If a meter display instrument is used: adjust the phase control so that the meter needle moves no more than 5 percent of full scale for probe-to-part distances of up to 0.006 inch (0.15 mm). This is the thickness of two sheets of paper (approximately).

(2) If an impedance plane instrument is used: adjust the phase control so that the lift-off signal moves horizontally to the left as shown in Detail III, View C.

F. Adjust the balance point to the position shown in Detail III. See View B for the meter display and View C for the impedance plane display.

NOTE: Some probes do not have the coil accurately positioned in the center of the probe body, which can cause the balance point to move during the scan around the fastener.

G. Adjust the instrument sensitivity as follows:

(1) Put the probe at probe position 2 (adjacent to the same diameter fastener used for probe position 1) on the reference standard, above the notch to get a maximum signal. See Detail III, View A.

(2) If a meter instrument is used:

(a) Adjust the instrument sensitivity to get a notch signal that is 60 percent of full scale (40 percent of full scale higher than the balance point). See Detail III, View B.

(3) If an impedance plane instrument is used:

(a) Adjust the instrument sensitivity to put the notch signal at 60 percent of full screen height (40 percent higher than the balance point). See Detail III, View C.

H. Make a complete scan around the fastener at probe position 1 on Detail III and monitor the display for movement of the balance point. If the balance point moves more than 5% of the signal display, use a different probe.

I. Set the instrument alarm to 50% of the notch signal set in par. 4.G.

5. Inspection Procedure

A. Examine the internal skin surface, around the driven button end of the fastener as follows:

(1) Calibrate the instrument as specified in paragraph 4.

(2) Put the probe on the skin surface and adjacent to the driven button end of the fastener.

(3) Balance the instrument.

(4) Do a complete scan inspection around the fastener. During the scan :

(a) Keep the probe adjacent to the fastener at all times.

(b) Keep the probe as vertical as possible to the part surface to decrease the balance point movement.

(c) Make a mark at the fastener locations that cause signals to occur that are 20% (or more) above the balance point and are almost the same as the signal you got from the reference standard notch.

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

1) Put the probe on the reference standard at probe position 2 (see Detail III) to get the signal from the notch.

2) If the signal has changed 10% or more, do the calibration and inspection again on all the areas examined since the last calibration check.

6. Inspection Results

A. Inspection results for meter display instruments:

(1) An upscale needle movement that is 40% (or more) of full scale (20% higher than the balance position) is a possible crack signal. A crack signal occurs during a short scan.

B. Inspection results for impedance plane display instruments:

(1) Vertical signals that are 40% (or more) of full screen height (20% higher than the balance point) are possible crack signals. A crack signal occurs during a short scan.

C. Signals can occur at different locations as a scan is made around the fastener. This can be caused by an edge effect signal from the fastener hole caused by an out-of-round condition of the driven button end during installation of the fastener. If the signal is more than that referred to in par 6.A.(1) or 6.B.(1) do more analysis as follows:

(1) Get local engineering approval and remove the fastener.

(2) Do a detailed visual inspection of the hole to look for surface conditions such as burrs, galling, corrosion and out-of-round holes. If one or more of the conditions above are found, get local engineering approval and do a clean-up ream to remove the condition.

(3) Do the fastener hole inspection as specified in Part 6, 51-00-00, Fig. 16.

<u>CAUTION</u>: IT IS POSSIBLE TO GET A CRACK SIGNAL WHEN YOU DO THIS PROCEDURE, BUT NOT WHEN YOU DO THE PART 6, 51-00-00, FIG. 16, FASTENER HOLE INSPECTION. THIS CAN OCCUR IF THERE ARE CRACKS THAT DO NOT GO INTO THE HOLE. THE PART 6, 51-00-00, FIG. 16, FASTENER HOLE INSPECTION WILL ONLY IDENTIFY CRACKS THAT GO INTO THE HOLE.

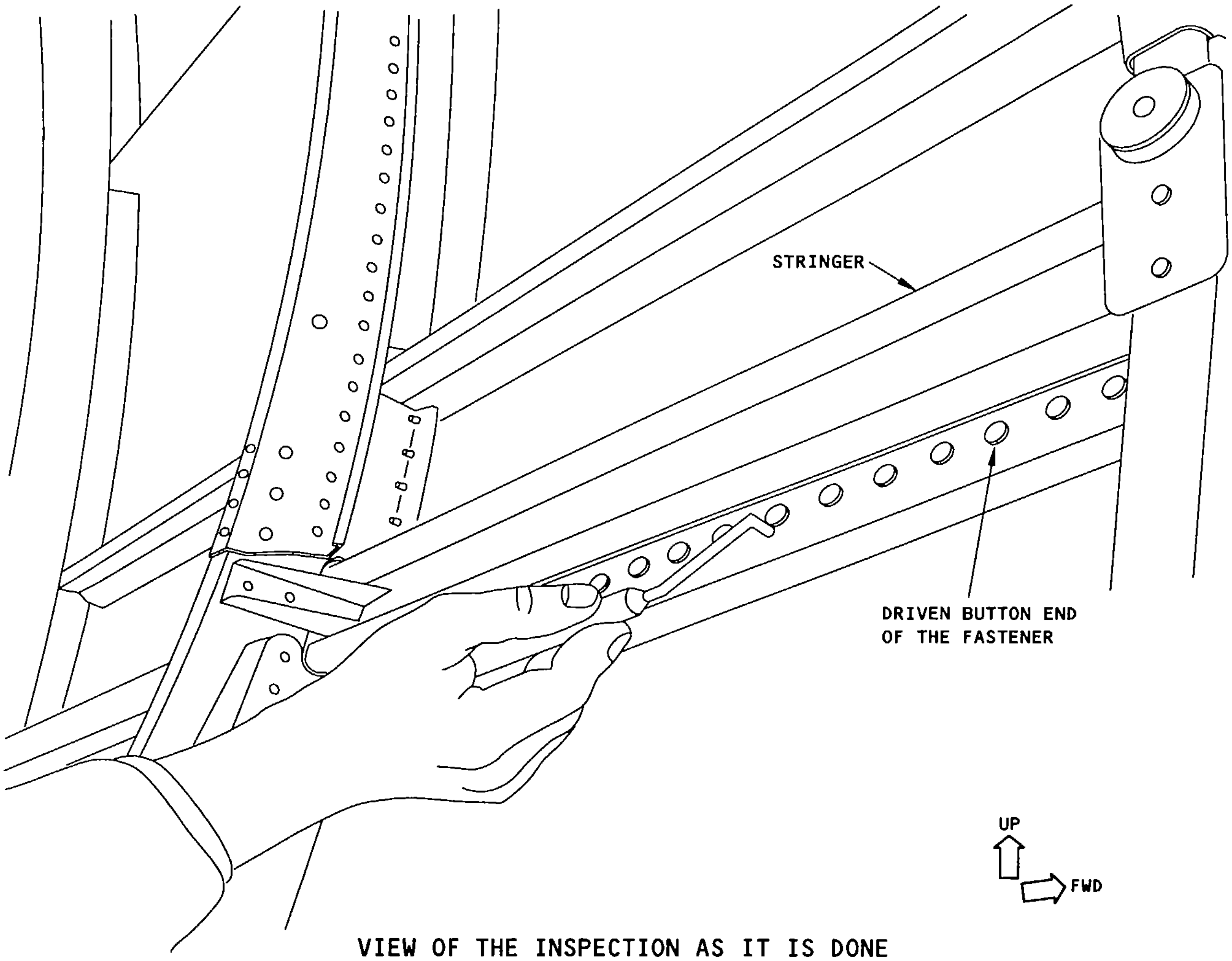
(4) If a crack signal does not occur when the fastener hole inspection procedure (specified in par 6.C.(3)) is done, do as follows:

(a) Put an aluminum rivet back into the hole. Make sure the rivet fits tight in the hole and has a sufficient shank length to be used as a probe guide.

(b) Make a scan around the shank of the rivet as specified in par. 5.A.(4).

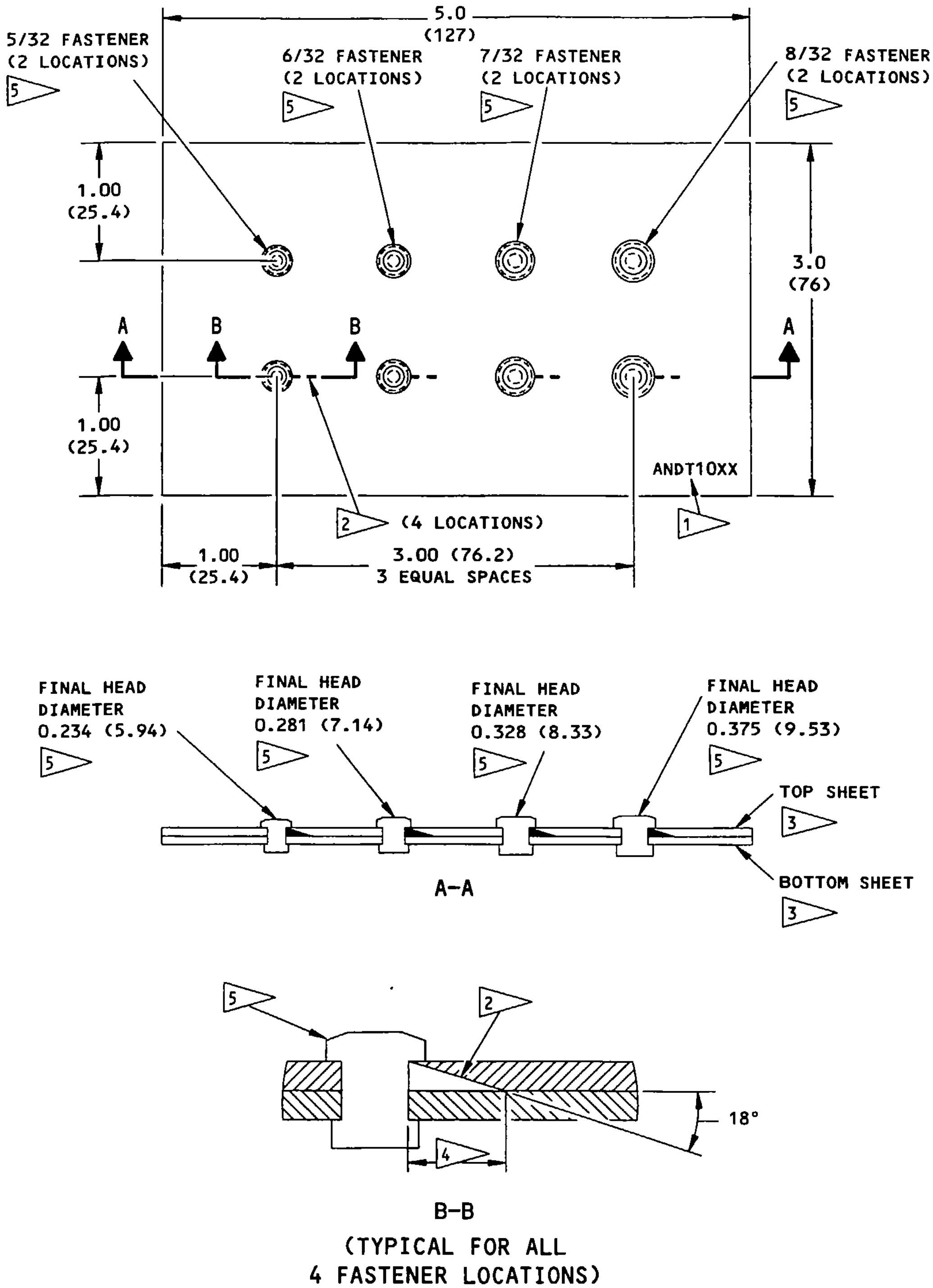
(c) If the crack signal occurs again, reject the hole.

D. Refer to the flow chart in Detail IV that shows the sequence of steps identified in par. 6.C.(1) thru (3) for more analysis of a signal that is 20% or more of the balance point.



VIEW OF THE INSPECTION AS IT IS DONE
ON THE INTERNAL SURFACE OF THE INBOARD
SKIN AT THE LAP SPLICE

TYPICAL INSPECTION AREA
DETAIL I



REFERENCE STANDARDS ANDT1079 THRU ANDT1082
DETAIL II (SHEET 1)

REFERENCE STANDARD NUMBER		ANDT1079	ANDT1080	ANDT1081	ANDT1082
MATERIAL THICKNESS [3]	TOP SHEET	0.040 (1.02)	0.050 (1.27)	0.063 (1.60)	0.070 (1.78)
	BOTTOM SHEET	0.040 (1.02)	0.050 (1.27)	0.063 (1.60)	0.070 (1.78)
NOTCH LENGTH AT THE FASTENER LOCATION [4]	5/32 FASTENER	0.142 (3.61)	0.172 (4.37)	0.211 (5.36)	0.232 (5.89)
	6/32 FASTENER	0.150 (3.81)	0.180 (4.57)	0.219 (5.56)	0.240 (6.10)
	7/32 FASTENER	0.158 (4.01)	0.188 (4.78)	0.227 (5.77)	0.248 (6.30)
	8/32 FASTENER	0.166 (4.22)	0.196 (4.98)	0.235 (5.97)	0.256 (6.50)

TABLE I

NOTES:

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

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

- ANGULAR TOLERANCE: ±1.0 DEGREE
- NOTCH LOCATION TOLERANCES:

  THE NOTCH LOCATION MUST BE WITHIN ±0.005 (±0.10) OF THE CENTERLINE OF THE HOLE AS SHOWN.
- MATERIAL: 2024-T3 OR T4 CLAD ALUMINUM
- FASTENERS: USE ONLY ALODINED RIVETS

  QUANTITY (2) BACR15BB5AD---C
  (2) BACR15BB6AD---C
  (2) BACR15BB7AD---C
  (2) BACR15BB8AD---C
- SURFACE ROUGHNESS: 63 Ra OR BETTER

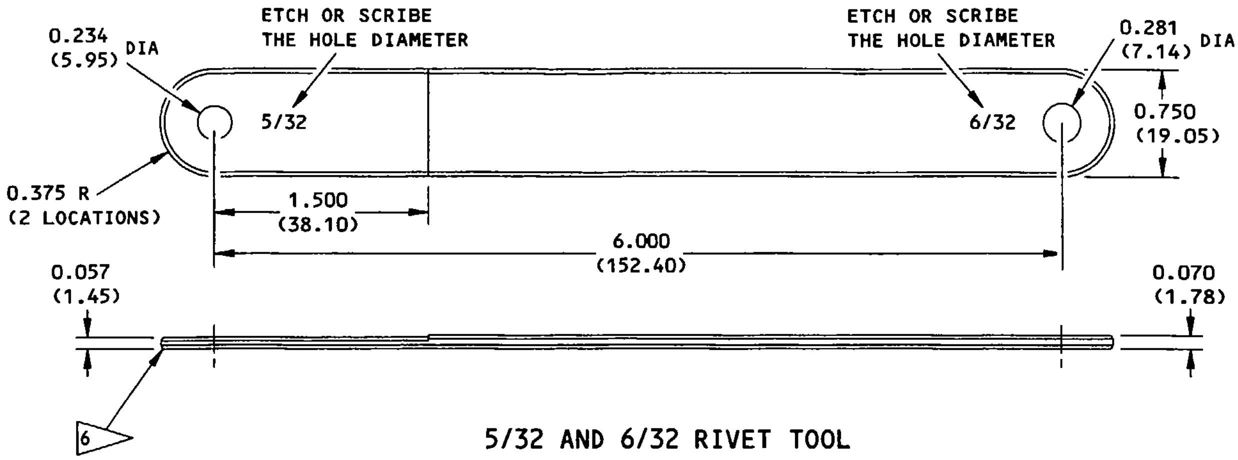
[1] ETCH OR SCRIBE THE REFERENCE STANDARD NUMBER TO THE APPLICABLE REFERENCE STANDARD AS SPECIFIED IN TABLE I.

[2] TAPERED EDM NOTCH:
MAXIMUM WIDTH: 0.010 (0.25)
LENGTH: SEE TABLE I

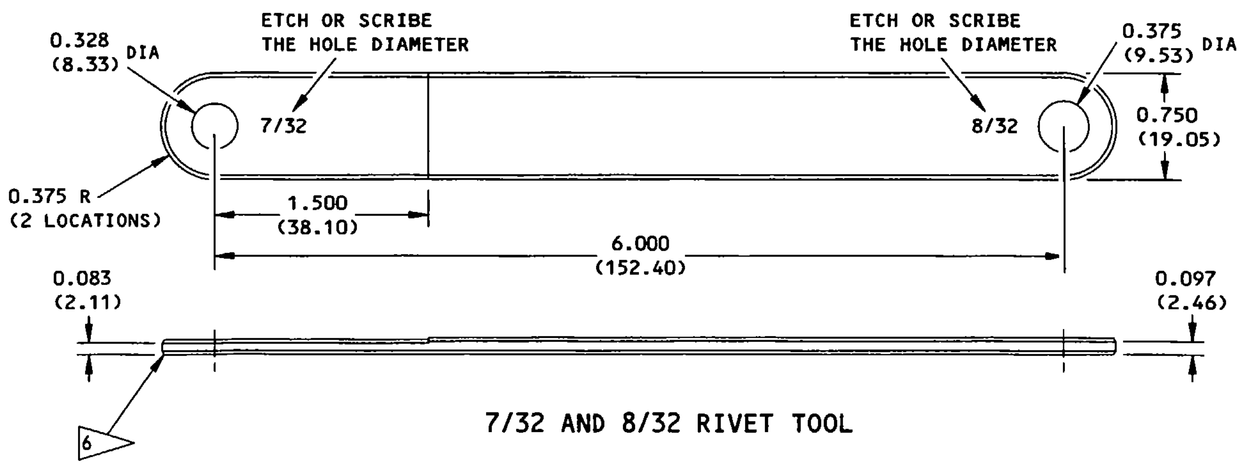
[5] INSTALL THE RIVETS AS FOLLOWS:

- MAKE SURE THE TAIL END OF THE RIVETS HAVE A "C" STAMP THAT IDENTIFIES THAT THE RIVETS ARE ALODINED.
- MACHINE THE FASTENER HEADS TO SIMULATE THE DRIVEN BUTTON DIAMETER.
  5/32 0.231 ±0.002 (5.87 ±0.05)
  6/32 0.278 ±0.002 (7.06 ±0.05)
  7/32 0.325 ±0.002 (8.26 ±0.05)
  8/32 0.372 ±0.002 (9.45 ±0.05)
- CLEAN THE RIVETS, HOLES, COUNTERSINKS AND ALL SURFACES OF THE REFERENCE STANDARDS WITH SOLVENT.
- PUT THE APPLICABLE DIAMETER HOLE OF THE RIVET TOOL AROUND THE RIVET HEAD SO THAT THE SURFACE OF THE TOOL TOUCHES THE TOP SHEET OF THE REFERENCE STANDARD.
- COMPRESS THE RIVET TO GET A BUTTON DIAMETER ON THE TAIL END THAT IS 1.3 TO 1.5 TIMES THE SHANK DIAMETER.

REFERENCE STANDARDS ANDT1079 THRU ANDT1082
DETAIL II (SHEET 2)



5/32 AND 6/32 RIVET TOOL



7/32 AND 8/32 RIVET TOOL

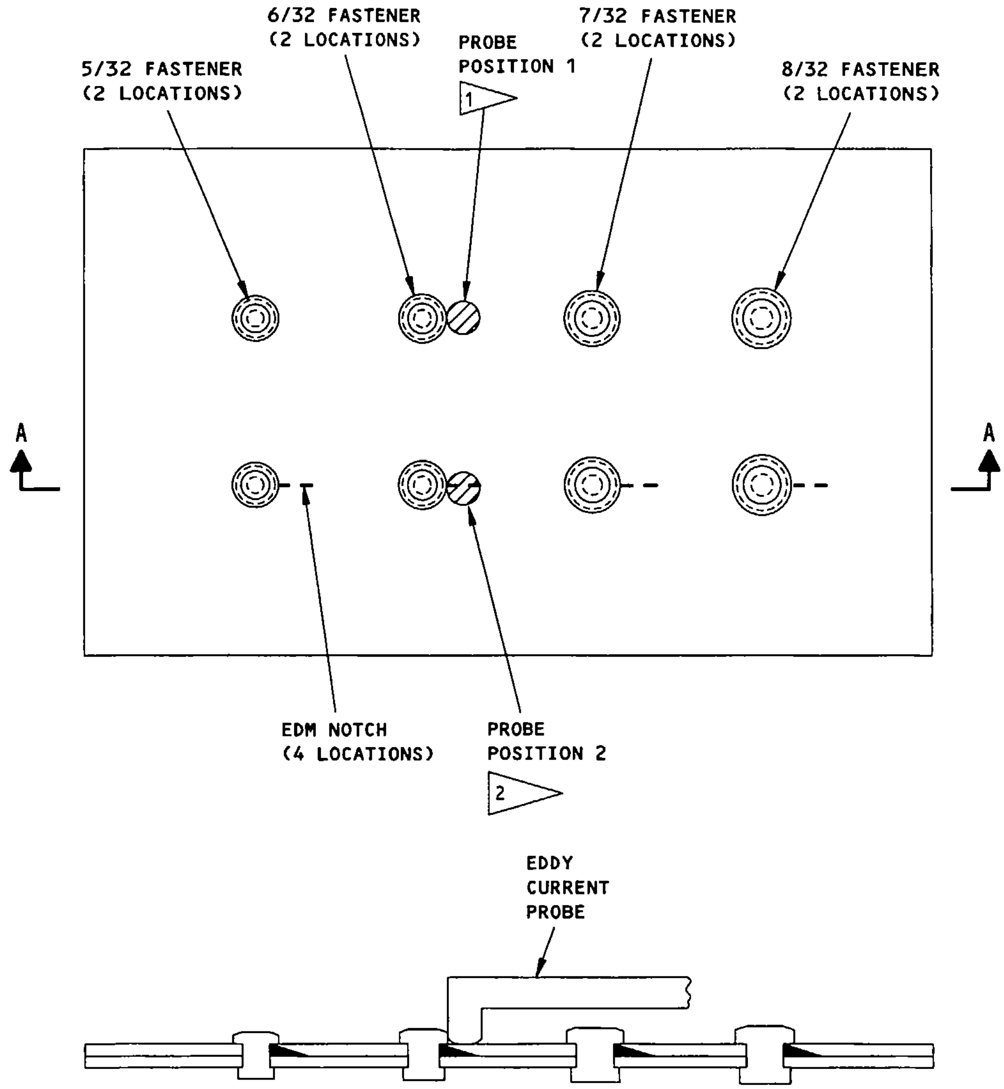
NOTES

- ALL DIMENSIONS ARE IN INCHES (MILLIMETERS ARE IN PARENTHESES)
- MATERIAL: STEEL OR STAINLESS STEEL; 40 KSI (OR MORE) YIELD STRENGTH
- USE: THIS TOOL IS PUT AROUND THE RIVET HEAD TO PREVENT EXPANSION OF THE RIVET HEAD AS THE RIVETS ARE COMPRESSED TO FORM THE BUTTON ON THE TAIL END.

  THE RIVET TOOLS CAN BE USED AS LONG AS THE FINAL RIVET HEAD DIAMETERS ARE AS SPECIFIED ON SHEET 1.

6 BREAK ALL EXTERNAL EDGES TO A 0.020 RADIUS. DO NOT BREAK HOLE EDGES.

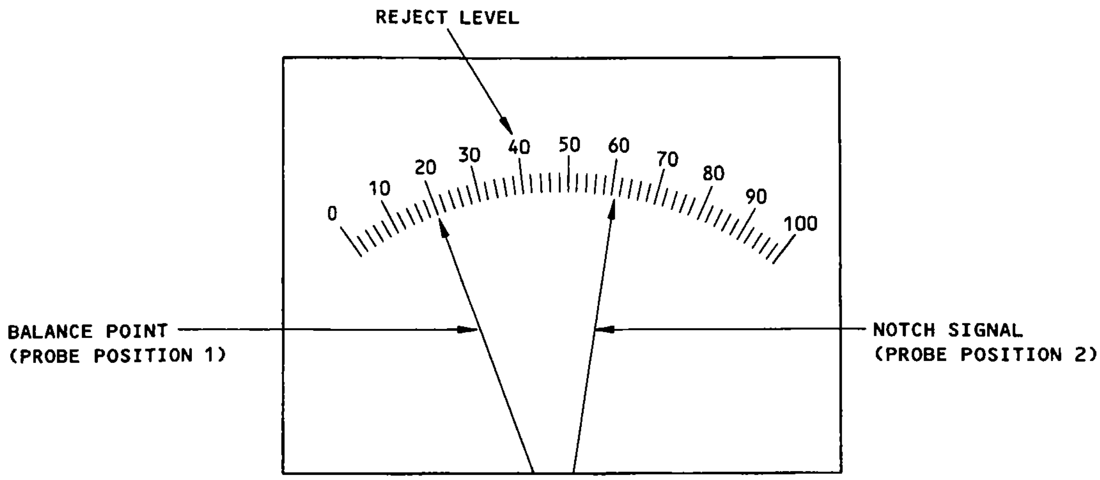
REFERENCE STANDARDS ANDT1079 THRU ANDT1082 - TOOLS TO PREVENT RIVET HEAD EXPANSION
DETAIL II (SHEET 3)



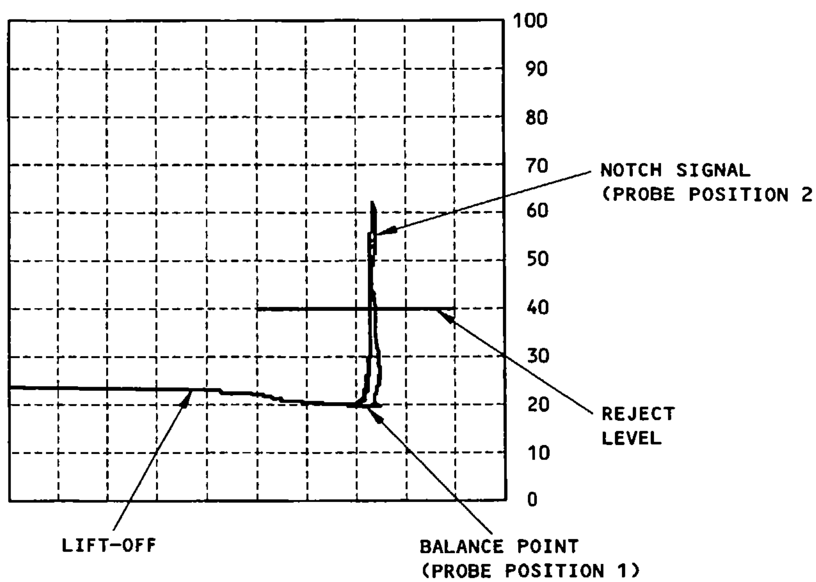
A-A
PROBE POSITION ON THE REFERENCE STANDARD

VIEW A

CALIBRATION AND PROBE POSITIONS
DETAIL III (SHEET 1)



METER DISPLAY
VIEW B



IMPEDENCE PLANE DISPLAY
VIEW C

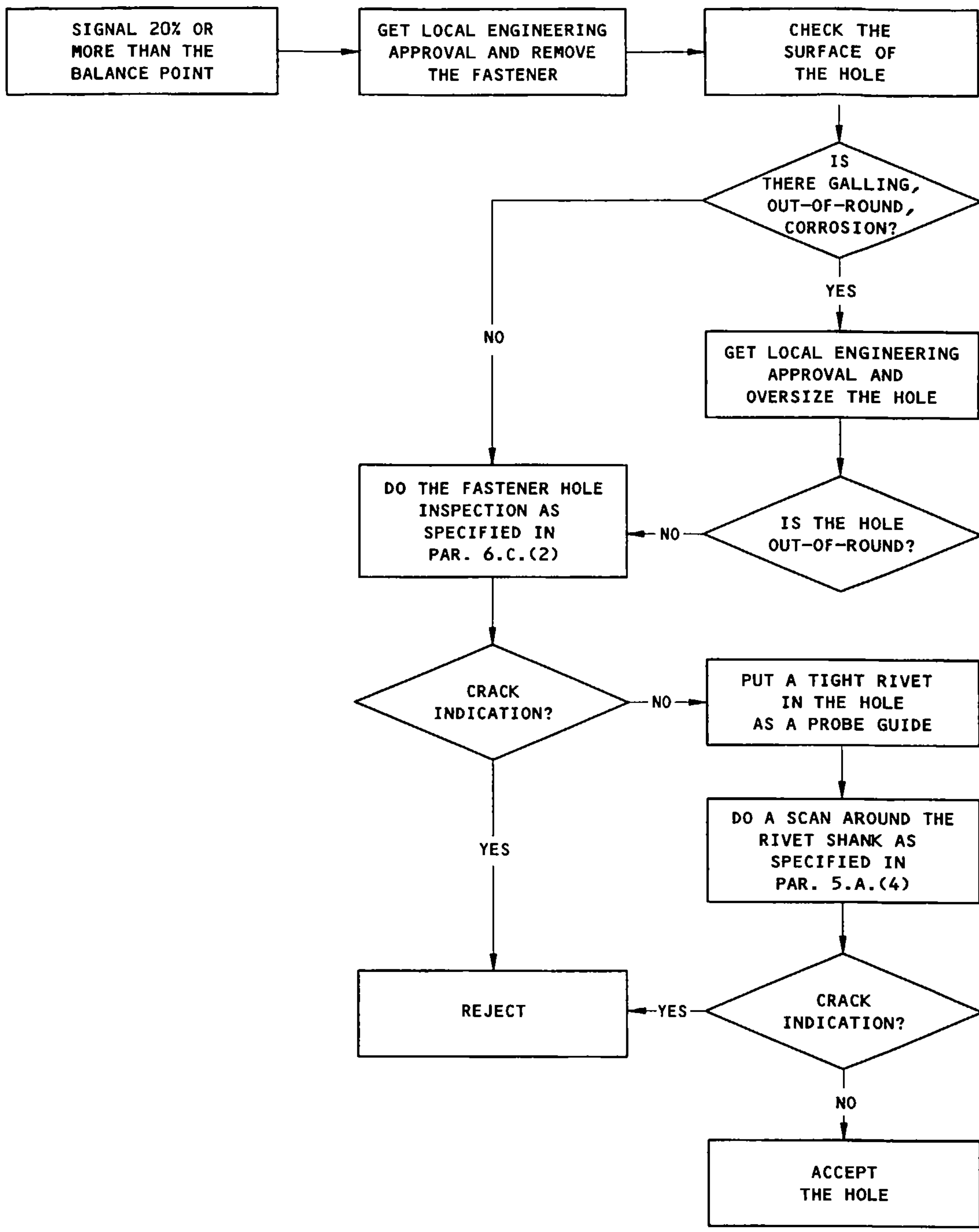
NOTES:

- THE CALIBRATION IS DONE WITH THE PROBE ADJACENT TO THE MACHINED FASTENER HEADS AS SHOWN IN VIEW A. THE INSPECTION ON THE AIRPLANE IS DONE WITH THE PROBE ADJACENT TO THE DRIVEN BUTTON END (TAIL SIDE) OF THE FASTENER.

[1] TYPICAL PROBE POSITION 1 FOR ALL (4) FASTENER LOCATIONS WITHOUT A NOTCH

[2] TYPICAL PROBE POSITION 2 FOR ALL (4) FASTENER LOCATIONS WITH A NOTCH

CALIBRATION AND PROBE POSITIONS
DETAIL III (SHEET 2)



SIGNAL ANALYSIS FLOWCHART
DETAIL IV

SLIDING PROBE INSPECTION PROCEDURE FOR FASTENER LOCATIONS WITH DECALS

1. Purpose

   A. Use this eddy current procedure to help find cracks that extend from a fastener location in fuselage skins where the fastener head can not be seen because of decals.

   B. This procedure specifies a scan procedure only. Refer to the sliding probe procedure that references this procedure for the equipment data, calibration data, and to do the inspection result analysis.

2. Equipment

   A. Refer to the procedure that references this procedure for the equipment data.

3. Preparation for Inspection

   A. Identify the distance between the fastener row to be examined and the skin edge as follows:

      (1) Identify a visible fastener at each end of the decal.

      (2) Measure the distance from the fastener centerline to the skin edge.

      (3) Make marks along the decal that are the distance that was measured in par. 3.A.(2) from the skin edge. Make these marks at intervals that are almost the length of the straightedge. (see Detail I)

      (4) Use a straightedge to connect the marks from par. 3.A.(3) and make a line on the skin from the centerline marks or the visible fastener across the decal. This line will identify the approximate position of the hidden inspection fasteners. (see Detail I)

4. Instrument Calibration

   A. Put a shim or tape that is not transparent on the fasteners of the reference standard to simulate the decal. The shim or tape thickness must be the same (+/- 0.005 inch (0.13 mm)) as the decal to be simulated. If the thickness is unknown, use an eddy current instrument that can identify the thickness of the decal.

   B Continue instrument calibration as specified in the procedure that referenced this procedure.

5. Inspection Procedure

A. Put the probe at one end of the decal so that it is centered on the line you marked on the skin.

B. Move the probe along the line to find the first hidden fastener. Use a "scrubbing" procedure to help find these fasteners (see Detail I). The "scrubbing procedure" is as follows:

(1) Slide the probe forward and backward in short strokes in the fastener area while you monitor the signal.

(2) The maximum signal will occur when the probe is moved across the fastener centerline. (See Detail II)

NOTE: It is important to fully scrub the fastener area to identify the maximum signal. Fasteners not fully scrubbed can cause reject condition and/or rivet location errors to occur.

NOTE: When you make a scan, keep the permanent screen adjustment "ON" so that the signals can be compared on the screen. Do a manual erase after each fastener location has been examined.

C. Monitor the instrument signal pattern. Compare the signals with the signal patterns shown in the procedure that referenced this procedure. Make a mark at all fastener locations that cause signals to occur that are above the reject level of the procedure that referenced this procedure.

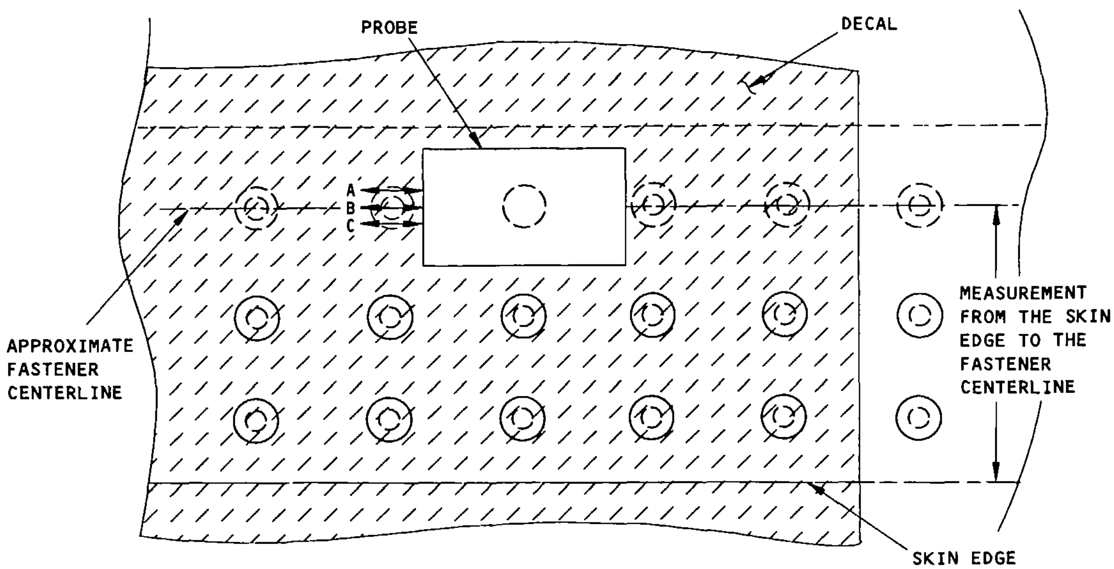
D. Erase the screen and move the probe to the adjacent fastener location.

E. Do par. 5.B again.

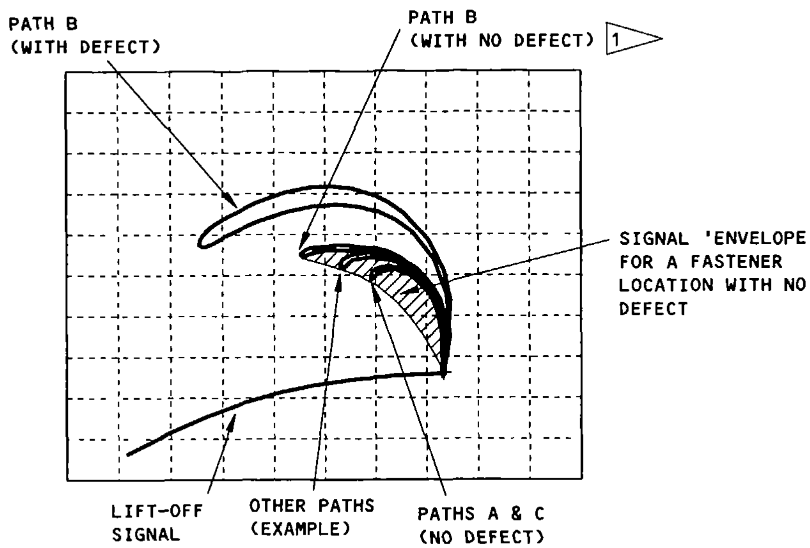
F. Continue to move the probe along the line and do par. 5.B thru 5.E until each hidden fastener location in the decal has been examined.

6. Inspection Results

A. Refer to the procedure that referenced this procedure to help make an analysis of the inspection results.



EXAMPLE SCRUBBING PROCEDURE
DETAIL I



EXAMPLE SCRUBBING SIGNALS
DETAIL II

NOTES:

[1] MAXIMUM SIGNAL AT THE FASTENER CENTERLINE

384997

PART 6 - EDDY CURRENT
SLIDING PROBE INSPECTION OF THE INBOARD SKIN OF THE LAP SPLICE

1. Purpose

   A. Use this procedure to do an inspection for cracks in the inboard skin along the lower row of fasteners in the lap splice.

   B. This inspection procedure can be used on fuselage skins with Alodine or anodized fasteners.

   C. This procedure is done from the external side of the airplane at the lap splices. See Detail I for the typical inspection areas along the lower row of fasteners. This procedure will find cracks at tear strap locations and between tear straps.

   D. This procedure uses a sliding probe and an impedance plane display instrument that can operate in a dual frequency mode.

   E. You cannot do this procedure at a location where the fastener is magnetic (steel) or if a fastener has a protruding head. At locations where the fastener is magnetic or protruding, you must do one of the procedures that follow:

      (1) Do an external inspection as follows:

         (a) For 727 SSID airplanes, refer to Part 6, 53-30-00, Fig. 5, and Part 6, 53-30-27, Fig. 18 for SB 727-53A0222 airplanes.

         (b) For 737 airplanes, refer to Part 6, 53-30-14.

         (c) For 747 airplanes, refer to Part 6, 53-30-00, Fig. 5.

      (2) Do an open hole inspection as shown in Part 6, 51-00-00, Fig. 16.

   F. The probe must be accurately aligned with the fastener centerline to do this procedure correctly. For accurate alignment, the use of a probe guide is mandatory. If two inspectors do the inspection, a probe guide is not mandatory if one inspector carefully monitors the probe alignment.

   G. The upper skin thickness on the airplane must be between 0.036 inch (0.91 mm) and 0.100 inch (2.54 mm) to use this procedure.

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 an eddy current instrument that:

(a) Can operate in a dual frequency mode.

(b) Has an impedance plane display.

(c) Operates at a frequency range of 1 kHz to 20 kHz

(d) Has a permanent screen adjustment (screen persistence). The permanent screen adjustment is necessary so that signals stay on the screen until manually erased.

(2) The instruments that follow were used to help prepare this procedure.

(a) Phasec 2D, D-60 and D-62; Hocking Krautkramer

(b) Nortec 19e; Staveley Instruments

(c) Nortec 2000D and Nortec 2000D+; Staveley Instruments

(d) Nortec Workstation; Staveley Instruments

(e) Phasec 2200 (dual frequency model); Hocking Krautkramer

(f) US-454; Uniwest

(g) Elotest B300; Rohmann GmbH

(h) Elotest M2V3; Rohmann GmbH

C. Probes

(1) Use a reflection sliding probe that operates at a frequency range from 1 kHz to 20 kHz.

(2) Some probes give unusual signals on the airplane because of the distance between fasteners and other structure conditions. To get the correct results from this procedure, it is necessary to use one of the probes that follow.

(a) NEC-4039; NDT Engineering Corp

(b) TEK-1504; TECHNA NDT

(c) SPO-367 DF; EC NDT

D. Reference Standard

(1) See Detail II for data about the probe guides and reference standards that are applicable to your lap splice inspection.

E. Special Tools

(1) Use a nonconductive probe guide to align the centerline of the probe with the centerline of the fasteners. See Detail III for data about the probe guide.

NOTE: Monitor the probe guide position on the centerline of the fasteners during the scans and adjust it if necessary. It is possible that adjacent fasteners on the airplane are not aligned with each other.

(2) Use a magnet to identify magnetic steel fasteners.

(3) Use Teflon (or equivalent) tape on the reference standard before calibration if there is paint on the airplane. The thickness of the tape applied to the reference standard must be almost equivalent to the estimated paint thickness on the airplane. Par. 3.D specifies how to measure the paint thickness with an eddy current instrument.

3. Preparation for Inspection

A. Identify all the inspection areas. Refer to the applicable service bulletin or the specific NDT procedure.

B. Remove loose paint, dirt, and sealant from the surface of the inspection area.

C. If you cannot see the fasteners because the paint is too thick, remove a sufficient amount of paint so that you can see the fasteners.

D. For airplanes that are painted: Make an estimate of the paint thickness on the skin. You can use calibrated nonconductive shims with an eddy current procedure (lift-off measurement) that uses a direct reading or an indirect reading. Apply Teflon tape or clear tape layers to the reference standard, before calibration, so the thickness of the tape layer is approximately equivalent to the thickest paint on the airplane.

NOTE: You can also refer to the paint thickness instructions in the McDonnell Douglas Nondestructive Testing Standard Practice Manual, Part 6, 06-10-01.002, to measure paint thickness on the airplane.

4. Instrument Calibration

A. Refer to the specific NDT procedure to identify the applicable reference standard(s) necessary for calibration. Table A shows the allowable skin thickness ranges permitted for use with each reference standard.

B. Refer to Table A to identify the applicable frequencies necessary to calibrate the equipment on the reference standard(s) identified in para. 4.A.

C. Make initial adjustments to your instrument as follows:

(1) Set the operation mode to "dual frequency".

(2) Set the probe drive to its highest level

(3) Set the low pass filter to 50 Hz.

(4) Set the high pass filter to 0 or "off".

(5) Set the screen persistence to "permanent" or "manual erase".

(6) Set **Frequency 1 (F1)** to the value identified in Table A for the applicable reference standard

(7) Set **Frequency 2 (F2)** to the value identified in Table A for the applicable reference standard

NOTE: Frequency 2 must be one quarter of Frequency 1. It is permitted to set Frequency 2 to a value that is within 100 Hz of the value specified in Table A. Some instruments will not allow Frequency 2 settings that are exactly four times less than Frequency 1.

(8) Refer to Detail XIV for the remainder of the initial adjustments for your instrument.

D. Adjust the nonconductive probe guides (NDT1087-P1 positioners) on the reference standard so that the probe is centered when you make a scan on each fastener row.

E. Calibrate your dual frequency eddy current instrument as specified in Details V thru XII. Refer to Detail IV for a flowchart that shows the calibration procedure.

NOTE: All of the steps must be done carefully to do the calibration for dual frequency eddy current. This procedure shows typical screen displays for each step. We recommend that you use an instrument that can keep your adjustments in memory, and save them at the middle and end of the calibration procedure.

5. Inspection Procedure

A. Put the probe on the outer skin of the lap splice between two fasteners in the upper fastener row, away from a tear strap location.

NOTE: Always balance the probe on fasteners in the upper fastener row before you examine the fasteners in the lower row, to make sure you do not balance on a crack location.

B. Use the nonconductive probe guide to align the probe on the fasteners in the upper row of the lap splice so that the centerline of the probe will move across the center of the fasteners.

C. Move the probe left and right between two fasteners while you monitor the signal. The signal will be at its highest vertical screen position when the probe is centered between two fasteners.

D. Balance the instrument at the location where the probe is centered between two fasteners. Do not balance the probe on the signal "dip" that can occur as the probe gets near each fastener. See Detail VI, View C.

E. Move the probe to the lower row of the lap splice. Use the nonconductive probe guide to align the probe with the centerline of the fasteners. Move the probe slowly along the centerline of the fasteners in the lower row. See Detail I. As you move the probe, do the steps that follow:

(1) Monitor the instrument display for signals that are higher than the alarm level set in par. 4 (Detail XI, View B). Make a record of signals that are higher than the alarm level.

(2) Keep the permanent screen adjustment "on" so that the signals can be compared on the screen. Do a manual erase after 5 to 10 fastener signals have been compared on the screen.

(3) Monitor the instrument display for large downscale signals. These signals are indications of tear straps or doublers. On tear straps or doublers the signal can move off of the bottom of the screen. Visually identify the location of the tear straps. To examine signals at tear strap locations, do the steps that follow:

(a) While you continue to make a scan across the tear strap, monitor the instrument baseline (the same vertical screen height as the balance point). A signal that goes across the baseline while you are above a tear strap must be examined some more. See Detail XIII.

(b) To examine signals that go across the baseline when you are on a tear strap, balance the probe between the two fasteners on the upper row of the lap splice that go through the tear strap. Then make a scan of the fasteners in the lower row that go through the tear strap. Make a record of signals that are higher than the alarm level set in par. 4 (Detail XI, View B).

F. Magnetic fasteners will cause unusual signals. Use a magnet to identify magnetic fasteners. Refer to the applicable alternative procedures that follow to examine areas around magnetic fasteners.

(1) For 727 SSID airplanes, refer to Part 6, 53-30-00, Fig. 5, and Part 6, 53-30-27, Fig. 18 for SB 727-53A0222 airplanes.

(2) For 737 airplanes, refer to Part 6, 53-30-14.

(3) For 747 airplanes, refer to Part 6, 53-30-00, Fig. 5.

6. <u>Inspection Results</u>

A. Signals at fastener locations between tear straps or doublers, if they are higher than the alarm level, are crack indications.

B. Signals at fastener locations above tear straps or doublers, if they are higher than the balance point, or higher than the alarm level when the instrument is balanced at the tear strap, are crack indications.

C. Use the procedures that follow to examine crack indications.

(1) Inspection from the internal surface of the airplane skin.

(a) For 727 airplanes, refer to Part 6, 53-30-27, Fig. 17.

(b) For 737 airplanes, refer to Part 6, 53-30-16.

(c) For 747 airplanes, refer to Part 6, 51-00-00, Fig. 23.

(2) Low frequency inspection from the internal surface of the airplane at tear strap or doubler locations.

(a) For 727 and 747 airplanes, refer to Part 6, 53-30-00, Fig. 5.

(b) For 737 airplanes, refer to Part 6, 53-30-12.

(3) High frequency open hole inspection after removal of fasteners.

(a) For 727 thru 747 airplanes, refer to Part 6, 51-00-00, Fig. 16.

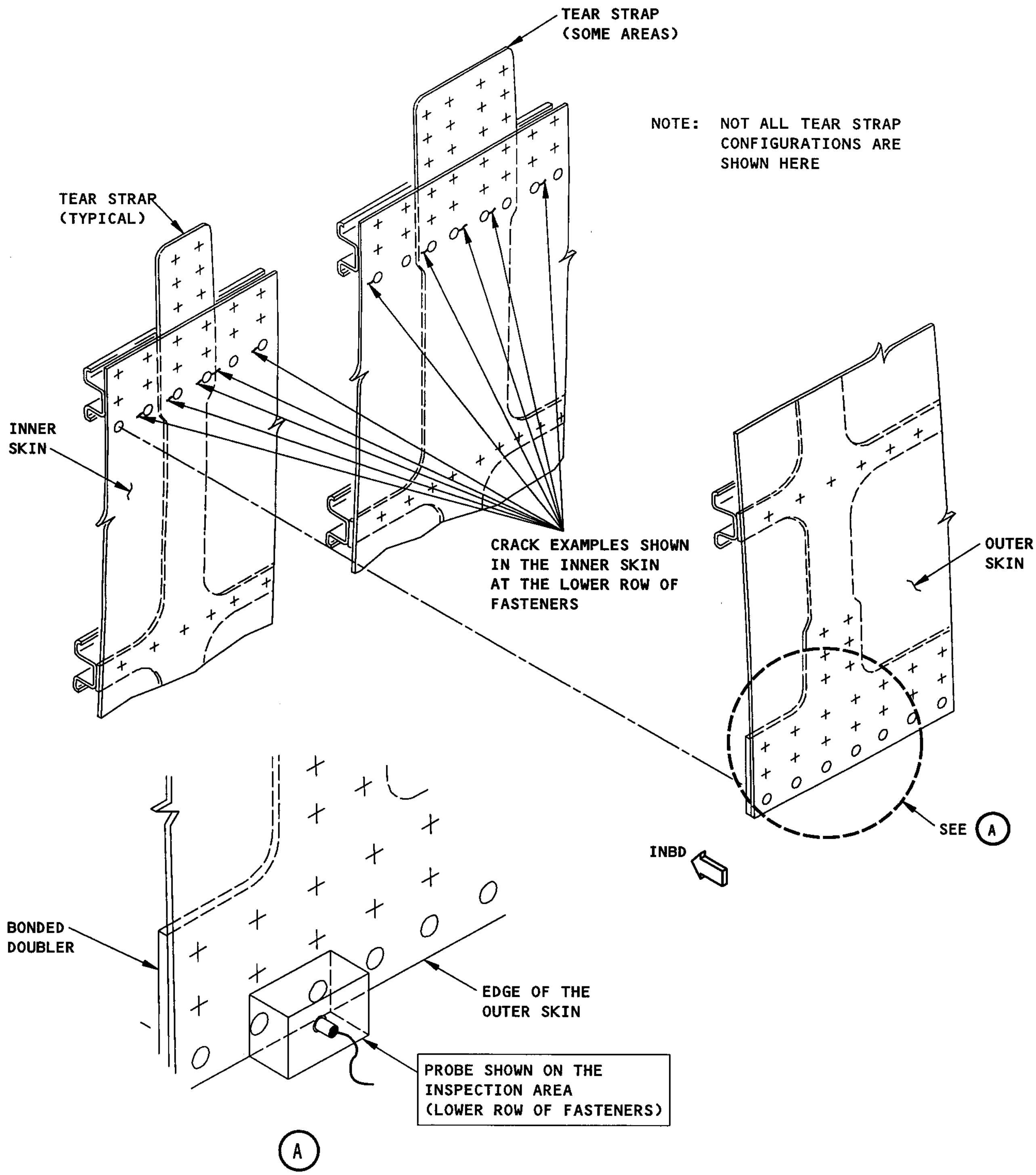
TABLE A

REFERENCE STANDARD AND FREQUENCY SELECTION FOR

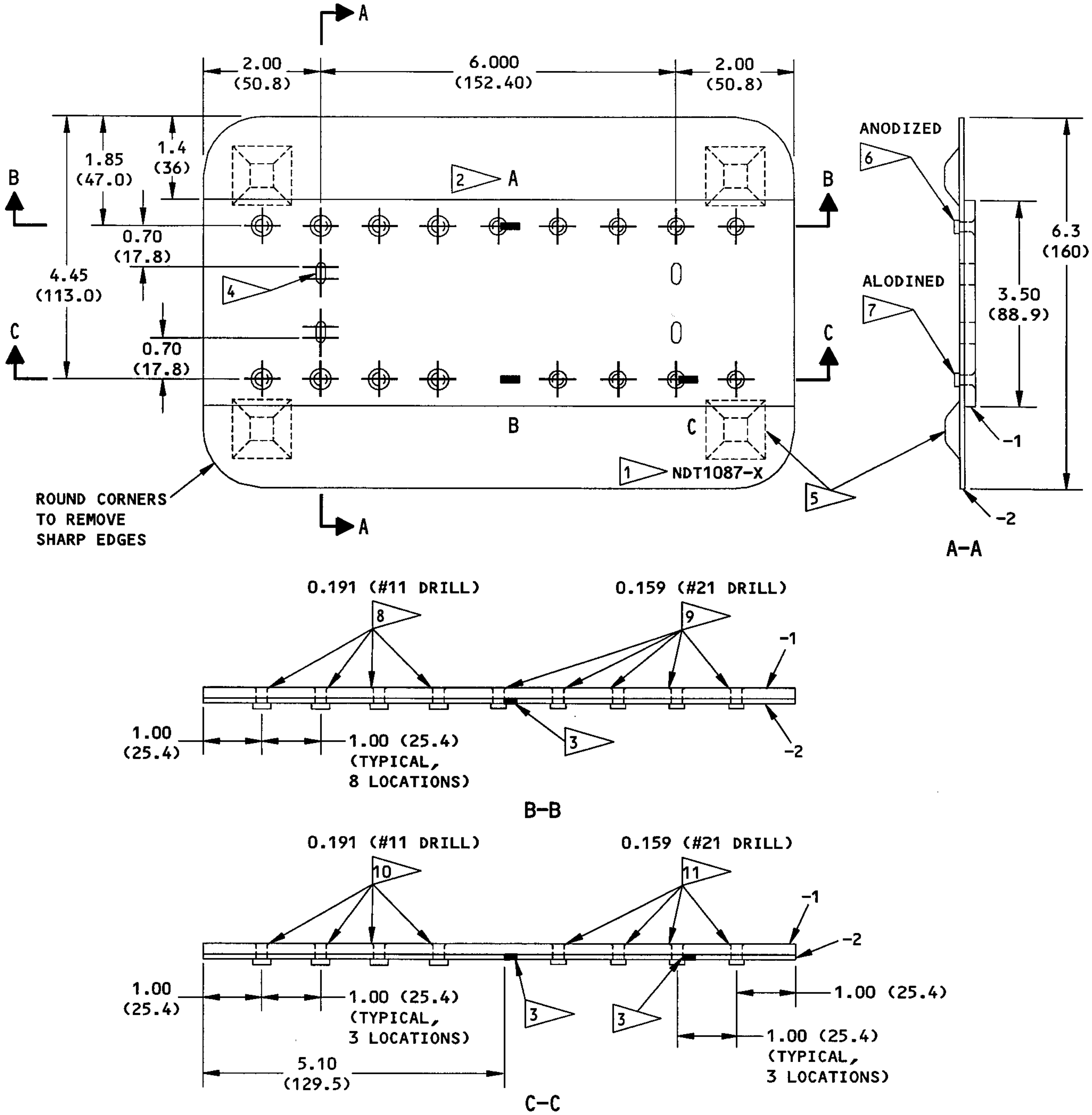
APPLICABLE SKIN THICKNESSES

[1] UPPER "SKIN" THICKNESS RANGE	MINIMUM LOWER SKIN THICKNESS	EDM NOTCH LENGTH	REFERENCE STANDARD NUMBER	FREQ 1 [kHz]	FREQ 2 [kHz]
0.040 - 0.062	0.036	**0.200**	**NDT1087-1**	**14**	**3.4**
(1.00 - 1.58)	(1.00)				
0.063 - 0.070	0.036	**0.200**	**NDT1087-2**	**12**	**3**
(1.60 - 1.78)	(1.00)				
0.071 - 0.080	0.036	**0.180**	**NDT1087-3**	**11**	**2.7**
(1.80 - 2.03)	(1.00)				
0.081 - 0.089	0.036	**0.200**	**NDT1087-4**	**9**	**2.25**
(2.06 - 2.26)	(1.00)				
0.090 - 0.100	0.05	**0.200**	**NDT1087-5**	**8**	**2**
(2.29 - 2.54)	(1.27)				
0.063 - 0.079	0.05	**0.250**	**NDT1087-6**	**12**	**3**
(1.60 - 2.00)	(1.27)				
0.080 - 0.089	0.05	**0.250**	**NDT1087-7**	**9**	**2.25**
(2.03 - 2.26)	(1.27)				
0.090 - 0.100	0.06	**0.250**	**NDT1087-8**	**8**	**2**
(2.29 -2.54)	(1.52)				

[1] "Skin" thickness refers to the total thickness of all layers above the lower skin



TYPICAL INSPECTION AREAS - EXTERNAL INSPECTION
DETAIL I



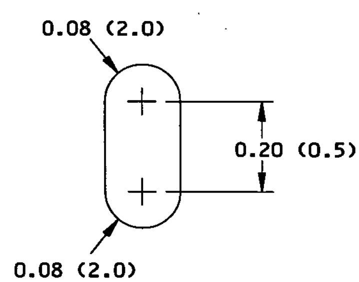
REFERENCE STANDARD NDT1087-X
DETAIL II (SHEET 1)

REFERENCE STANDARD NUMBER	UPPER-1 SHEET THICKNESS	LOWER-2 SHEET THICKNESS	EDM NOTCH LENGTH	UPPER (ANODIZED) RIVET ROW [6]		LOWER (ALODINED) RIVET ROW [7]	
				LEFT SIDE [8]	RIGHT SIDE [9]	LEFT SIDE [10]	RIGHT SIDE [11]
NDT1087-1	0.050 (1.27)	0.040 (1.00)	0.200 (5.00)	***6D5 (SEE TABLE 2)	***5D4 (SEE TABLE 2)	BACR15GF6D5	BACR15GF5D4
NDT1087-2	0.071 (1.80)	0.040 (1.00)	0.200 (5.00)	***6D5 (SEE TABLE 2)	***5D5 (SEE TABLE 2)	BACR15GF6D5	BACR15GF5D5
NDT1087-3	0.080 (2.00)	0.040 (1.00)	0.180 (4.57)	***6D5 (SEE TABLE 2)	***5D5 (SEE TABLE 2)	BACR15GF6D5	BACR15GF5D5
NDT1087-4	0.090 (2.29)	0.040 (1.00)	0.200 (5.00)	***6D5 (SEE TABLE 2)	***5D5 (SEE TABLE 2)	BACR15GF6D5	BACR15GF5D5
NDT1087-5	0.100 (2.54)	0.050 (1.27)	0.200 (5.00)	***6D6 (SEE TABLE 2)	***5D5 (SEE TABLE 2)	BACR15GF6D6	BACR15GF5D5
NDT1087-6	0.071 (1.80)	0.063 (1.60)	0.250 (6.35)	***6D6 (SEE TABLE 2)	***5D6 (SEE TABLE 2)	BACR15GF6D6	BACR15GF5D6
NDT1087-7	0.090 (2.29)	0.080 (2.00)	0.250 (6.35)	***6D6 (SEE TABLE 2)	***5D6 (SEE TABLE 2)	BACR15GF6D6	BACR15GF5D6
NDT1087-8	0.100 (2.54)	0.090 (2.29)	0.250 (6.35)	***6D6 (SEE TABLE 2)	***5D6 (SEE TABLE 2)	BACR15GF6D7	BACR15GF5D6

REFERENCE STANDARD DATA
TABLE 1

RIVET CODE	ALLFAST FASTENING SYSTEMS INC. PART NUMBER	SIERRA PACIFIC SUPPLY CO. PART NUMBER
***5D4	AF1049U1D5C4	NAS1097D5-4D
***5D5	AF1049U1D5C5	NAS1097D5-5D
***5D6	AF1049U1D5C6	NAS1097D5-6D
***6D5	AF1049U1D6C5	NAS1097D6-5D
***6D6	AF1049U1D6C6	NAS1097D6-6D
***6D7	AF1049U1D6C7	NAS1097D6-7D

ANODIZED FASTENER DATA
TABLE 2



VIEW A

REFERENCE STANDARD NDT1087-X
DETAIL II (SHEET 2)

NOTES:

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

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

- SURFACE ROUGHNESS = 125 Ra OR BETTER
- MATERIAL: 2024-T3 ALUMINUM; CLAD OR BARE (SEE TABLE 1 FOR THE THICKNESS)

1 ETCH OR STEEL STAMP THE REFERENCE STANDARD NUMBER NDT1087-X.

2 ETCH OR STEEL STAMP THE NOTCH LOCATIONS AS SHOWN.

3 EDM NOTCH ALONG FASTENER CENTERLINE (3 LOCATIONS)
MAXIMUM WIDTH: 0.007 (0.17)
DEPTH: THROUGH-THICKNESS
NOTCH LENGTH: SEE TABLE 1

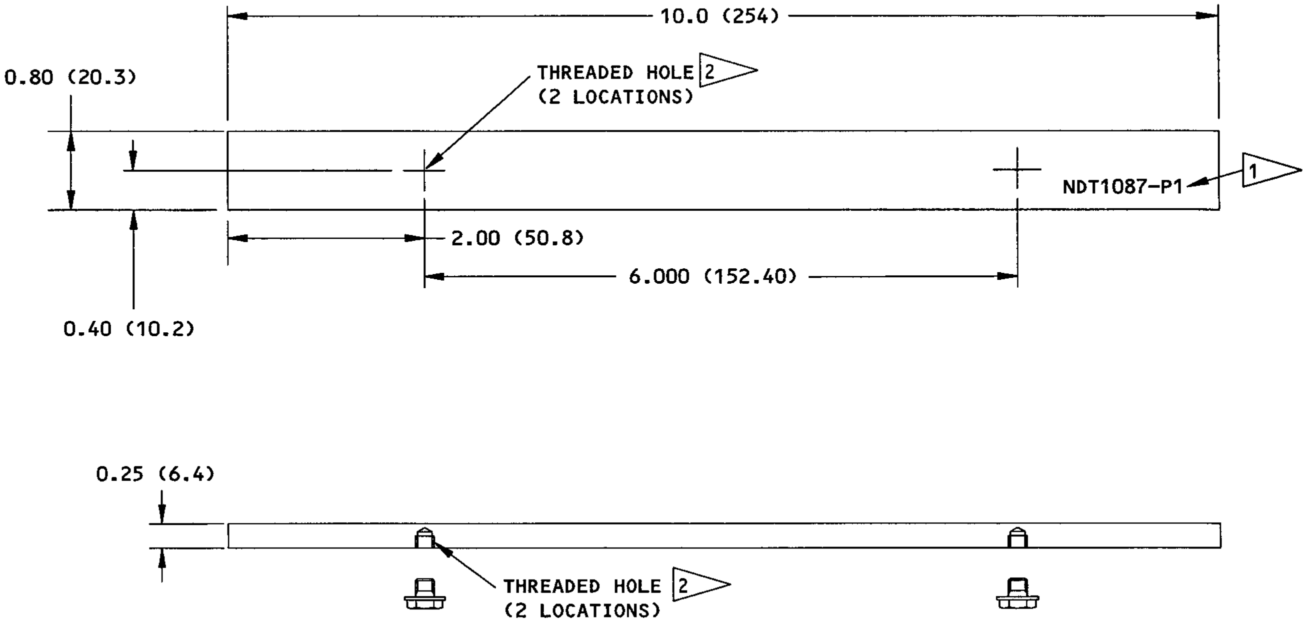
4 SLOT FOR THE PROBE GUIDES (TYPICAL, 4 LOCATIONS) SEE VIEW A.

5 BOND 4 RUBBER FEET TO THE PART IN THE APPROXIMATE LOCATIONS SHOWN.

6 INSTALL ANODIZED RIVETS AS SPECIFIED IN PART 1, 51-01-04.

7 INSTALL ALODINED RIVETS AS FOLLOWS:
- SOLVENT CLEAN EACH RIVET AND RIVET HOLE BEFORE INSTALLATION
- COUNTERSINK DEPTH:
  0.033 (0.84) FOR 5/32 RIVETS
  +0.000/-0.002 (+0.00/-0.05).
  0.041 (1.04) FOR 6/32 RIVETS
  +0.000/-0.002 (+0.00/-0.05)
- MINIMUM BUTTON DIAMETER:
  0.230 (5.8) FOR 5/32 RIVETS
  0.276 (7.0) FOR 6/32 RIVETS
  0.368 (9.3) FOR 8/32 RIVETS
- ALL OTHER INSTALLATION DATA AS SPECIFIED IN PART 1, 51-01-04

REFERENCE STANDARD NDT1087-X
DETAIL II (SHEET 3)



NOTES:

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

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

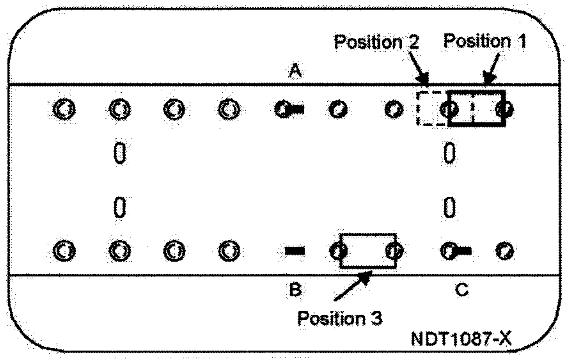
- SURFACE ROUGHNESS = 125 Ra OR BETTER
- MATERIAL: PLEXIGLASS OR PLASTIC MATERIAL THAT IS ALMOST THE SAME AS PLEXIGLASS
- MAKE TWO PROBE GUIDES FOR EACH REFERENCE STANDARD

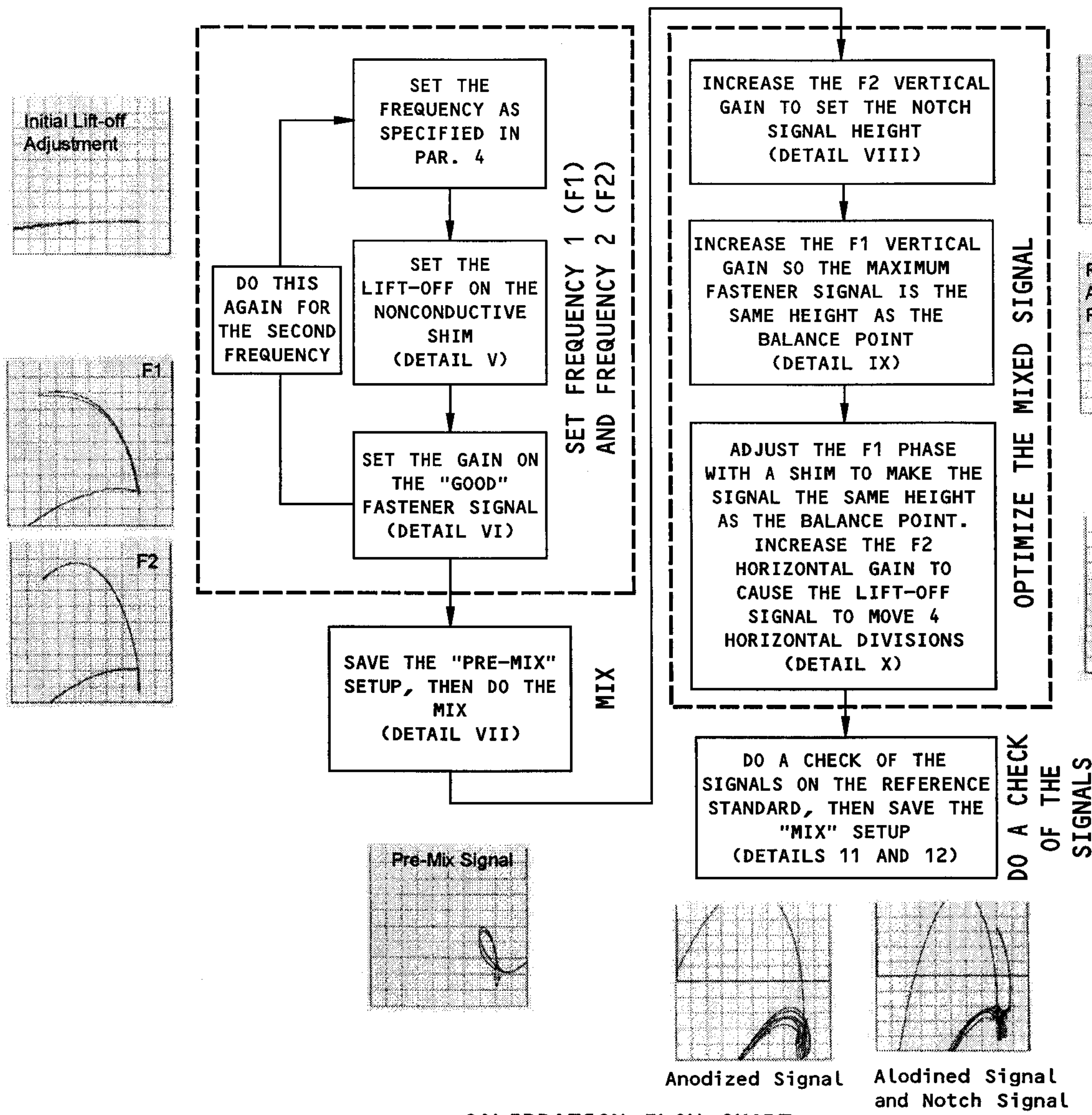
1 ETCH THE PROBE GUIDE NUMBER NDT1087-P1 IN THE LOCATION SHOWN

2 DRILL AND TAP A HOLE FOR 8-32 THUMBSCREWS (OR METRIC EQUIVALENT)
- HOLE DEPTH: 0.18 (4.7)
- THE SCREW GRIP LENGTH MUST MATCH THE REFERENCE STANDARD THICKNESS
- THE SCREW SHANK DIAMETER MUST MATCH THE REFERENCE STANDARD SLOT WIDTH

PROBE GUIDE NDT1087-P1

DETAIL III



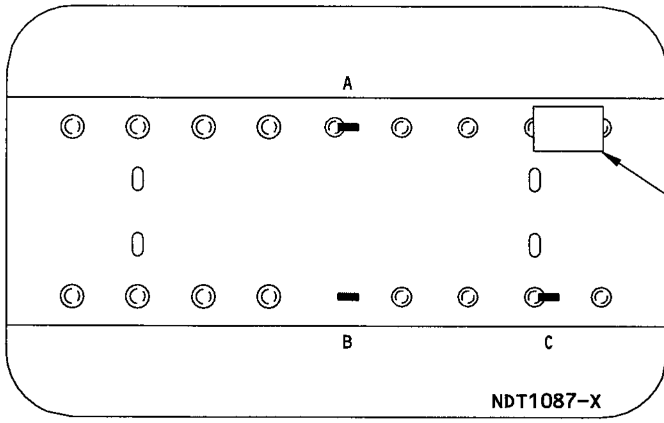


CALIBRATION FLOW CHART
DETAIL IV

DO THE LIFT-OFF CALIBRATION FOR FREQUENCY 1 AND FREQUENCY 2:

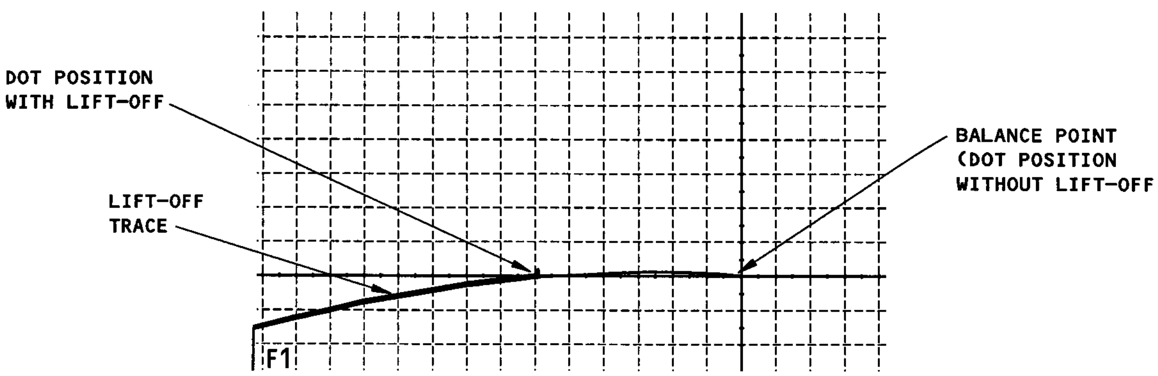
1. SET YOUR INSTRUMENT TO VIEW THE DISPLAY FOR FREQUENCY 1 OR FREQUENCY 2. MAKE SURE THE HORIZONTAL AND VERTICAL GAINS ARE EQUAL OR THE X:Y RATIOS ARE AT 0.0 dB.
2. PUT THE PROBE AT POSITION 1 ON THE APPLICABLE REFERENCE STANDARD AND BALANCE THE INSTRUMENT. SEE VIEW A.

NOTE: ALWAYS BALANCE THE INSTRUMENT WHEN THE PROBE IS CENTERED BETWEEN FASTENERS. DO NOT BALANCE THE INSTRUMENT ON THE DOWNSCALE "DIP" THAT OCCURS NEAR EACH FASTENER AT SOME FREQUENCIES. SEE DETAIL VI, VIEW C. IT IS RECOMMENDED TO MARK THE LOCATION WHERE THE PROBE IS CENTERED AT THE CORRECT POSITION ON THE REFERENCE STANDARD.



PROBE POSITION TO BALANCE THE INSTRUMENT AND DO THE LIFT-OFF ADJUSTMENT
VIEW A

3. SET THE BALANCE POINT. USE THE POSITION CONTROLS TO SET THE GRATICULE LOCATION APPROXIMATELY 30% OF FULL SCREEN HEIGHT AND 80% OF FULL SCREEN WIDTH. SEE VIEW B.



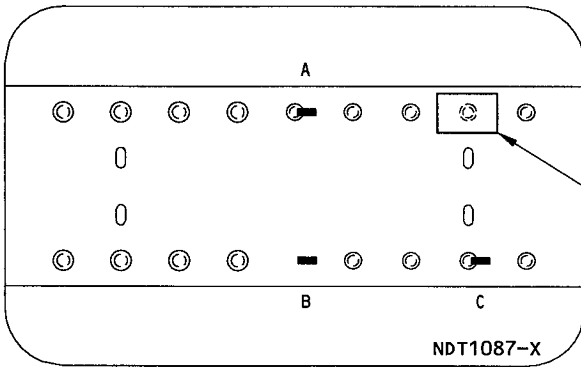
F1 LIFT-OFF SET POINT (F2 SET POINT IS ALMOST THE SAME)
VIEW B

4. PUT A 0.024 TO 0.032 INCH (0.61 TO 0.81 MM) NONCONDUCTIVE SHIM UNDER THE PROBE AT POSITION 1. TWO BUSINESS CARDS CAN BE USED AS SHIMS.
5. ADJUST THE PHASE AND GAIN CONTROLS UNTIL THE SIGNALS WITH AND WITHOUT THE SHIMS ARE THE SAME SCREEN HEIGHT. SEE VIEW B.

LIFT-OFF CALIBRATION FOR FREQUENCY 1 AND FREQUENCY 2
DETAIL V

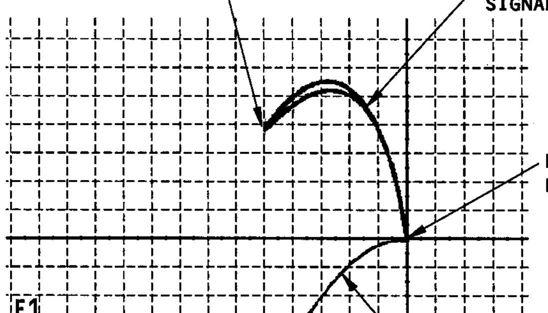
DO THE GAIN ADJUSTMENT FOR FREQUENCY 1 (F1) AND FREQUENCY 2 (F2):

1. SET THE INSTRUMENT TO FREQUENCY 1
2. MOVE THE PROBE ABOVE A "GOOD" FASTENER AT POSITION 2. SEE VIEW A. ADJUST THE PROBE POSITION UNTIL THE SIGNAL IS AT ITS MAXIMUM LENGTH.

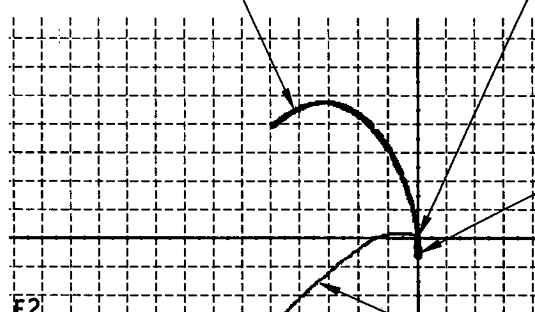


PROBE POSITION FOR FREQUENCY 1 AND FREQUENCY 2 GAIN ADJUSTMENT
VIEW A

3. ADJUST THE GAIN CONTROLS (AND THE X:Y RATIOS, IF APPLICABLE) TO SET THE END POINT OF THE SIGNAL AT 4 VERTICAL DIVISIONS AND 5 HORIZONTAL DIVISIONS FROM THE BALANCE POINT. SEE VIEW B FOR FREQUENCY 1 AND VIEW C FOR FREQUENCY 2.



F1 CALIBRATION SCREEN DISPLAY
VIEW B



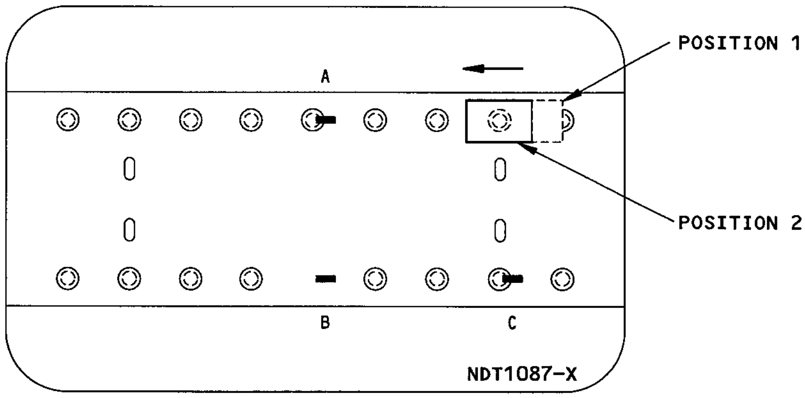
F2 CALIBRATION SCREEN DISPLAY
VIEW C

4. SET THE INSTRUMENT TO FREQUENCY 2 AND DO STEPS 1 THRU 3.
5. SAVE THE PRE-MIX SET-UP IN THE INSTRUMENT MEMORY WHEN YOU HAVE SET THE CALIBRATION GAINS FOR FREQUENCY 1 AND FREQUENCY 2. WE RECOMMEND YOU DO THIS SO THAT YOU WILL NOT HAVE TO DO THIS PROCEDURE AGAIN IF YOUR SIGNALS ARE NOT SUFFICIENT AFTER YOU HAVE DONE THE OPTIMIZATION PROCEDURE OF DETAILS VIII THRU XII.

GAIN ADJUSTMENT FOR FREQUENCY 1 AND FREQUENCY 2
DETAIL VI

DO A CHECK OF THE MIXED SIGNAL FROM FREQUENCY 1 AND FREQUENCY 2:

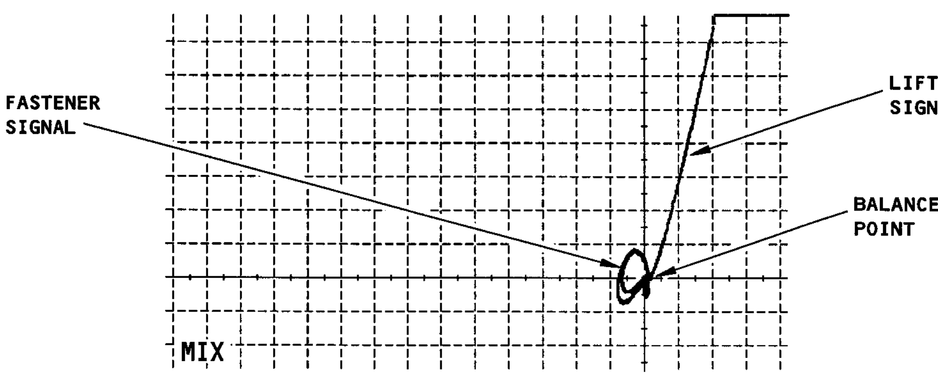
1. CHANGE THE INSTRUMENT DISPLAY TO VIEW THE "MIX" SIGNAL ("F1-F2" OR "SUM" ON SOME INSTRUMENTS).
2. PUT THE PROBE AT POSITION 1 (VIEW A) AND BALANCE THE INSTRUMENT.
3. GET THE LIFT-OFF SIGNAL TO SHOW ON THE SCREEN DISPLAY AND MOVE THE PROBE ACROSS THE "GOOD" FASTENER AT POSITION 2 (SEE VIEW A). THE SIGNALS MUST LOOK ALMOST THE SAME AS THE SIGNAL SHOWN IN VIEW B. THE PHASE ANGLE OF THE LIFT-OFF SIGNAL IS NOT CRITICAL, BUT IT MUST MOVE TO THE RIGHT.



PROBE POSITION TO DO A CHECK OF THE MIXED SIGNAL
VIEW A

NOTE: THE CORRECT FREQUENCY MIX FOR THIS PROCEDURE IS F2-F1. SOME INSTRUMENTS, LIKE THE NDT 19E OR NORTEC 2000D USE F1-F2 FOR THE MIX. YOU MUST ADD 180 DEGREES TO THE PHASE VALUES OF FREQUENCY 1 AND FREQUENCY 2 TO GET THE CORRECT MIX SIGNAL.

4. KEEP THE INSTRUMENT DISPLAY IN THE "MIX" MODE WHEN YOU CALIBRATE THE INSTRUMENT IN THE FIGURES THAT FOLLOW.



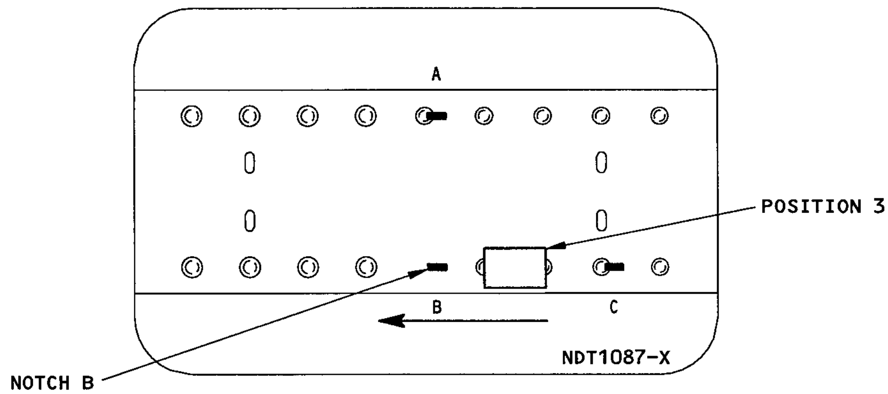
MIX DISPLAY SIGNAL
VIEW B

NOTE: THE FASTENER SIGNAL CAN BE LARGER WITH SOME INSTRUMENTS AND THE LIFT-OFF SIGNAL ANGLE CAN BE DIFFERENT, BUT THE INSTRUMENT CAN STILL BE CALIBRATED WITH THIS PROCEDURE

MIX DISPLAY SIGNAL
DETAIL VII

ADJUST THE MIXED SIGNAL AMPLITUDE FOR THE EDM NOTCH B SIGNAL

1. PUT THE PROBE AT POSITION 3 ON THE APPLICABLE REFERENCE STANDARD AND BALANCE THE INSTRUMENT. SEE VIEW A.

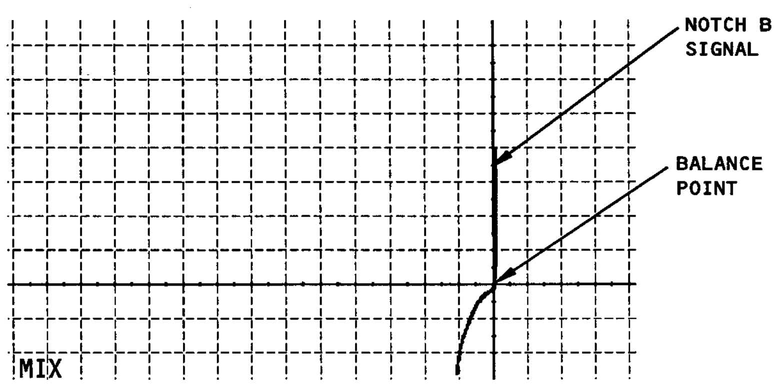


PROBE POSITION FOR INITIAL NOTCH B SIGNAL HEIGHT ADJUSTMENT
VIEW A

2. PUT THE PROBE AT NOTCH B AND MAXIMIZE THE SIGNAL.
3. HOLD THE PROBE AT THE LOCATION WHERE THE SIGNAL FROM NOTCH B IS AT ITS MAXIMUM SCREEN HEIGHT.
4. ADJUST THE FREQUENCY 2 VERTICAL GAIN WHILE YOU MONITOR THE "MIX" SIGNAL UNTIL THE NOTCH SIGNAL IS 4 SCREEN DIVISIONS ABOVE THE BALANCE POINT ON THE SCREEN. SEE VIEW B.

   NOTE: FOR INSTRUMENTS WITHOUT SEPARATE HORIZONTAL AND VERTICAL GAIN CONTROLS (LIKE THE HOCKING 2200) INCREASE THE FREQUENCY 2 GAIN.

5. TURN THE PROBE 180 DEGREES AND DO A CHECK OF THE NOTCH SIGNAL. IF IT IS LOWER THAN BEFORE, ADJUST THE GAIN AGAIN TO GET THE SIGNAL UP TO 4 SCREEN DIVISIONS.

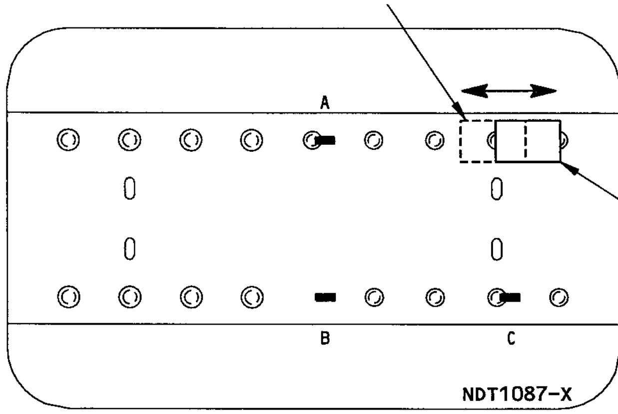


SIGNAL FROM NOTCH B
VIEW B

MIXED SIGNAL OPTIMIZATION - ADJUSTMENT OF NOTCH B SIGNAL HEIGHT
DETAIL VIII

ADJUST THE MIXED SIGNAL TO DECREASE THE FASTENER SIGNAL:

1. PUT THE PROBE AT POSITION 1 ON THE APPLICABLE REFERENCE STANDARD AND BALANCE THE INSTRUMENT. SEE VIEW A.



PROBE POSITION FOR FASTENER SIGNAL SUPPRESSION
VIEW A

2. MOVE THE PROBE ACROSS A "GOOD" ANODIZED FASTENER AND MONITOR THE SIGNAL.

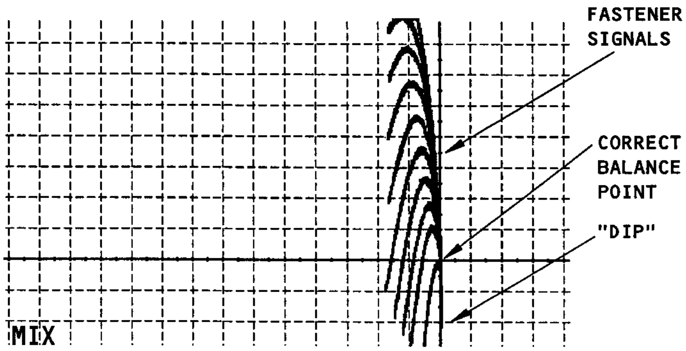
   NOTE: THE SIGNAL CAN MOVE ABOVE THE TOP OF THE SCREEN

3. HOLD THE PROBE AT THE LOCATION WHERE THE FASTENER SIGNAL IS AT THE MAXIMUM SCREEN HEIGHT (OR OFF THE SCREEN).

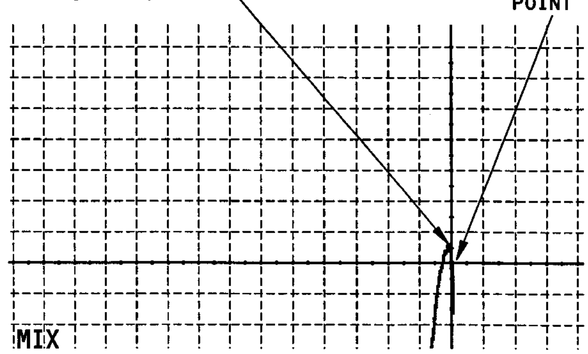
4. INCREASE THE FREQUENCY 1 VERTICAL GAIN IN 1 DB INCREMENTS WHILE YOU MONITOR THE "MIX" DISPLAY UNTIL THE MAXIMUM ANODIZED FASTENER SIGNAL BEGINS TO DECREASE TOWARD THE BALANCE POINT. SEE VIEW B.

5. MOVE THE PROBE BACK AND THEN ACROSS THE "GOOD" FASTENER AGAIN.

6. CONTINUE TO DO STEP 5 AND INCREASE THE FREQUENCY 1 VERTICAL GAIN OR CH. 1 GAIN UNTIL THE MAXIMUM SIGNAL FROM A "GOOD" ANODIZED FASTENER IS WITHIN 1 VERTICAL DIVISION FROM THE BALANCE POINT. SEE VIEW C.



FASTENER SIGNAL DISPLAY AS THE GAIN
IS INCREASED
VIEW B

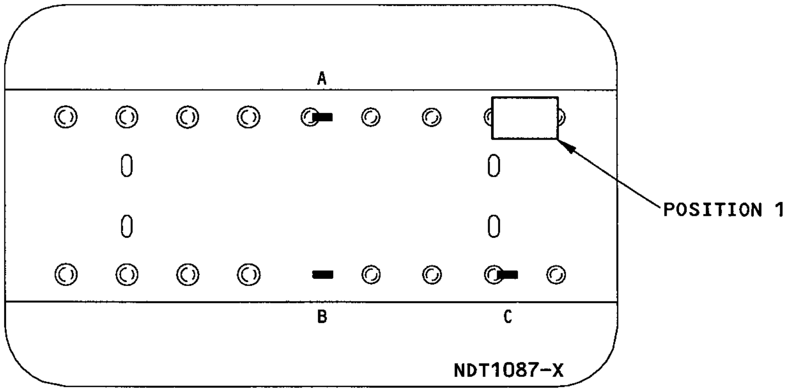


FINAL FASTENER SIGNAL
VIEW C

MIXED SIGNAL OPTIMIZATION - SUPPRESSION OF THE FASTENER SIGNAL
DETAIL IX

ADJUST THE LIFT-OFF SIGNAL:

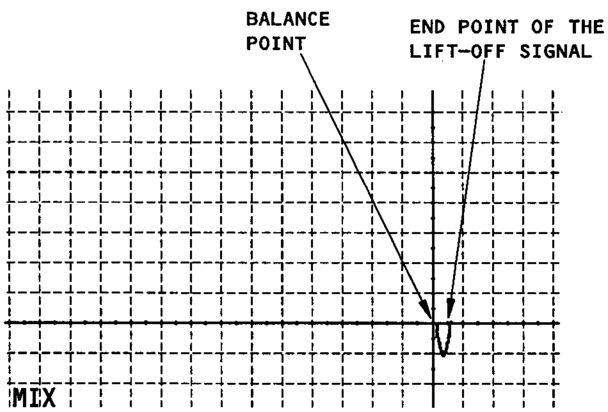
1. PUT THE PROBE AT POSITION 1 ON THE APPLICABLE REFERENCE STANDARD AND BALANCE THE INSTRUMENT. SEE VIEW A.



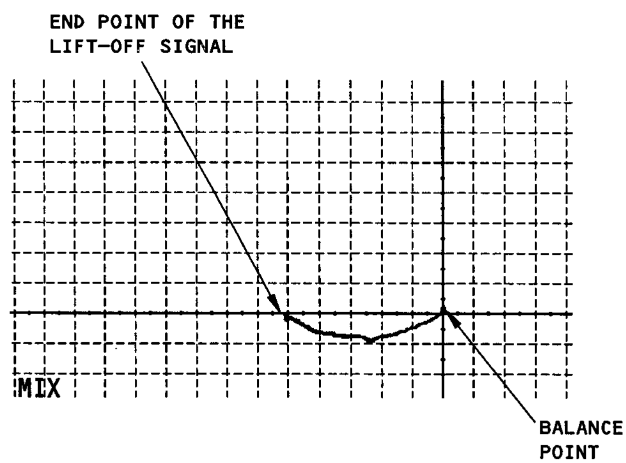
PROBE POSITION FOR THE FINAL LIFT-OFF ADJUSTMENT
VIEW A

2. PUT A 0.012 TO 0.016 INCH (0.30 TO 0.41 MM) NONCONDUCTIVE SHIM UNDER THE PROBE AT POSITION 1. A BUSINESS CARD CAN BE USED AS A SHIM. KEEP THE BUSINESS CARD UNDER THE PROBE TO CAUSE THE LIFT-OFF SIGNAL. DO NOT BALANCE AGAIN WHEN YOU DO STEP 3 AND 4 BELOW.

3. ADJUST THE FREQUENCY 1 PHASE CONTROL WHILE YOU MONITOR THE "MIX" DISPLAY UNTIL THE END POINT OF THE LIFT-OFF SIGNAL IS AT THE SAME VERTICAL SCREEN HEIGHT AS THE BALANCE POINT. SEE VIEW B.



INITIAL LIFT-OFF SIGNAL SET POINT
VIEW B



FINAL LIFT-OFF SIGNAL SET POINT
VIEW C

NOTE: LIFT-OFF IS LEFT FOR ALL INSTRUMENTS BUT HOCKING 2200, FOR WHICH LEFT-OFF IS TO THE RIGHT

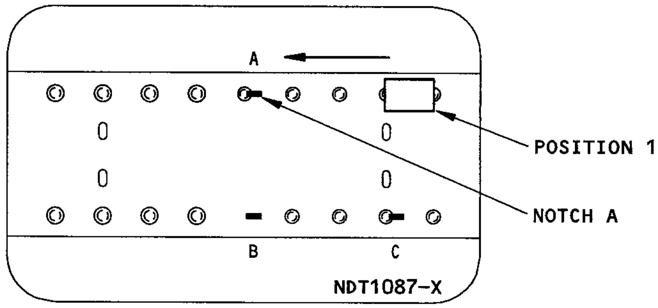
4. INCREASE THE FREQUENCY 2 HORIZONTAL GAIN WHILE YOU MONITOR THE "MIX" DISPLAY UNTIL THE END POINT OF THE LIFT-OFF SIGNAL MOVES ABOUT ONE QUARTER OF THE SCREEN WIDTH TO THE LEFT OF THE BALANCE POINT. SEE VIEW C.

MIXED SIGNAL OPTIMIZATION - FINAL LIFT-OFF ADJUSTMENT
DETAIL X

FINAL SIGNAL CHECK ON THE REFERENCE STANDARD FOR ANODIZED FASTENERS:

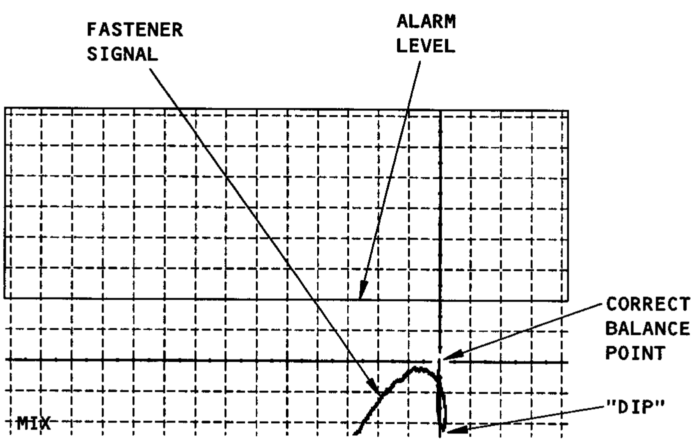
1. PUT THE PROBE AT POSITION 1 ON THE APPLICABLE REFERENCE STANDARD AND BALANCE THE INSTRUMENT. SEE VIEW A.

   NOTE: ALWAYS BALANCE THE INSTRUMENT WHEN THE PROBE IS CENTERED BETWEEN THE FASTENERS. DO NOT BALANCE THE INSTRUMENT ON THE DOWNSCALE "DIP" THAT OCCURS NEAR EACH FASTENER. SEE VIEW B.

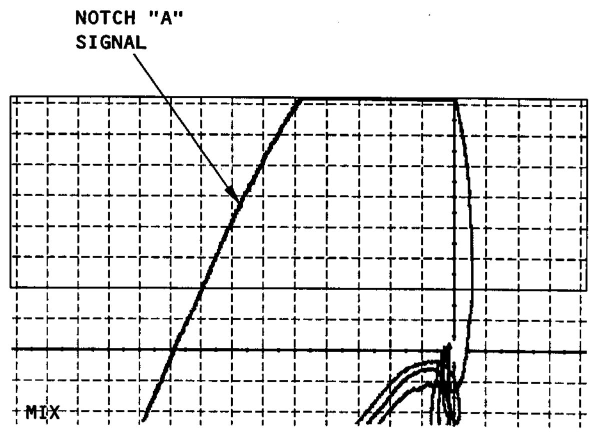


PROBE POSITION FOR AN ANODIZED FASTENER NOTCH SIGNAL
VIEW A

2. SET THE ALARM TO ALARM WHEN THE SIGNAL IS 3 SCREEN DIVISIONS ABOVE THE BALANCE POINT.
3. MOVE THE PROBE ALONG THE UPPER ROW OF FASTENERS IN THE REFERENCE STANDARD, ACROSS NOTCH A, AND MONITOR THE SIGNAL FROM THE NOTCH. IT IS POSSIBLE THAT THE NOTCH "A" SIGNAL WILL NOT GO OFF THE SCREEN DISPLAY, AS SHOWN IN VIEW C, FOR SOME INSTRUMENTS.



CORRECT BALANCE POINT AND "DIP"
VIEW B

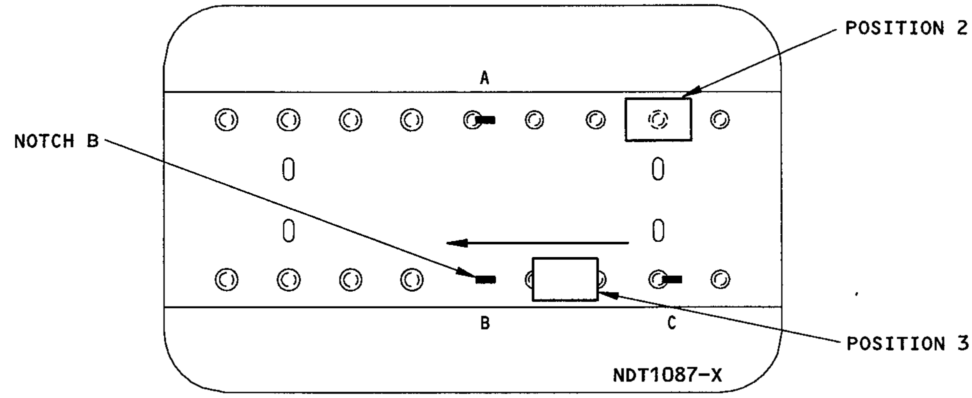


NOTCH "A" SIGNAL AT THE ANODIZED FASTENER
VIEW C

SIGNAL CHECK ON THE REFERENCE STANDARD - ANODIZED FASTENERS
DETAIL XI

FINAL SIGNAL CHECK ON THE REFERENCE STANDARD FOR ALODINED FASTENERS:

1. PUT THE PROBE AT POSITION 3 ON THE APPLICABLE REFERENCE STANDARD AND BALANCE THE INSTRUMENT. SEE VIEW A



PROBE POSITION FOR AN ALODINED FASTENER NOTCH SIGNAL
VIEW A

2. MOVE THE PROBE ALONG THE LOWER ROW OF FASTENERS IN THE REFERENCE STANDARD, ACROSS NOTCH B, AND MONITOR THE SIGNAL FROM THE NOTCH. THE SIGNAL FROM NOTCH B MUST BE ALMOST THE SAME AS THE SIGNAL SHOWN IN VIEW B.
3. IF THE NOTCH "B" SIGNAL IS NOT 4 DIVISIONS ABOVE THE BALANCE POINT, THEN:
   (a) PUT THE PROBE AT POSITION 3 AND BALANCE THE INSTRUMENT. MOVE THE PROBE ABOVE NOTCH "B" AND MAXIMIZE THE NOTCH SIGNAL. ADJUST THE FREQUENCY 2 VERTICAL GAIN UNTIL THE SIGNAL NOTCH B SIGNAL IS 4 VERTICAL DIVISIONS ABOVE THE BALANCE POINT.
   (b) PUT THE PROBE AT POSITION 2 AND INCREASE THE FREQUENCY 1 VERTICAL GAIN UNTIL THE MAXIMUM ANODIZED FASTENER SIGNAL IS WITHIN 1 VERTICAL DIVISION FROM THE BALANCE POINT.

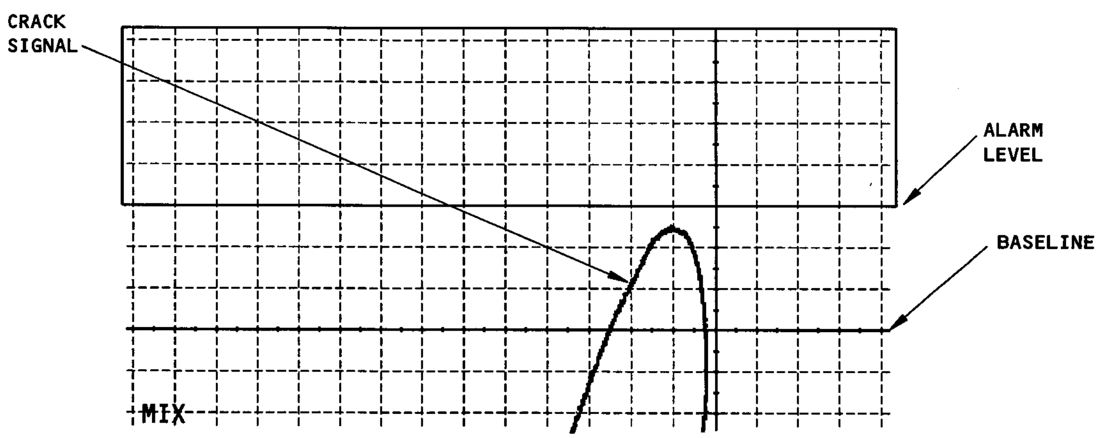
ALODINED FASTENER NOTCH B SIGNALS
VIEW B

4. AS A FINAL CHECK, MONITOR THE SIGNAL FROM NOTCH C. THIS NOTCH CAN GIVE DIFFERENT SIGNALS THAT ARE RELATED TO THE INSTALLATION FIT OF THE FASTENER IN YOUR REFERENCE STANDARD. THIS NOTCH SIGNAL IS FOR REFERENCE ONLY. DO NOT USE THIS NOTCH SIGNAL FOR CALIBRATION.
5. SAVE YOUR FINAL CALIBRATION IN THE INSTRUMENT MEMORY.

SIGNAL CHECK ON THE REFERENCE STANDARD -- ALODINED FASTENERS
DETAIL XII

SIGNALS AT TEAR STRAP LOCATIONS THAT ARE HIGHER THAN THE BASELINE (AS SHOWN IN VIEW A) ARE POSSIBLE CRACKS. TO EXAMINE THESE SIGNALS, DO THE STEPS THAT FOLLOW:

1. BALANCE YOUR INSTRUMENT ON THE UPPER FASTENER ROW AS SPECIFIED IN PAR. 5
2. EXAMINE THE LOWER ROW OF FASTENERS THAT GO THROUGH THE TEAR STRAP.
3. MAKE A RECORD OF A SIGNAL THAT IS HIGHER THAN THE ALARM LEVEL SET IN PAR. 4. THESE SIGNALS ARE CRACK INDICATIONS.



SCREEN DISPLAY OF A CRACK SIGNAL AT A TEAR STRAP LOCATION
VIEW A

NOTE: THE BALANCE POINT IS OFF THE BOTTON OF THE SCREEN DISPLAY.

CRACK SIGNAL AT A TEAR STRAP LOCATION
DETAIL XIII

PHASEC 2D

1. Press “Menu” button.
2. Set mode to Normal Dual.
3. Set Drive dB to +8
4. Set probe inductance to 82
5. Set probe1 and probe2 to “reflection”.
6. Set Filter1 and Filter2 to “BP LOCK”
7. Set HP/LP1 and HP/LP2 to DC/50.0.
8. Set input gains for frequency 1 and frequency 2 to “high”
9. Set GAINMIX to “0.0/0.0”
10. Set PHASEMIX to “0.0”
11. Set DISPLAY to “Spot”
12. Set Graticule to Grid 2 (fine graticules)
13. Set View to “Frequency 1”
14. Set SPOT XY to 138/-19
15. Set View to “Frequency 2”
16. Set SPOT XY to 138/-19
17. Set View to “mix”
18. Set SPOT XY to 138/-19
19. Set Active to Mix
20. Set Shape to Box
21. Set Top/Btm to 69/29
22. Set Lft/Rght to -138/39
23. Set persistence to permanent

PHASE 2D INITIAL INSTRUMENT ADJUSTMENT

Equipment Initial Adjustments
Detail XIV (Sheet 1)

PHASEC 2200

1. Press Menu button
2. Set probe to "Standard"
3. Set probe drive to "+10dB"
4. Set graticule to "Rect. C" (8 divisions vertically, 16 horizontally)
5. Press Menu again to enter operating mode
6. Select Mode at bottom of display.
7. Set <mode> to "Refl 2 Ch"
8. Set Display to "XY"
9. Set persistence to "Permn't"
10. Set View to "Ch1"
11. Select Input function
12. Set Hi-Pass to "DC"
13. Set Lo-Pass to "50 Hz"
14. Set Inp. Gain to "0dB"
15. Select "PosXY" function
16. Set X-pos 1 at "+60"
17. Set Y-pos 1 at "-38". Balanced dot should now lie on a graticule point two vertical divisions from the bottom of the screen and four horizontal divisions from the right edge.
18. Set the Mode to "Sum View" and select sum to set the values in step 19 and 20 below.
19. View "SUM"
20. Set SUM GAIN to 0.0dB.
21. Set SUM PHASE to 180 degrees

NOTE: The Phasec 2200 does not have independent vertical and horizontal gains. When the procedure specifies a horizontal or vertical gain adjustment, use the gain control for the applicable channel and the x:y ratio

NOTE: When you make the final lift-off adjustment as specified in Detail X with the Phasec 2200, the lift-off signal goes to the right. Decrease the frequency 2 "X" value in the X:Y mode (example -10 to -4 dB) until the lift-off signal moves to the **right** a similar but opposite distance from the balance point as shown in Detail X, View C.

PHASE 2200 INITIAL INSTRUMENT ADJUSTMENT

Equipment Initial Adjustments
Detail XIV (Sheet 2)

NORTEC 2000D, 2000D+ AND WORKSTATION

1) Push the Set-up button

2) Set the frequency mode to Dual Freq and the probe drive to high. Use the up-arrows and the smart knob to adjust the correct values.

3) Push the Display/Alarm button.

4) Highlight the dual function with the soft key. (Use the right up-arrow.)

5) Make sure that A/G tracking is set to off. Adjust it with the smart knob.

6) Make sure the auto mix function is set to off. Adjust with the smart knob.

7) Push the Display/Alarm button, then the dual soft key on the right side of the screen. Set the value to display F1 (frequency 1) with the smart knob.

8) Push the Main/filter button until the LP filter function shows on the top, right of the display. Use the smart knob to set 50 Hz. Set the high pass filter to "off"

9) Push the Main/filter button until the "FREQ" appears in the lower left of the display (this causes frequency 1 to be displayed). Make the necessary adjustments to frequency 1 as specified in the procedure.

10) Push the Main/filter button again to select FREQ 2 (frequency 2)

    NOTE: You must push Display, then Dual (right up arrow) and use the smart knob to set the display to F2 (frequency 2) or you will not be able to see the adjustments you make on the screen.

11) To see the mix mode, push Display/alarm, then dual soft key and use the smart knob to set the display to F1-F2. The display does not show a label that tells what signal is displayed on the screen. You must push Display, then dual, and monitor the upper right side of the screen to make sure that the correct display is shown on the screen.

12) You must add 180 degrees to the phase of channel 1 and channel 2 to cause the correct upscale signal.

NORTEC 2000D, 2000D+, AND WORKSTATION INITIAL INSTRUMENT ADJUSTMENT

Equipment Initial Adjustments
Detail XIV (Sheet 3)

NOTE: The correct frequency mix for this procedure is F2 – F1

The mixed notch signal will move downscale for the Nortec (Staveley) instruments because the instruments use F1 – F2 to do the mix. To change the display to F2 – F1 you must add 180 degrees to the phase values for each frequency so that the notch signal moves upscale. If you add 180 degrees to a phase value and the result is more than 360, then subtract 360 degrees to get the correct phase value.

Examples: (1) Initial phase value is 280 degrees, 280 + 180 = 460,

460 – 360 = 100 degrees. Correct phase is 100 degrees

(2) Initial phase value is 30 degrees, 30 + 180 = 210,

less than 360 degrees. Correct phase is 210 degrees

NORTEC 2000D, 2000D+, AND WORKSTATION INITIAL INSTRUMENT ADJUSTMENT (CONTINUED)

Equipment Initial Adjustments
Detail XIV (Sheet 4)

ELOTEST M2V3

1) Adjust the parameters for channel 1 in the signal display mode as follows:
   a) With the F-key you can set the active channel.
   b) With the cursor Up and Down keys, you can set the parameter.
   c) With the + and - keys you can adjust all parameters to the necessary values:
      (1) Frequency: (11 kHz)
      (2) Preamplifier: 16 dB (Do not use the Auto-Preamp)
      (3) Total gain: 30,0 dB (This is the sum of Preamp+Mainamp+Y-Spread)
      (4) Spread Y: 0 dB
      (5) Phase: 355
      (6) Display: y/x low. rt.
      (7) Lowpass: 50 Hz
      (8) Amplitude: 100%
      (9) Attenuation: off
      (10) Additional Preamp: off

2) Adjust the parameters for channel 2 in the signal display mode as follows:
   a) With the F-key you can set the active channel.
   b) With the cursor Up and Down keys, you can set the parameter.
   c) With the + and - keys you can adjust all parameters to the necessary values:
      (1) Frequency: (2.7 kHz)
      (2) Total gain: 30,0 dB (This is the sum of Preamp+Mainamp+Y-Spread)
      (3) Spread Y: 0 dB
      (4) Phase: 58.5

      NOTE: The missing parameters Preamplifier, Display, Lowpass, Amplitude, Attenuation and Additional Preamp are already correctly set-up from channel 1.

ELOTEST M2V3 INITIAL INSTRUMENT ADJUSTMENT

Equipment Initial Adjustments
Detail XIV (Sheet 5)

(1) Adjust the parameters for channel 1 in the Parameter Setup display mode as follows:

a) With the cursor Up and Down keys, you can set the parameter.

b) With the Smart knob or the cursor right (inc) and left (dec) keys you can adjust all parameters to the necessary values

(1) Frequency: 11 kHz

(2) Amplitude: 50%

(3) Preamplifier: 16 dB

(4) Mainamplifier: 18,5 dB

(5) Spread Y: 0 dB

(6) Phase: 358 °

(7) Lowpass: 50 HZ

(8) Highpass: off

(9) Dot Position Y: -59,4 %

(10) Dot Position X: 59,4 %

NOTE: When the Dot-Position X or Y is highlighted, you can call up pre-programmed Dot-Positions with the F1 key.

(2) Adjust the parameters for channel 2 in the Parameter Setup display mode as follows:

a) With the cursor Up and Down keys, you can set the parameter.

b) With the Smart knob or the cursor right (inc) and left (dec) keys you can adjust all parameters to the necessary values

(1) Frequency: 2.6 kHz

(2) Mainamplifier: 16,5 dB

(3) Phase: 358 °

NOTE: The missing parameters Amplitude, Preamplifier, Spread Y, Lowpass, Highpass, and Dot Positions X and Y, are already correctly set-up from channel 1.

ELOTEST B 300 INITIAL INSTRUMENT ADJUSTMENT

Equipment Initial Adjustments
Detail XIV (Sheet 6)

TROUBLESHOOTING:

If you do not get the correct results, do the calibration again but refer to the items that follow that identify possible solutions.

1. The instrument in use does not have independent horizontal and vertical gain adjustments:

- Calibration on the anodized fasteners must be done so that the endpoints of the frequency 1 and frequency 2 signals move to the same vertical and horizontal position on the screen. For this adjustment, it is necessary to use independent horizontal and vertical gain controls or gain and X:Y ratio adjustments.
- If your instrument has a single gain control and an X:Y ratio adjustment, then:
  - To adjust the signal so the endpoint moves to the left, the "x" value must be changed from a larger to a smaller x value. For example, if you change the value from -10 dB to -4 dB, you will move the endpoint to the left. This is equivalent to an increase in the horizontal gain.

2. Mix Signal Does not look the same as Detail VII, View C

- Make sure the vertical and horizontal gains for each channel are equal (V:H ratio is 1:1) when you adjust the phase in Detail V. If the lift-off signal moves upscale from the balance point, the mixed lift-off signal can move down and left. If you use a Nortec instrument, it is normal to get a downscale lift-off signal when the steps before the mix are done correctly. You must add 180 degrees of phase to each channel to move the lift-off signal to the right

- Monitor the F1 and F2 signals separately while you hold the probe at position 2 where you get the maximum signal from a good anodized fastener. The signals from frequency 1 and 2 must start from the same null point and end at the same screen position. If they do not, then adjust the signals so the endpoints occur at 4 vertical and 5 horizontal divisions from the balance point.

- Use an 0.012 inch (0.30 mm) shim (the thickness of a business card) when you set the lift-off in Detail V. Adjust the phase control so that no part of the horizontal lift-off signal rises above the baseline.
- If the steps above do not correct the lift-off, do par. 4.F thru 4.M again.

TROUBLESHOOTING

Equipment Initial Adjustments
Detail XIV (Sheet 7)

3. Signal From a Good Fastener Signal Gives a Large Upscale Signal:

- Make sure that the initial mix signal, shown in Detail VII, View B looks almost the same
- Adjust the Good fastener signal again
  - o View the mix signal
  - o Balance the probe at position 1. See Detail IX.
  - o Move the probe above the Good fastener at position 2.
  - o As you move the probe above the Good fastener so the signal amplitude is at its maximum, increase the Frequency 1 gain until the maximum signal (top of the signal arch) is within 1 vertical division of the balance point.
  - o Do a check of the notch B signal. If it is not at least 4 vertical divisions from the balance point, then do the instructions in Details VIII and IX again.

4. Final Lift-off Signal Does Not Move to the Left:

- If you use a Phasec 2200:
  - o The lift-off signal will move to the right when you calibrate the instrument with the instructions given in Detail X.
  - o It is acceptable for the lift-off signal to move to the right. The crack signal will still move upscale.
  - o Adjust the channel 2 gain so that the lift-off signal moves to the right approximately 4 horizontal divisions.
  - o Adjust the phase 1 control if the lift-off signal is not horizontal.
- For all other instruments specified in 1.B.2:
  - o Increase the Frequency 2 horizontal gain.

5. The Notch B signal is too high (much greater than 4 vertical divisions) after the final signal mix:

- Decrease the Frequency 2 vertical gain. Frequency 2 is the lower frequency and is most sensitive to the notch.

TROUBLESHOOTING

Equipment Initial Adjustments
Detail XIV (Sheet 8)

EFFECTIVITY
MODEL: 707-100/-200 ALL 707-300/-400 ALL 707-300B, CUM LINE NO. 268 THRU 870 707-300C, CUM LINE NO. 332 THRU 868 720 ALL
SSI DOCUMENT (D6-44860) REFERENCE: SSD 53-A05-12 SSD 53-A15-12 SSD 53-A25-12 SSD 53-A35-12 SSD 53-A45-12
SERVICE BULLETIN REFERENCE: 2856, 2857, 2858, 2859, 2860, 2861, 2862, 2863

PART 6 - EDDY CURRENT

FUSELAGE PLATES/SKINS

1. Purpose

A. To detect subsurface cracks at the fuselage monocoque skin spotwelds from BS 259 to BS 1241. Spotweld surface cracks will also be detected by this procedure.

2. Equipment

A. Any instrument that will satisfy the performance requirements of this procedure is suitable for this inspection. The Zetec MIZ-10 was used in the development of this procedure and was found to be suitable.

B. Spring-loaded surface probe or pencil probe as referred to in Part 6, 51-00-00, Fig. 4, Surface Inspection of Aluminum Parts. The probe must be capable of operating at 50 kHz. This procedure was verified with the following pencil probes:

(1) NDT Product Engineering UP905-70B, NDT Products

C. Surface Crack Reference standard per Part 6, 51-00-00, Fig. 4, Surface Inspection of Aluminum Parts.

3. Preparation for Inspection

A. Wipe surface clean.

B. Paint need not be removed.

Fuselage Skin Spotwelds
Figure 1 (Sheet 1)

4. Instrument Calibration

   A. Set instrument frequency at 50 kHz and calibrate per Part 6, 51-00-00, Fig. 4, Surface Inspection of Aluminum Parts.

   B. Slight adjustments to balance and liftoff must be made on a crack-free area of the airplane since the crack standard does not exactly duplicate airplane structure.

   C. Check subsurface crack detection capability by placing a 0.020-inch thick clad aluminum skin over the reference standard notch. The eddy current notch signal through the skin should be with 25 percent of the signal obtained from the standard without the 0.020-inch skin over the notch.

5. Inspection Procedure

   A. Slide the eddy current probe across each spotweld in a cross pattern.

   NOTE: For inspection about a rivet installed for repairs, slide probe on skin around the head of the rivet.

   B. Cracks will be indicated by meter deflection which will vary with the size of the crack, its depth below the surface, and the instrument being used. Individual instrument response characteristics may be checked by inspecting spotwelds that contain visible cracks.

Fuselage Skin Spotwelds
Figure 1 (Sheet 2)

EFFECTIVITY
MODEL: 707/720 SSI DOCUMENT (D6-44860) REFERENCE: SSD 53-A00-21 SSD 53-A10-21 SSD 53-A20-21 SSD 53-A30-21 SSD 53-A40-21 SERVICE BULLETIN REFERENCE: 2962

PART 6 - EDDY CURRENT

FUSELAGE - PLATES/SKIN

1. Purpose

   A. To find cracks in the fuselage skin around countersunk fasteners at the lap joints, the circumferential butt joints or other fuselage locations while the fasteners are still installed.

   B. The cracks start on the inner surface of the outer skin at the edge of the countersink. From there, the cracks move up the countersink and out along the faying surface.

   C. There are three procedures, each optional to the others, which can be used to do this inspection. The procedures are:

      (1) Part 6, 53-30-07, Fig. 8, "Rotating Surface Probe Method"

      (2) Part 6, 53-30-07, Fig. 9, "Sliding Probe Method"

      (3) Part 6, 53-30-07, Fig. 10, "Oversized Template Method"

      NOTE: The Sliding Probe Method (Part 6, 53-30-07, Fig. 9) is permitted for the longitudinal lap joint inspections only, since it is sensitive to the crack orientation.

   D. For inspection procedures to find cracks with the fasteners removed, before the cracks extend beyond the countersink, refer to Part 6, 53-30-00, Fig. 1.

2. Equipment

   A. Refer to tne applicable paragraph within the procedures listed in par. 1.C.

Fuselage Skin Countersunk Fasteners
Figure 2 (Sheet 1)

3. Preparation for Inspection

A. Safe access to the fuselage is required. Scaffolding, ladders or other access devices are required.

B. Make sure the inspection area is clean.

C. Paint removal is not required to do this inspection if the fastener heads can be clearly identified through the paint and if the surface roughness does not interfere when the probe is scanned. However, when a painted structure is inspected, special precautions must be taken during the calibration procedure to make sure of adequate inspection sensitivity. If necessary, sand or strip thick or rough paint from the local areas to make the inspection easier.

4. Calibration

A. Refer to the applicable paragraph within the procedures listed in par. 1.C.

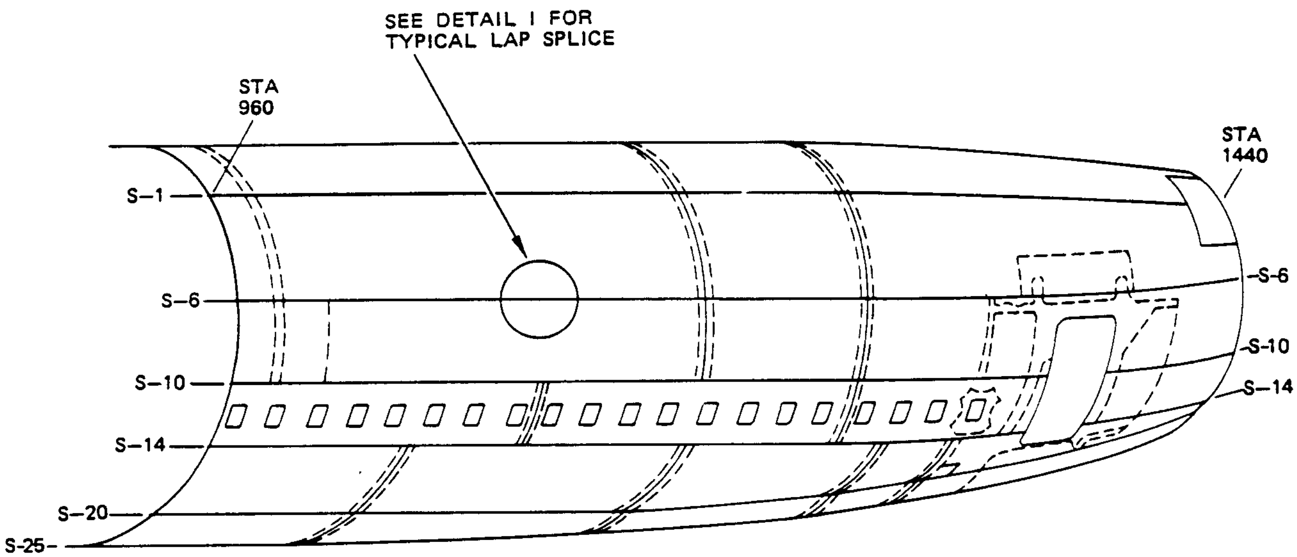
5. Inspection Procedure

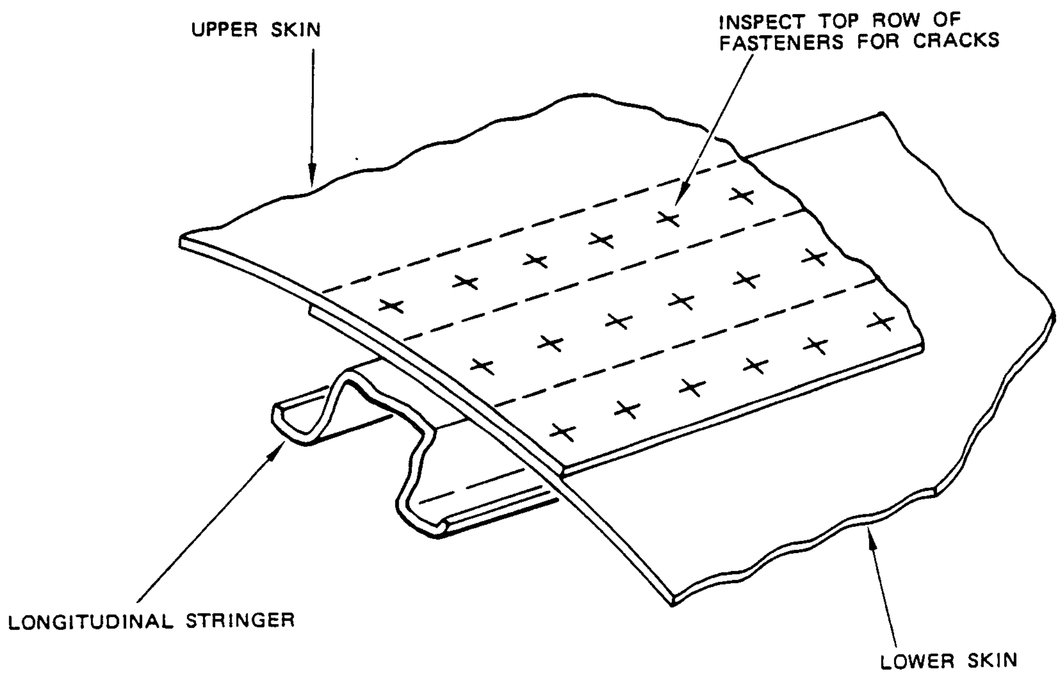
A. Refer to the applicable paragraph within the procedures listed in par. 1.C.

6. Inspection Results

A. Refer to the applicable paragraph within the procedures listed in par. 1.C.

Fuselage Skin Countersunk Fasteners
Figure 2 (Sheet 2)





TYPICAL LAP SPLICE
DETAIL I

Fuselage Skin Lap Splices
Figure 2 (Sheet 3)

EFFECTIVITY
MODEL: 707/720 SERVICE BULLETIN REFERENCE: 2797 SSI DOCUMENT (D6-44860) REFERENCE: SSD 53-A05-15 53-A15-15A 53-A15B 53-A15C 53-A25-15 53-A35-15 53-A35-15B 53-A45-15A 53-A45-15B

PART 6 - EDDY CURRENT

FUSELAGE - PLATES/SKINS

1. Purpose

   A. To detect cracks initiating from fastener holes beneath external doublers at Radio Altimeter Receiving Antenna Cutouts at Body Station 572 using low frequency eddy current.

   B. Low frequency eddy current inspection is required only if external doublers are are present. Compare airplane configuration with Detail III or IV determine if inspection is required.

2. Equipment

   A. Instrument - Any eddy current instrument that will satisfy the performance requirement of this procedure is suitable for this inspection. The following instrument was used during the development of this procedure.

      (1) MIZ-10, Zetec Inc.

Radio Altimeter Receiving Antenna Cutouts at BS 572
Figure 3 (Sheet 1)

B. Probe - The following probe was used in the development of this procedure. Any probe of similar size that will satisfy the performance requirements of this procedure is acceptable.

(1) Ring (encircling) probe, 0.7-inch O.D. and 0.3-inch I.D., O.D. and I.D. shielding probe usable at 2 kHz, Nortec P/N SPO-996.

(2) Alternate spot probe, 0.45-inch O.D. shielded probe usable at 2 kHz, Nortec P/N SPO-565A. See par. 5.A.(3), note (a) for conditions requiring the use of this probe.

(3) These probes are available from Nortec Inc.

C. Probe Guide - Non-metallic straight edge, 6.0-inch long.

D. Manufacture Reference Standard per Detail I.

3. <u>Preparation for Inspection</u>

A. Access - Inspection area is accessible from outside the airplane.

B. Identify the inspection area per Details III and IV and wipe surface clean.

4. <u>Instrument Calibration</u>

A. The following calibration is for the inspection of 0.125 dia fastener holes around the periphery of the antenna cutout. For this inspection the ring probe, par. 2.B., is used as a spot probe (Detail II [1]).

(1) Adjust instrument frequency to 2 kHz and place probe adjacent to the unnotched reference hole, Position 1, Detail II.

(a) A non-metallic straight edge is recommended to maintain uniform probe distance from fastener during calibration.

(2) Balance instrument per manufacturer's instructions.

(3) Adjust liftoff control per manufacturer's instructions to obtain the same response when the probe is on the standard as when lifted off the standard by 0.006 inch, (approximately the thickness of two sheets of paper).

<u>NOTE</u>: Probe is located at Position 1 during liftoff calibration.

(4) With the probe adjacent to the unnotched hole (Position 1), adjust meter response to read 20% of full scale with meter position control.

Radio Altimeter Receiving Antenna Cutouts at BS 572
Figure 3 (Sheet 2)

(5) Position probe adjacent to the notched reference hole (Position 2). Response should be upscale.

(6) Adjust instrument sensitivity to obtain 60% of full scale meter response difference between the notched and unnotched holes.

(7) Reposition probe at Position 1 and check null and liftoff. If readjustments are made, recheck sensitivity per par. 4.A.(6).

(8) Cracks will be indicated by a higher meter response.

B. The following calibration is for inspection of 0.187 dia fastener holes using a ring probe centered on the fastener (Detail II [2>).

(1) Adjust instrument frequency to 2 kHz and visually center probe over the unnotched reference standard hole (Position 3).

(2) Balance instrument per manufacturer's instructions.

(3) Adjust liftoff control per manufacturer's instructions to obtain the same response when the probe is on the bare standard as with the probe lifted off the part by 0.006 inch (approximately the thickness of two sheets of paper).

NOTE: Probe is visually centered over unnotched hole during liftoff calibration. Once probe is calibrated for liftoff, centering is usually accomplished by manipulating the probe over the fastener to obtain a minimum meter response.

(4) Center probe over the unnotched hole and adjust meter response to read 20% of full scale with meter position control.

(5) Center probe over the notched reference standard hole (Position 4). Response should be upscale.

(6) Adjust instrument sensitivity to obtain 60% of full scale meter response difference between the notched and unnotched holes.

(7) Reposition probe over unnotched reference hole (Position 3). If readjustments are made, recheck sensitivity per par. 4.B.(6).

(8) Cracks will be indicated by a higher meter response.

Radio Altimeter Receiving Antenna Cutouts at BS 572
Figure 3 (Sheet 3)

5. Inspection Procedure

A. Inspect for cracks out of fastener holes around periphery of antenna cutouts using ring or spot probes positioned adjacent to the fasteners. Depending on airplane configuration use Detail III [1]> or Detail IV [1]> for inspection location.

(1) Calibrate the instrument per par. 4.A.

(2) Use several areas adjacent to fasteners within inspection area to establish the airplane baseline response.

NOTE: Minor adjustments to the meter position control may be required since the reference standard does not exactly duplicate the airplane structure. Do not change instrument sensitivity when establishing the airplane baseline response.

(3) Scan along the fastener holes around the periphery of the antenna cutouts.

NOTE: (a) Use alternate probe per par. 2.B.(2) if fasteners are spaced too close together or if oversize fasteners are encountered.

(b) A non-metallic straight edge is recommended to maintain a uniform probe distance from the fasteners.

(4) Any location which gives a response 40% of full meter scale higher than the established baseline response is a potential crack and further investigation is required.

B. Inspect for cracks out of selected fastener holes using a ring probe centered on the fastener. Depending on airplane configuration, refer to Detail III [2]> or Detail IV [2]> for inspection fastener identification.

(1) Calibrate the instrument per par. 4.B.

(2) Use several fasteners to establish the airplane baseline response.

(a) Select a representative fastener from the group and set its response to 20% of full scale with meter position control.

NOTE: Do not change instrument sensitivity when establishing the airplane baseline response.

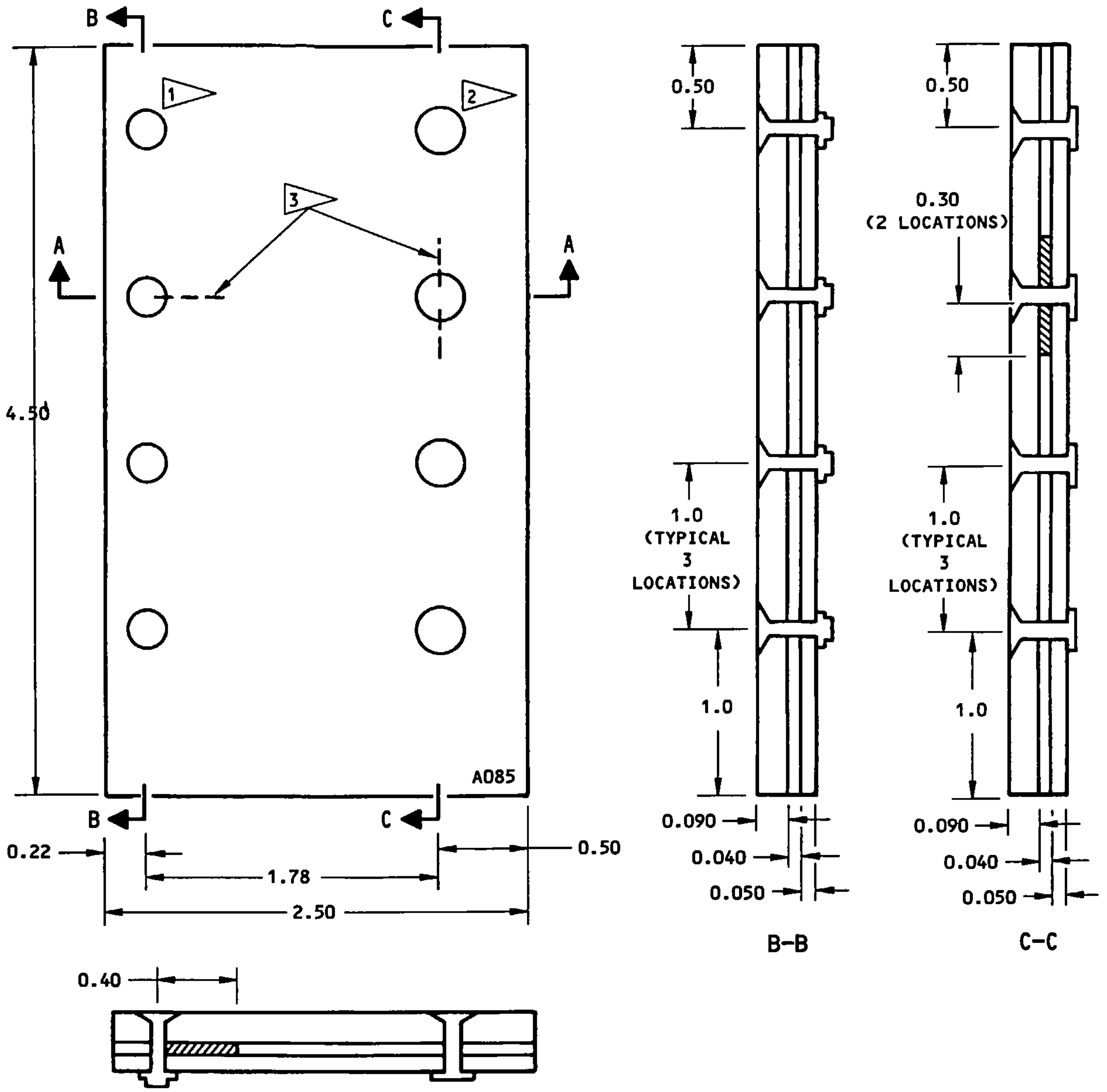
Radio Altimeter Receiving Antenna Cutouts at BS 572
Figure 3 (Sheet 4)

(3) Center the probe over the fastener requiring inspection.

NOTE: Centering of probe over the fastener is usually accomplished by manipulating the probe to obtain a minimum meter response.

(4) Any location which gives a response of 40% of full meter scale higher than the established baseline response has potential cracks and further investigation is required.

Radio Altimeter Receiving Antenna Cutouts at BS 572
Figure 3 (Sheet 5)



NOTES

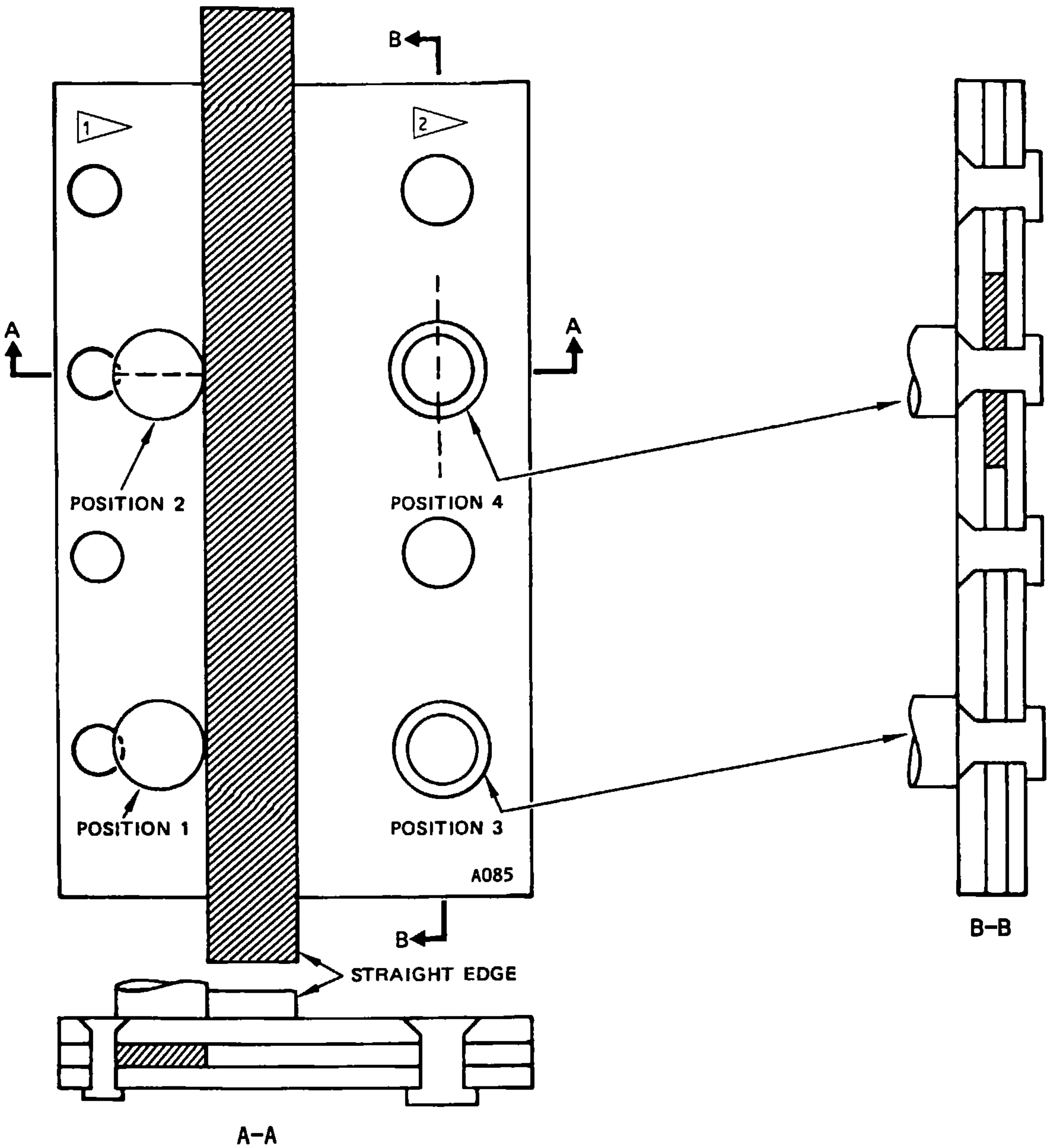
- ALL DIMENSIONS ARE IN INCHES.
- MATERIAL: 2024-T3 ALUMINUM
- ETCH OR STEEL STAMP WITH A085. PUT A LETTER "A" IN FRONT OF THE REFERENCE STANDARD NUMBER TO SHOW THAT IT HAS ALODINED RIVETS. SEE FLAGNOTE 2.
- TOLERANCE: X.X ± 0.05, X.XX ± 0.01, X.XXX ± 0.005

1. BACB30LU-04-03 FASTENERS, BACN10JC04 NUTS THIS ROW (0.125 INCH DIA).
2. BACR15CE6D4 RIVETS THIS ROW. THESE RIVETS MUST HAVE A CONVERSION COATED (ALODINED) FINISH. TO MAKE SURE THE FINISH IS ALODINE, REFER TO PART 1, 51-06-01. INSTALL THE RIVETS AS SPECIFIED IN PART 1, 51-01-04.
3. JEWELER'S SAWCUT 0.030 MAXIMUM WIDTH (3 LOCATIONS)

REFERENCE STANDARD A085
DETAIL I

Radio Altimeter Receiving Antenna Cutouts at BS 572
Figure 3 (Sheet 6)

G68863



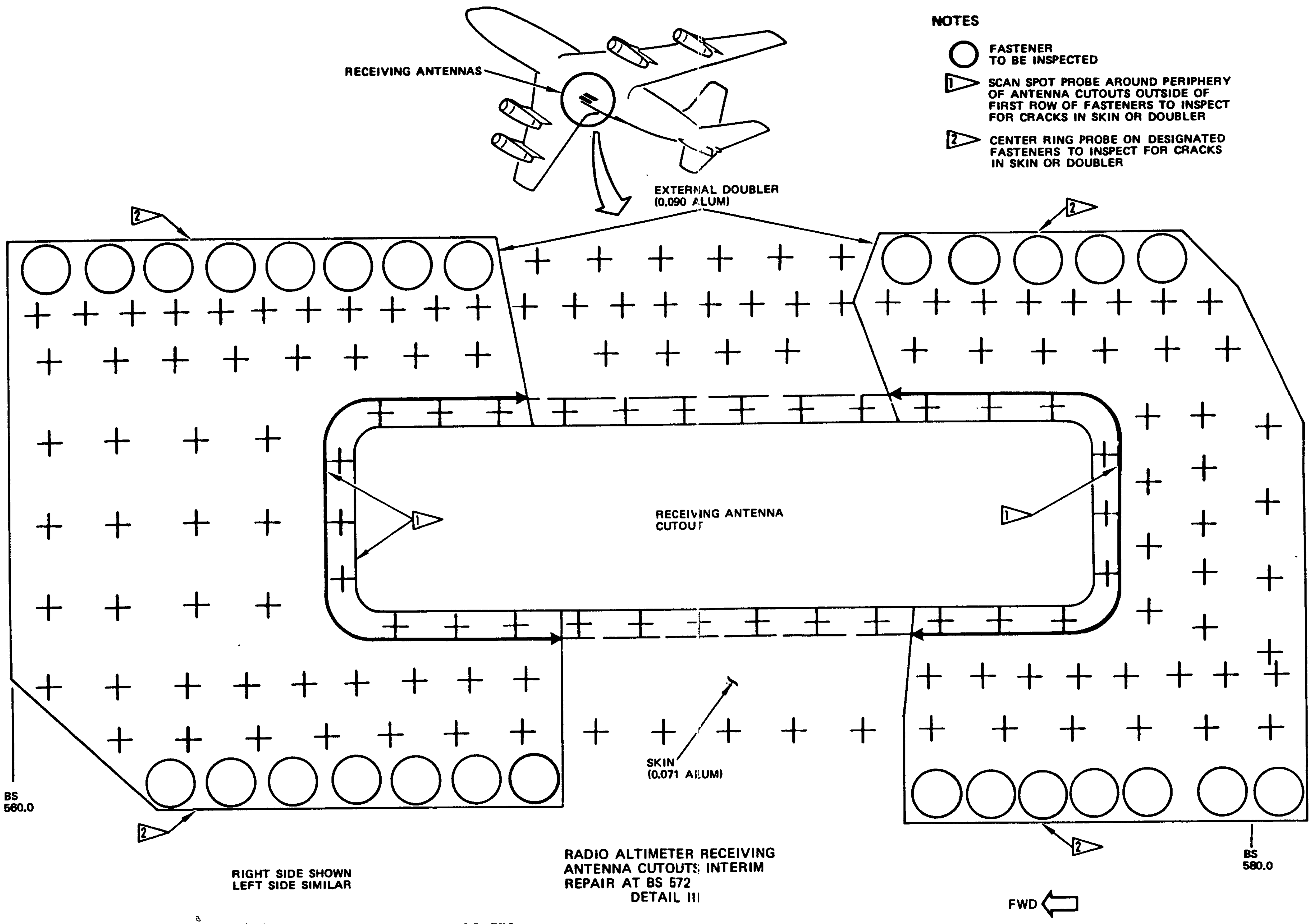
NOTES

1. CALIBRATE WITH SPOT PROBE ADJACENT TO FASTENER THIS ROW
2. CALIBRATE WITH RING PROBE CENTERED ON FASTENER THIS ROW

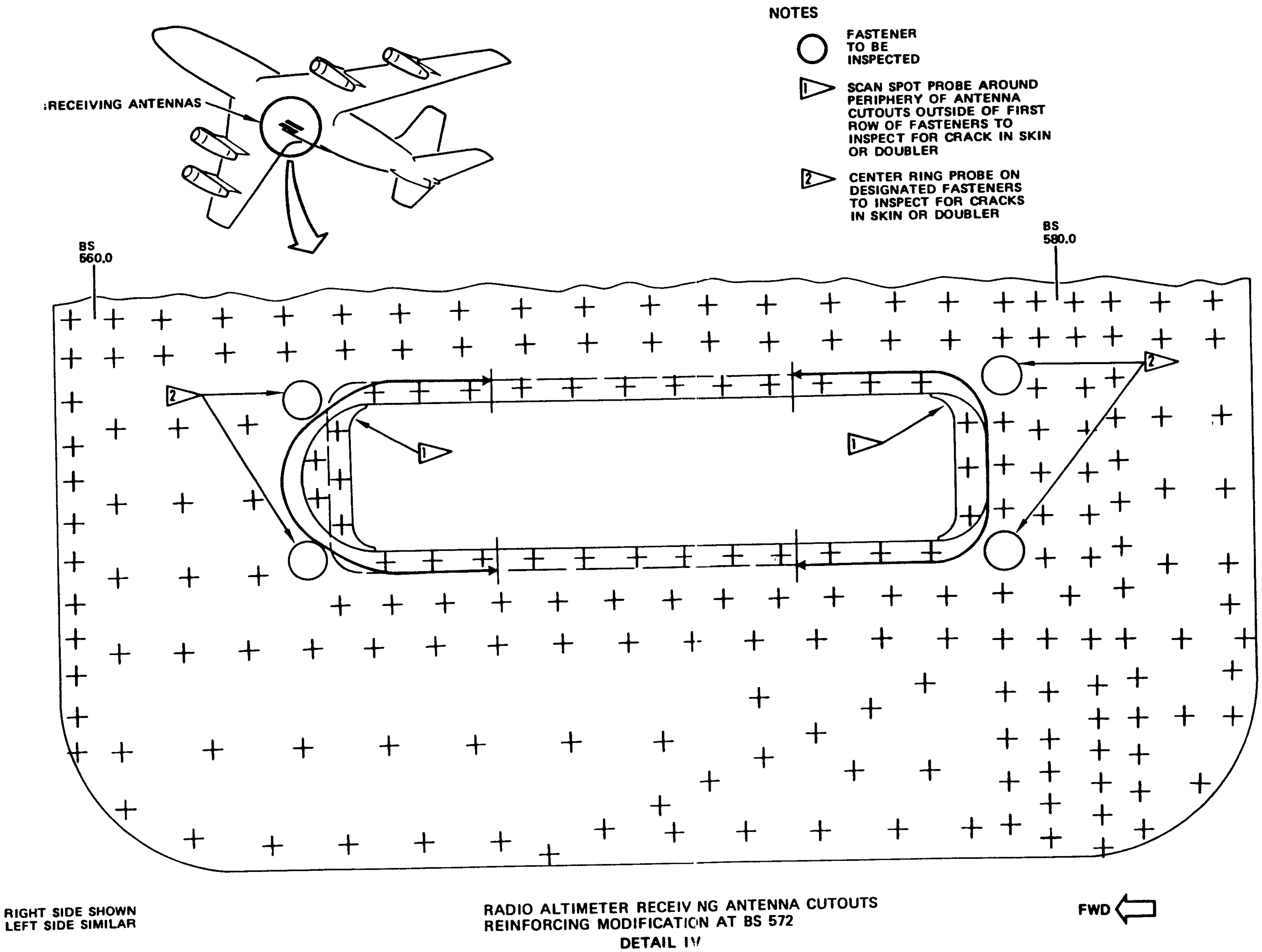
PROBE POSITION FOR CALIBRATION
REFERENCE STANDARD A085

DETAIL II

Radio Altimeter Receiving Antenna Cutouts at BS 572
Figure 3 (Sheet 7)



Radio Altimeter Receiving Antenna Cutouts at BS 572
Figure 3 (Sheet 8)



Radio Altimeter Receiving Antenna Cutouts at BS 572
Figure 3 (Sheet 9)

PART 6 - EDDY CURRENT

FUSELAGE - PLATES/SKINS

1. Purpose

   A. To perform high frequency eddy current inspection to detect cracks in the fuselage skin at edge of antenna cutouts or skin at edge of external doublers, surrounding the Radio Altimeter Receiving Antenna Cutouts at Body Station 572.

   B. Visual identification of inspection area is required due to four possible airplane configurations: Initial, Interim Repair, Reinforcing Modification and Permanent Repair. Airplane configuration designates the eddy current inspection required (Ref. Details I, II, III or IV).

2. Equipment

   A. Instrument:

      (1) Any eddy current instrument that will satisfy the performance requirements of this procedure is suitable for this inspection. The following instrument was used during this development of this procedure and found suitable.

         (a) ED520, Magnaflux Corporation

Radio Altimeter Receiving Antenna Cutouts at BS 572
Figure 4 (Sheet 1)

(2) Probes:

(a) Shielded pencil probe Part 1, 51-06-00, Fig. 1. The following probes are acceptable.

1) P/N P-50, NDT Product Engineering

2) P/N VM100PS, VM Products

(3) Reference Standard - refer to Part 6, 51-00-00, Fig. 4 for information on fabricating or purchasing the reference standard.

3. Preparation for Inspection

A. Access - Inspection area is accessible from outside the airplane.

B. Identify the inspection area configuration and wipe surface clean. Refer to Detail I, II, III or IV to identify inspection area.

C. Smooth paint by sanding lightly or remove paint if rough.

NOTE: (Chipped paint causes an irregular eddy current response which interferes with the inspection).

4. Instrument Calibration

Refer to Part 6, 51-00-00, Fig. 4.

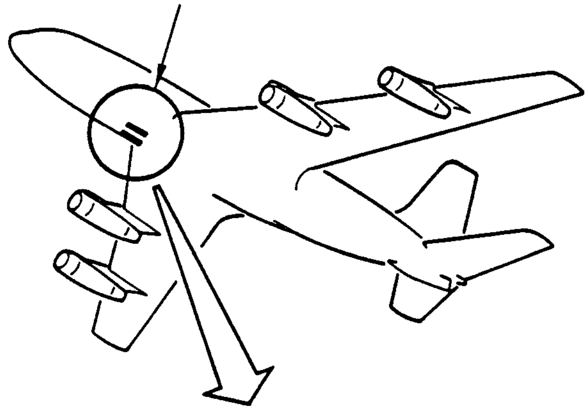
5. Inspection Procedure

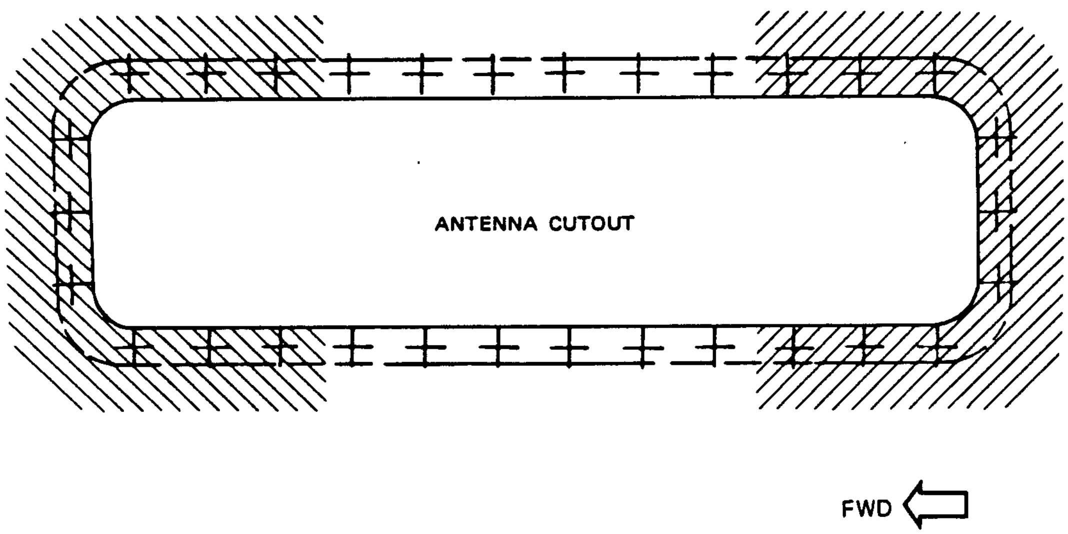
A. Visually identify airplane configuration by comparison with Detail I, II, III or IV.

B. Identify inspection requirements from appropriate Detail.

C. Inspect per appropriate Detail and Part 6, 51-00-00, Fig. 4.

Radio Altimeter Receiving Antenna Cutouts at BS 572
Figure 4 (Sheet 2)





NOTES

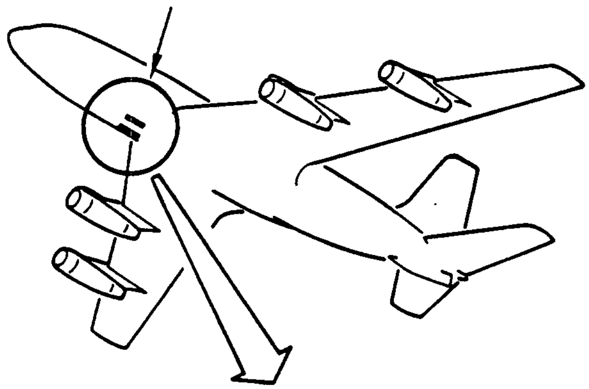
INSPECTION AREA–EDDY CURRENT INSPECT SKIN AROUND PERIPHERY OF ANTENNA CUTOUTS AND AROUND THE END OF FASTENERS IN THE INSPECTION AREA

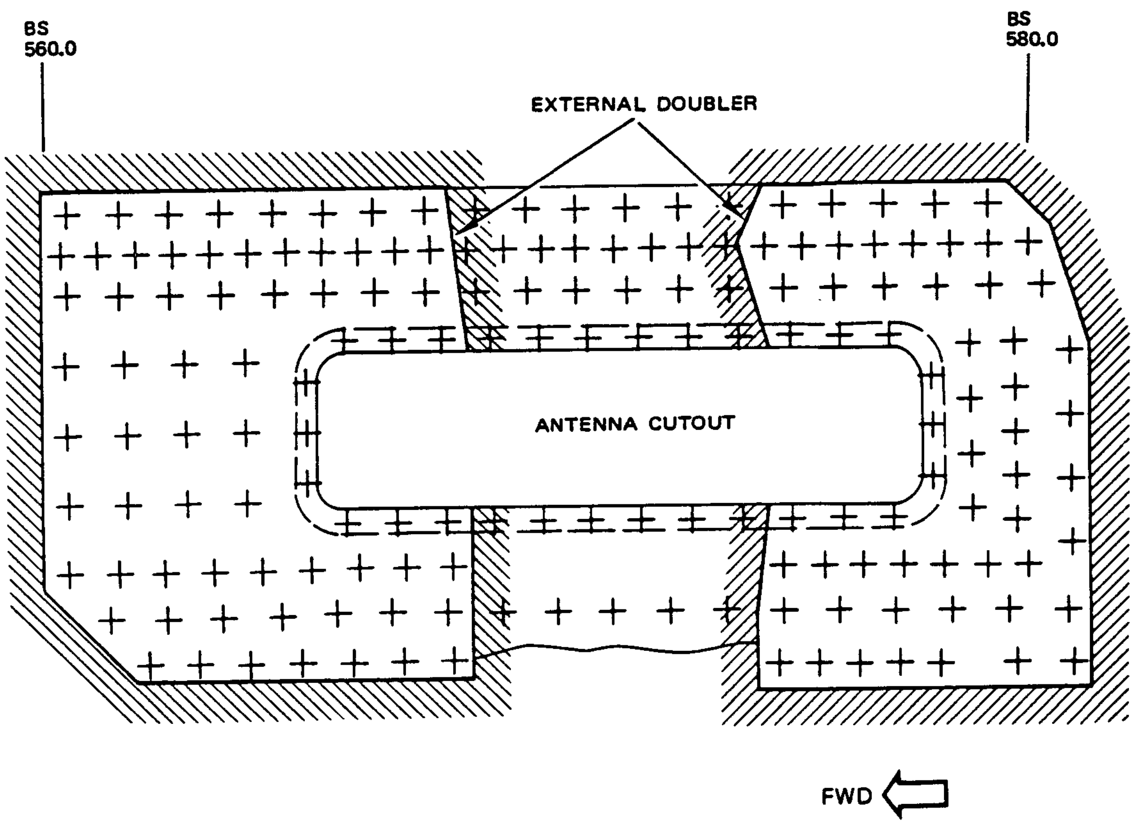
- RIGHT SIDE SHOWN LEFT SIDE SIMILAR

RADIO ALTIMETER – RECEIVING ANTENNA CUTOUTS AT BS 572 (INITIAL CONFIGURATION)

DETAIL I

Radio Altimeter Receiving Antenna Cutouts at BS 572
Figure 4 (Sheet 3)





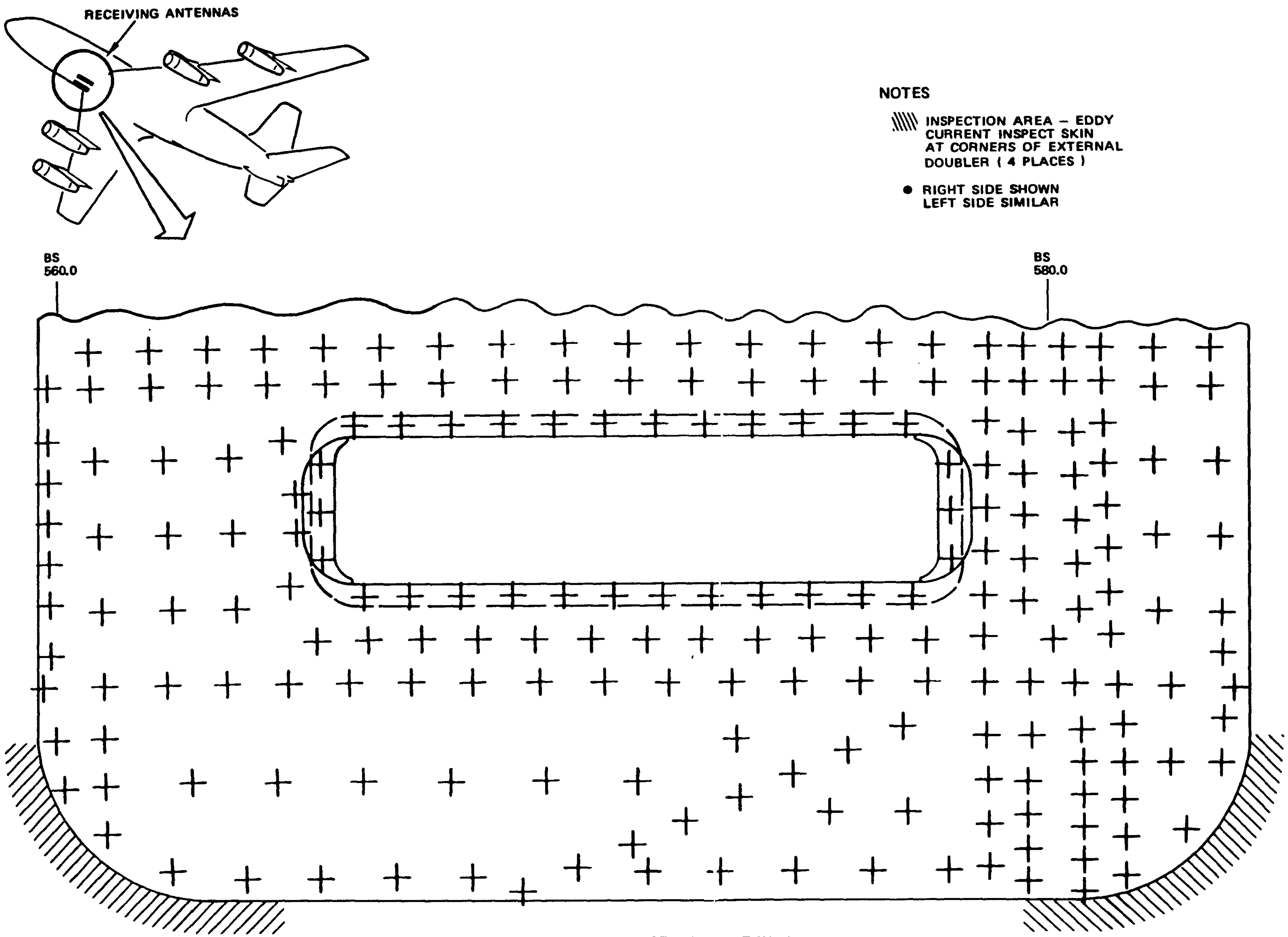
NOTES

INSPECTION AREA – EDDY CURRENT INSPECT SKIN AT EDGE OF EXTERNAL DOUBLER

- RIGHT SIDE SHOWN LEFT SIDE SIMILAR

RADIO ALTIMETER RECEIVING ANTENNA CUTOUTS AT BS 572 (INTERIM REPAIR)
DETAIL II

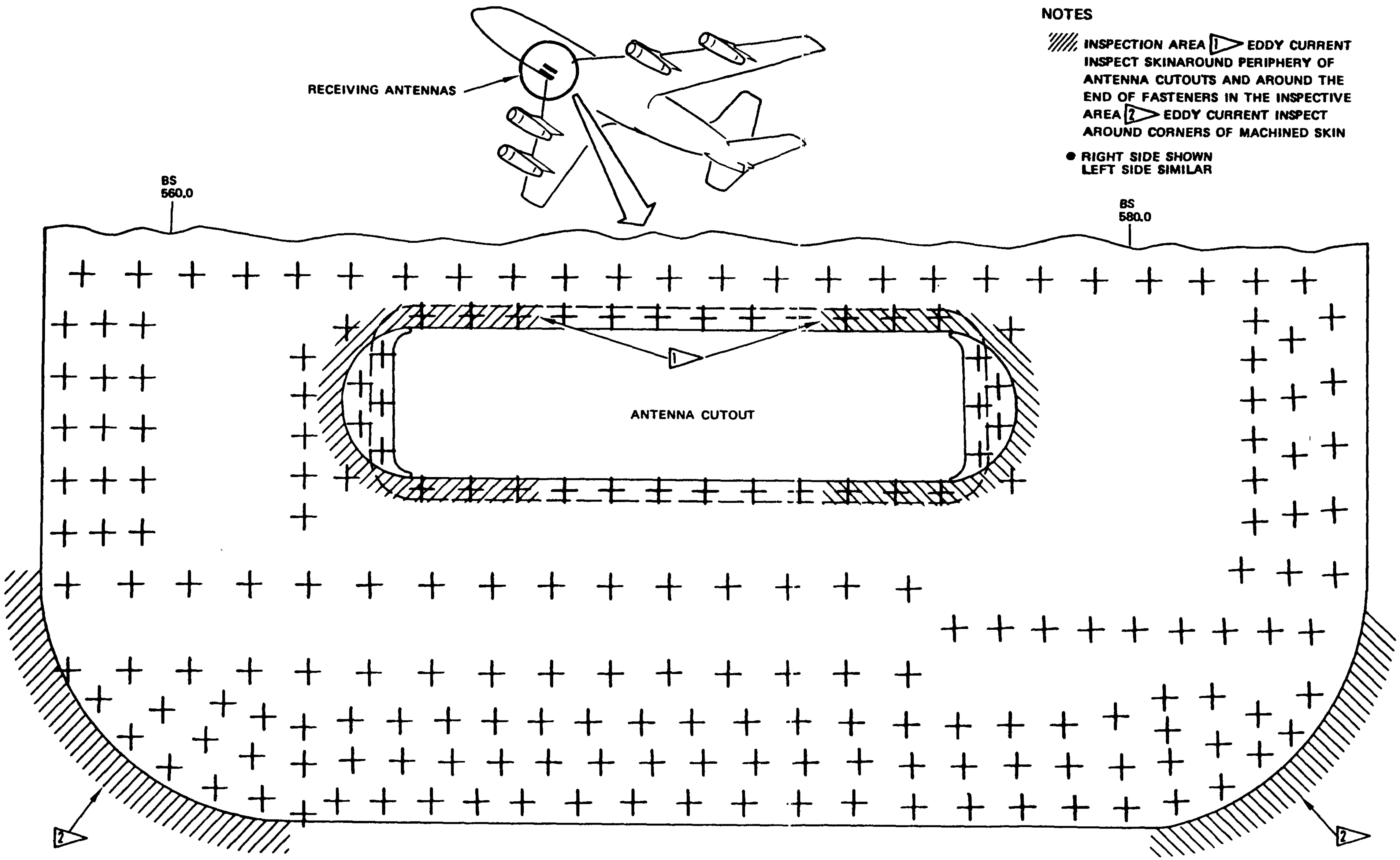
Radio Altimeter Receiving Antenna Cutouts at BS 572
Figure 4 (Sheet 4)



RADIO ALTIMETER RECEIVING ANTENNA CUTOUTS AT BS 572 (REINFORCING MODIFICATION)

DETAIL III

Radio Altimeter Receiving Antenna Cutouts at BS 572
Figure 4 (Sheet 5)



RADIO ALTIMETER RECEIVING ANTENNA CUTOUTS AT BS 572
(PERMANENT REPAIR CONFIGURATION)
DETAIL IV

Radio Altimeter Receiving Antenna Cutouts at BS 572
Figure 4 (Sheet 6)

PART 6 - EDDY CURRENT

FUSELAGE - PLATES/SKINS

1. Purpose

   A. To perform a low frequency eddy current inspection to detect cracks initiating from fastener holes beneath external doublers at Radio Altimeter Transmitting Antenna Cutouts at Body Station 408.

      NOTE: This low frequency eddy current inspection is required only if external doublers are are present. Compare airplane configuration with Detail III or IV determine inspection requirement.

2. Equipment

   A. Instrument - Any eddy current instrument that will satisfy the performance requirement of this procedure is suitable for this inspection. The following instrument was used during the development of this procedure.

      (1) MIZ-10, Zetec Inc.

   B. Probe - The following probe was used in the development of this procedure. Any probe of similar size that will satisfy the performance requirements of this procedure is acceptable.

      (1) Ring (encircling) probe, 0.7-inch OD and 0.3-inch ID, OD and ID shielding probe usable at 2000 Hz, Nortec P/N SPO-996. This probe is available from Nortec Inc.

Radio Altimeter Transmitting Antenna Cutouts at BS 408
Figure 5 (Sheet 1)

C. Probe Guide - Non-metallic straight-edge, 6.0-inch length.

D. Manufacture Reference Standard per Detail I.

3. Preparation for Inspection

A. Access - Inspection area is accessible from outside the airplane.

B. Identify the inspection area and wipe surface clean.

4. Instrument Calibration

A. The following calibration is for the inspection of 0.125-inch dia. fastener holes around the periphery of the antenna cutout. For this inspection the ring probe, par. 2.B., is used as a spot probe. See detail III, [7>].

(1) Adjust instrument frequency to 2 kHz and place probe adjacent to the unnotched reference hole, Position 1, Detail II.

(a) A non-metallic straight edge is recommended to maintain uniform probe distance from fastener during calibration.

(2) Balance instrument per manufacturer's instructions.

(3) Adjust liftoff control per manufacturer's instructions to obtain the same response when the probe is on the standard or lifted off the standard by 0.006 inch, (approximately the thickness of two sheets of paper).

NOTE: Probe is located at Position 1 during liftoff calibration.

(4) With the probe adjacent to the unnotched hole, Position 1 adjust meter response to read 20% of full scale with meter position control.

(5) Position probe adjacent to the notched reference hole Position 2. Response should be upscale.

(6) Adjust instrument sensitivity to obtain 60% of full scale meter response difference between the notched and unnotched holes.

(7) Reposition probe at Position 1 and check null and liftoff. If readjustments are made, recheck sensitivity per par. 4.A.(6).

(8) Cracks will be indicated by a higher meter response.

Radio Altimeter Transmitting Antenna Cutouts at BS 408
Figure 5 (Sheet 2)

B. The following calibration is for inspection of 0.187 dia. fastener holes using a ring probe centered on the fastener. See Detail II, [6].

(1) Adjust instruments frequency to 2 kHz and visually center probe over the unnotched reference standard hole, Position 3, Detail II.

(2) Balance instrument per manufacturer's instructions.

(3) Adjust liftoff control per manufacturer's instructions to obtain the same response when the probe is on the bare standard as with the probe lifted off the part by 0.006-inch (approximately the thickness of two sheets of paper).

NOTE: Probe is visually centered over unnotched hole during liftoff calibration. Once probe is calibrated for liftoff, centering is usually accomplished by manipulating the probe over the fastener to obtain a minimum meter response.

(4) Recenter probe over the unnotched hole and adjust meter response to read 20% of full scale with meter position control.

(5) Center probe over the notched reference standard hole, Position 4. Response should be upscale.

(6) Adjust instrument sensitivity to obtain 60% full scale meter response difference between the notched and unnotched holes.

(7) Reposition probe over unnotched reference hole, Position 3. If readjustments are made, recheck sensitivity per step B(6).

(8) Cracks will be indicated by a higher meter response.

5. Inspection Procedure

A. Inspection for cracks out of fastener holes around periphery of antenna cutouts using the Section 2.B ring probe positioned adjacent to the fasteners depending on airplane configuration use Detail III, [7]; Detail IV, [9], for inspection location.

(1) Calibrate the instrument per par. 4.A.

Radio Altimeter Transmitting Antenna Cutouts at BS 408
Figure 5 (Sheet 3)

(2) Use several areas adjacent to fasteners within inspection area to establish the airplane baseline response.

NOTE: Minor adjustments to the meter position control may be required since the reference standard does not exactly duplicate the airplane structure. Do not change instrument sensitivity when establishing the airplane baseline response.

(3) Scan along the fastener holes around the periphery of the antenna cutouts.

NOTE: A non-metallic, straight-edge is recommended to maintain a uniform probe distance from the fasteners.

(4) Any location which gives a response 40% of full meter scale higher than the established baseline response is a potential crack and further investigation is required.

B. Inspection for cracks out of selected fastener holes using a ring probe centered on the fastener. Depending on airplane configuration, refer to Detail III, [8], or Detail IV, [10], for inspection fastener identification.

(1) Calibrate the instrument per par. 4.B.

(2) Use several fasteners to establish the airplane baseline response.

(a) Select a representative fastener from the group and set its response to 20% of full scale with meter position control.

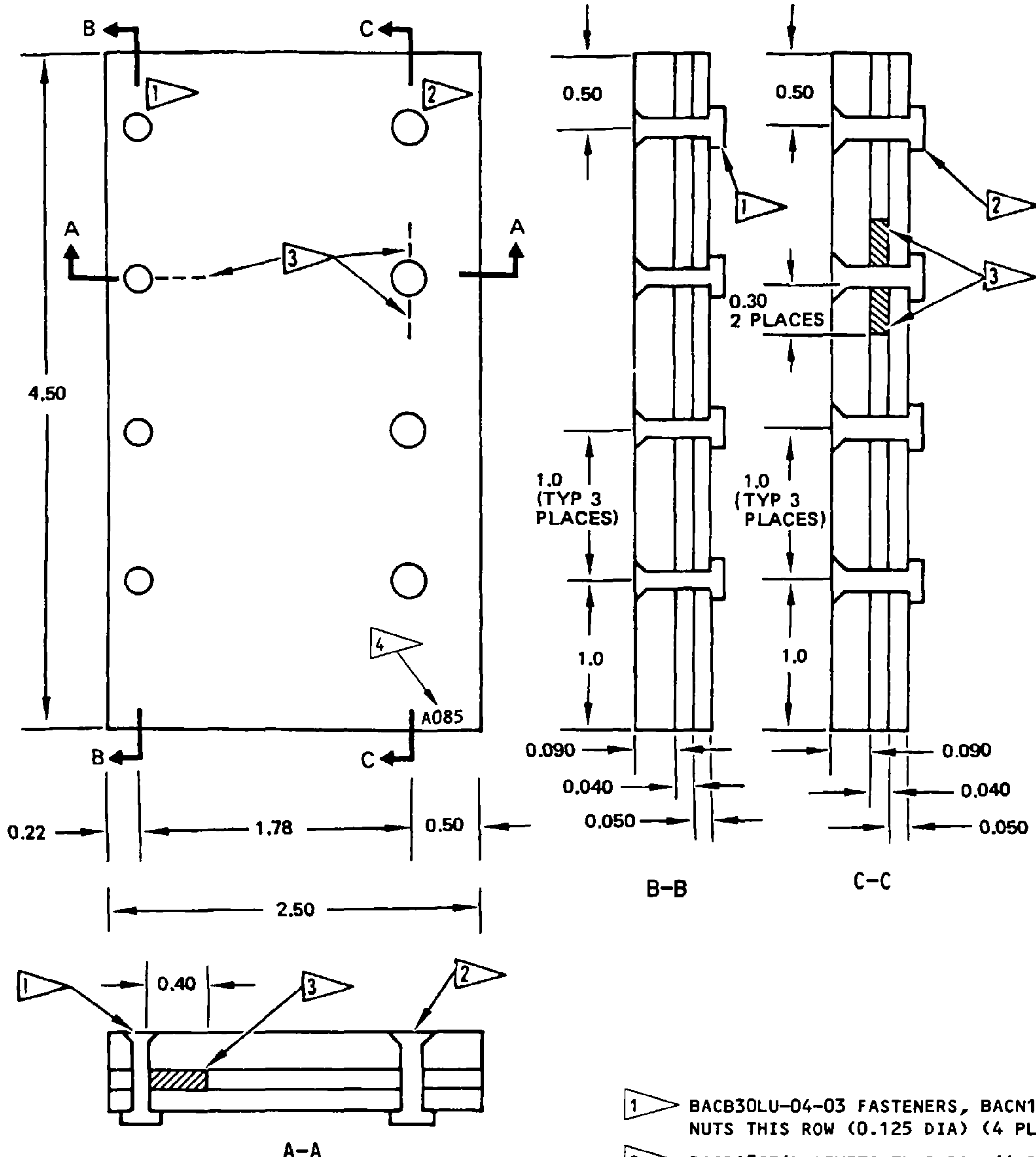
NOTE: Do not change instrument sensitivity when establishing the airplane baseline response.

(3) Center the probe over each fastener required to be inspected.

NOTE: Centering the probe over the fastener is usually accomplished by manipulating the probe to obtain a minimum meter response.

(4) Any location which gives a response of 40% of full meter scale higher than the established baseline response are potential cracks and further investigation is required.

Radio Altimeter Transmitting Antenna Cutouts at BS 408
Figure 5 (Sheet 4)



NOTES:

- ALL DIMENSIONS ARE IN INCHES
- MATERIAL: 2024-T3 ALUMINUM
- TOLERANCE: X.X = ±0.05
  X.XX = ±0.02
  X.XXX = ±0.005
- ETCH OR STEEL STAMP WITH A085

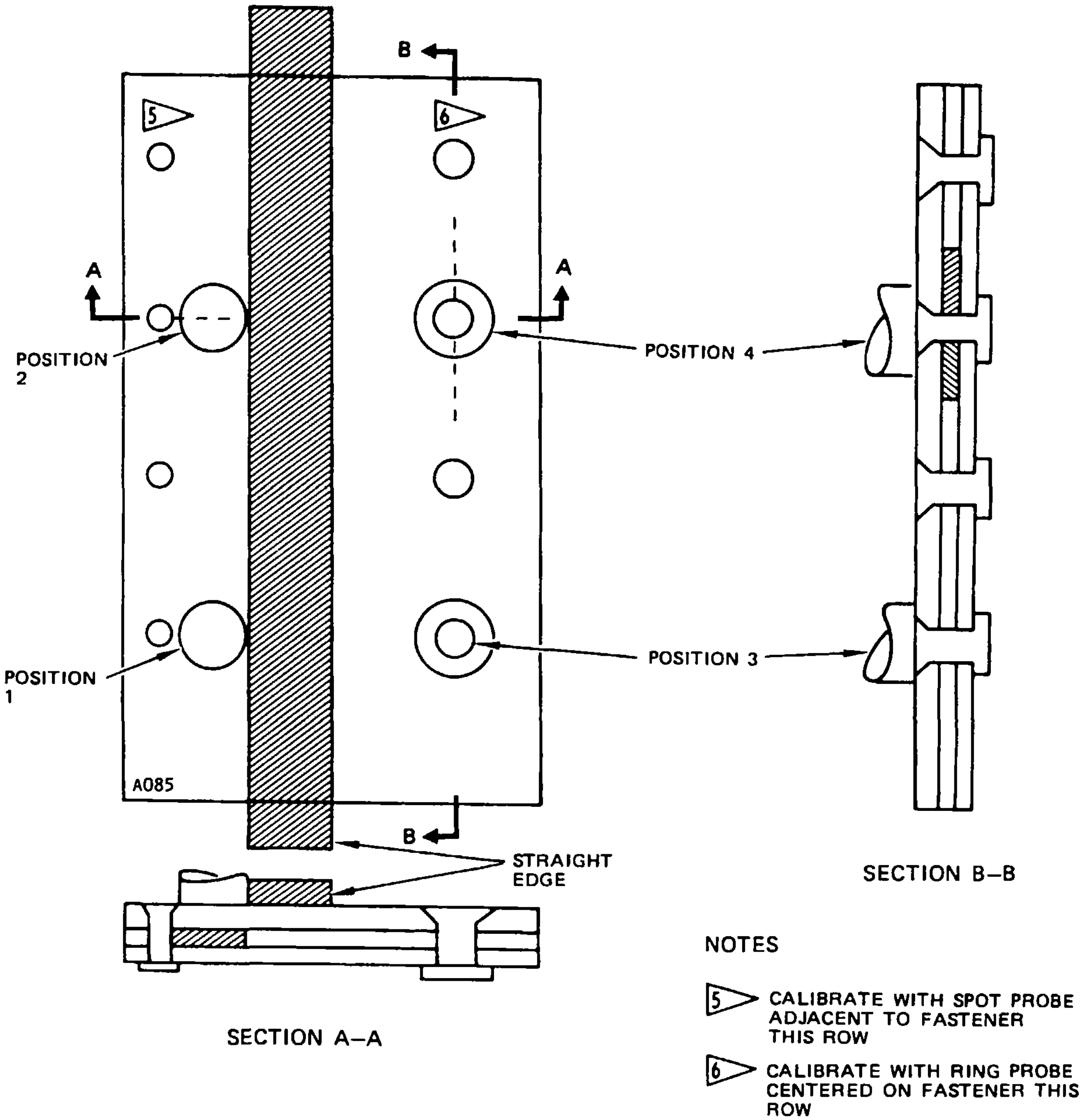
1 BACB30LU-04-03 FASTENERS, BACN10JC04 NUTS THIS ROW (0.125 DIA) (4 PLACES)

2 BACR15CE6D RIVETS THIS ROW (4 PLACES). THESE RIVETS MUST HAVE A CONVERSION COATED (ALODINED) FINISH. TO MAKE SURE THE FINISH IS ALODINE, REFER TO PART 1, 51-06-01. INSTALL THE RIVETS A SPECIFIED IN PART 1, 51-01-04.

3 JEWELER'S SAWCUT 0.030 MAX WIDTH

4 PUT A LETTER "A" IN FRONT OF THE REFERENCE STANDARD NUMBER TO SHOW THAT IT HAS ALODINED RIVETS. SEE FLAGNOTE 2

REFERENCE STANDARD A085
DETAIL I
Radio Altimeter Transmitting Antenna Cutouts at BS 408
Figure 5 (Sheet 5)



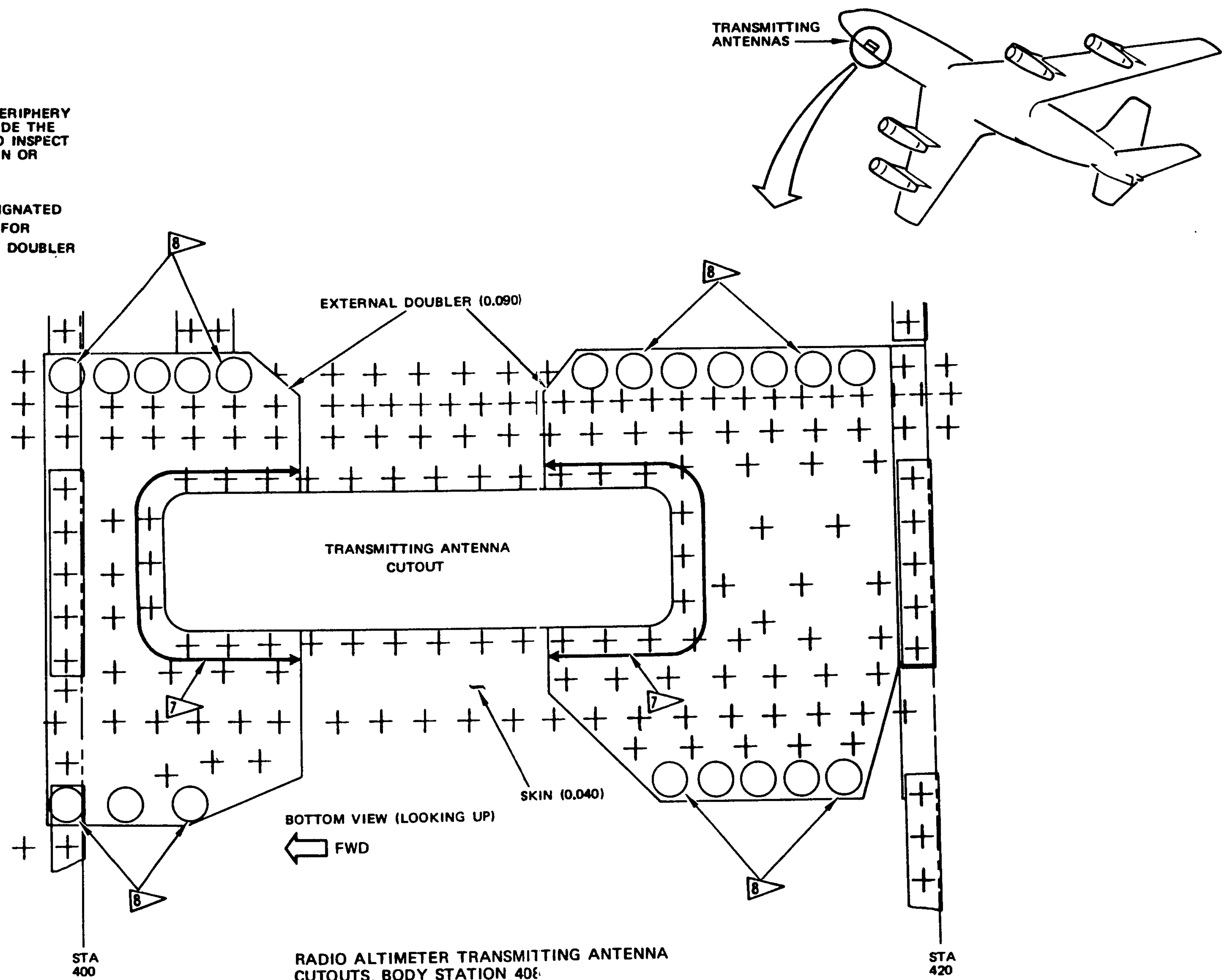
PROBE POSITION FOR
CALIBRATION REFERENCE
STANDARD A085
DETAIL II

Radio Altimeter Transmitting Antenna Cutouts at BS 408
Figure 5 (Sheet 6)

NOTES

7 SCAN SPOT PROBE AROUND PERIPHERY OF ANTENNA CUTOUTS OUTSIDE THE FIRST ROW OF FASTENERS TO INSPECT FOR POSSIBLE CRACKS IN SKIN OR DOUBLER

8 CENTER RING PROBE ON DESIGNATED FASTENERS, ○ TO INSPECT FOR POSSIBLE CRACKS IN SKIN OR DOUBLER



RADIO ALTIMETER TRANSMITTING ANTENNA CUTOUTS, BODY STATION 408
INTERIM REPAIR CONFIGURATION
(RIGHT SIDE SHOWN, LEFT SIDE SIMILAR)

DETAIL III

Radio Altimeter Transmitting Antenna Cutouts at BS 408
Figure 5 (Sheet 7)

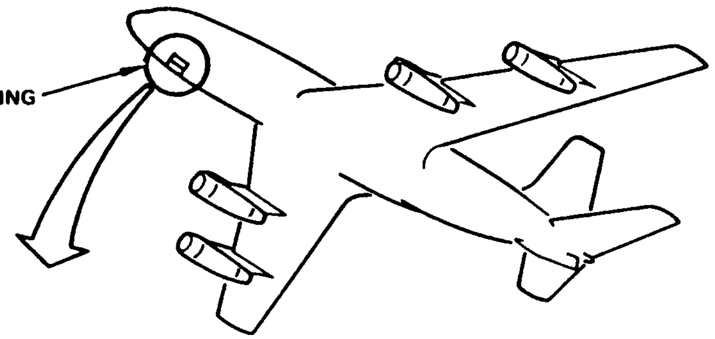
NOTES

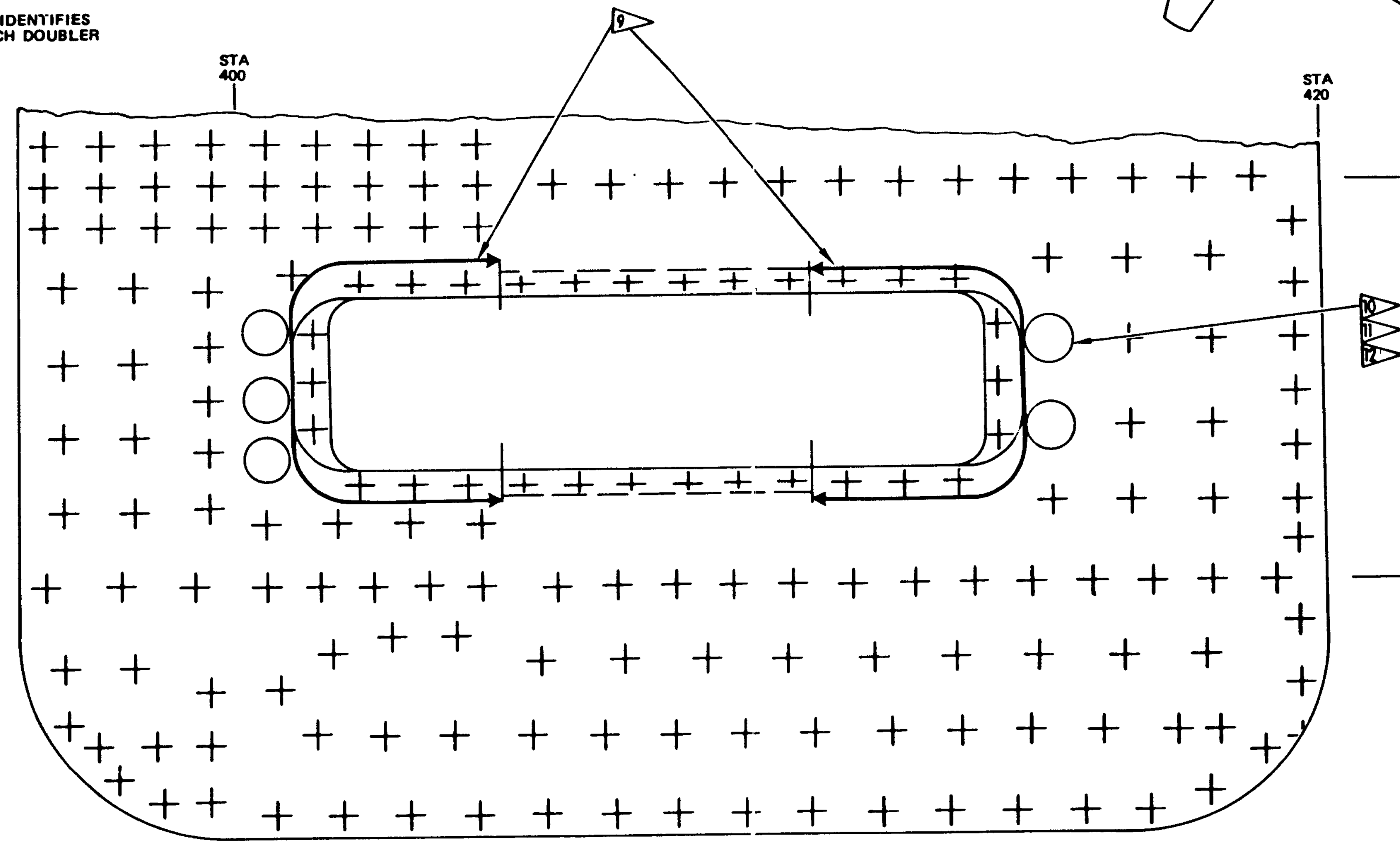
[9] SCAN SPOT PROBE AROUND PERIPHERY OF ANTENNA CUTOUTS OUTSIDE OF FIRST ROW OF FASTENERS TO INSPECT FOR POSSIBLE CRACKS IN SKIN OR DOUBLER

[10] CENTER RING PROBE ON DESIGNATED FASTENERS, ◯ TO INSPECT FOR POSSIBLE CRACKS IN SKIN OR DOUBLER

[11] SEE DETAIL I FOR REFERENCE STANDARD USED FOR CALIBRATION

[12] TWO FASTENER PATTERN IDENTIFIES AIRPLANES WITH 0.063 INCH DOUBLER





BOTTOM VIEW (LOOKING UP)

FWD

RADIO ALTIMETER TRANSMITTING ANTENNA CUTOUTS; BODY STATION 408
REINFORCING MODIFICATION CONFIGURATION
(RIGHT SIDE SHOWN, LEFT SIDE SIMILAR)

DETAIL IV

Radio Altimeter Transmitting Antenna Cutouts at BS 408
Figure 5 (Sheet 8)

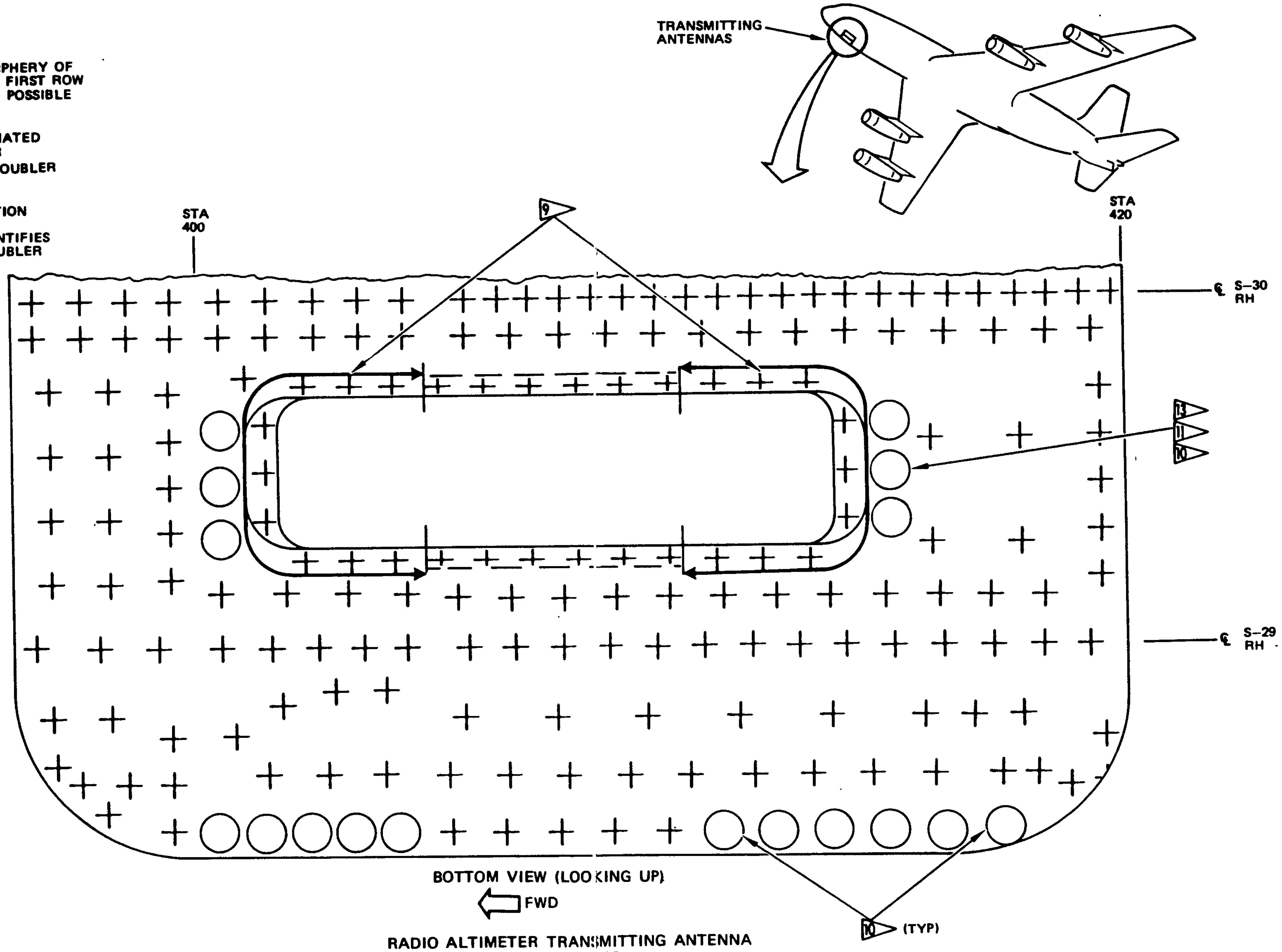
NOTES

9 SCAN SPOT PROBE AROUND PERIPHERY OF ANTENNA CUTOUTS OUTSIDE OF FIRST ROW OF FASTENERS TO INSPECT FOR POSSIBLE CRACKS IN SKIN OR DOUBLER

10 CENTER RING PROBE ON DESIGNATED FASTENERS, ◯ TO INSPECT FOR POSSIBLE CRACKS IN SKIN OR DOUBLER

11 SEE DETAIL I FOR REFERENCE STANDARD USED FOR CALIBRATION

13 THREE FASTENER PATTERN IDENTIFIES AIRPLANES WITH 0.080 INCH DOUBLER



BOTTOM VIEW (LOOKING UP)

RADIO ALTIMETER TRANSMITTING ANTENNA CUTOUTS BODY SECTION 408
REINFORCING MODIFICATION CONFIGURATION
(RIGHT SIDE SHOWN, LEFT SIDE SIMILAR)

DETAIL IV (CONTINUED)

Radio Altimeter Transmitting Antenna Cutouts at BS 408
Figure 5 (Sheet 9)

PART 6 - EDDY CURRENT

FUSELAGE - PLATES/SKINS

1. Purpose

   A. To perform a high frequency eddy current inspection to detect cracks in the fuselage skin at edge of antenna cutouts or skin at edge of external doublers, surrounding the Radio Altimeter Transmitting Antenna Cutouts at Body Station 408.

   B. Visual identification of inspection area is required due to four possible airplane configurations (Initial, Interim Repair, Reinforcing Modification and Permanent Repair). Airplane configuration designates the eddy current inspection required. See Details I, II, III and IV.

2. Equipment

   A. Instrument:

      (1) Any eddy current instrument that will satisfy the performance requirements of this procedure is suitable for this inspection. The following instrument was used during this development of this procedure.

         (a) ED520,Magnaflux Corporation

      (2) Probes

         (a) Shielded pencil probe Part 1, 51-06-00, Fig. 1. The following probes are acceptable.

            1) P/N P-50, NDT Product Engineering

2) P/N VM100PS, VM Products

(3) Refer to Part 6, 51-00-00, Fig. 4, to fabricate or procure the appropriate reference standards.

3. Preparation for Inspection

A. Inspection area is accessible from outside the airplane.

B. Identify the inspection area configuration and wipe surface clean. Refer to Detail I, II, III and IV to identify inspection area.

C. Smooth paint by sanding lightly or remove paint if rough.

NOTE: Chipped paint causes an irregular eddy current response which interferes with the inspection.

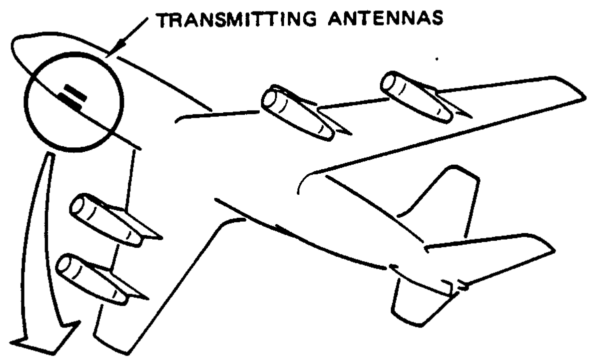
4. Instrument Calibration

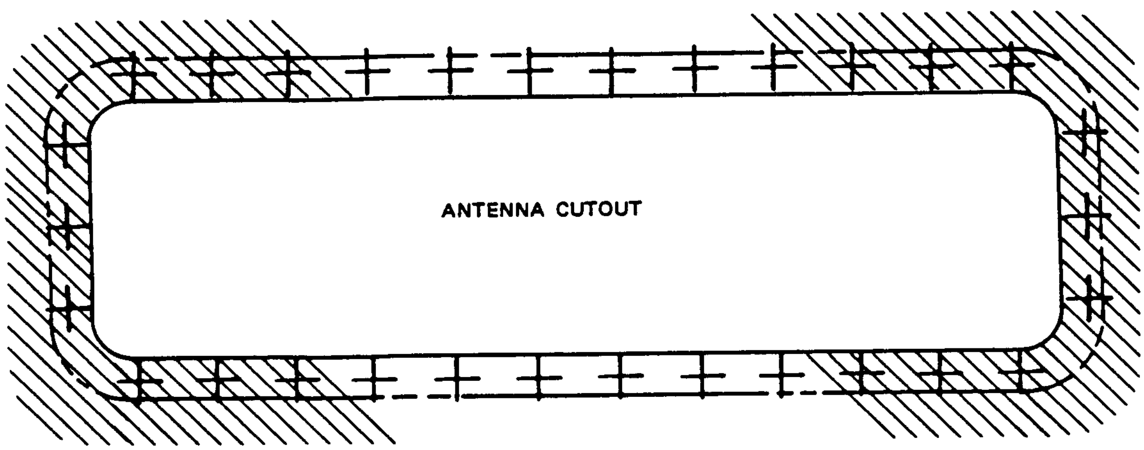
A. Visually identify airplane configuration by comparison with Detail I, II, III and IV.

B. Identify inspection requirements from appropriate detail.

C. Inspect per appropriate Detail and Part 6, 51-00-00, Fig. 4.

Radio Altimeter Transmitting Antenna Cutouts at BS 408
Figure 6 (Sheet 2)





BOTTOM VIEW - LOOKING UP

NOTES

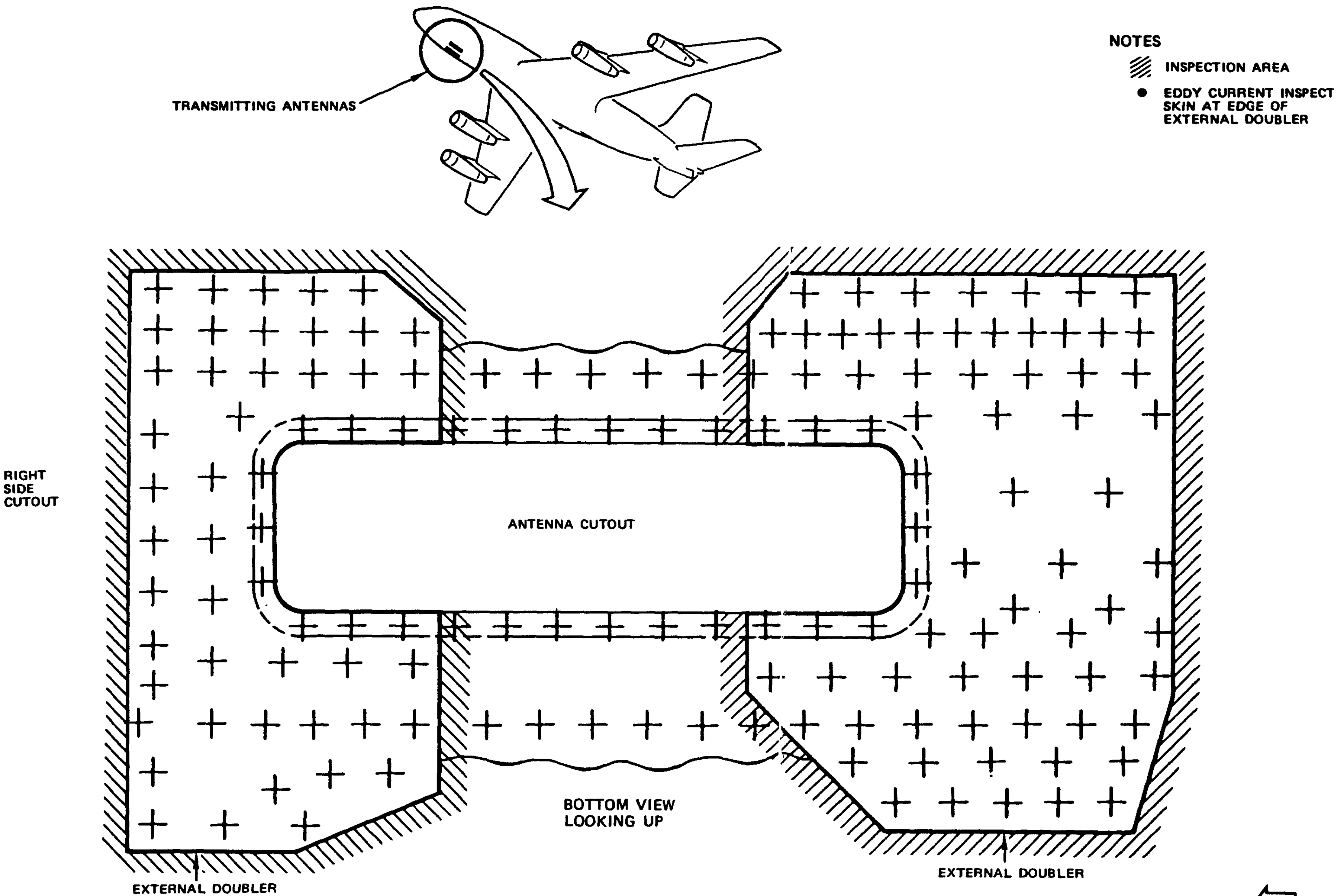
\\\\\\ INSPECTION AREA

FWD ⇦

- EDDY CURRENT INSPECT SKIN AROUND PERIPHERY OF ANTENNA CUTOUTS AND AROUND THE END OF FASTENERS IN THE INSPECTION AREA
- RIGHT SIDE SHOWN LEFT SIDE SIMILAR

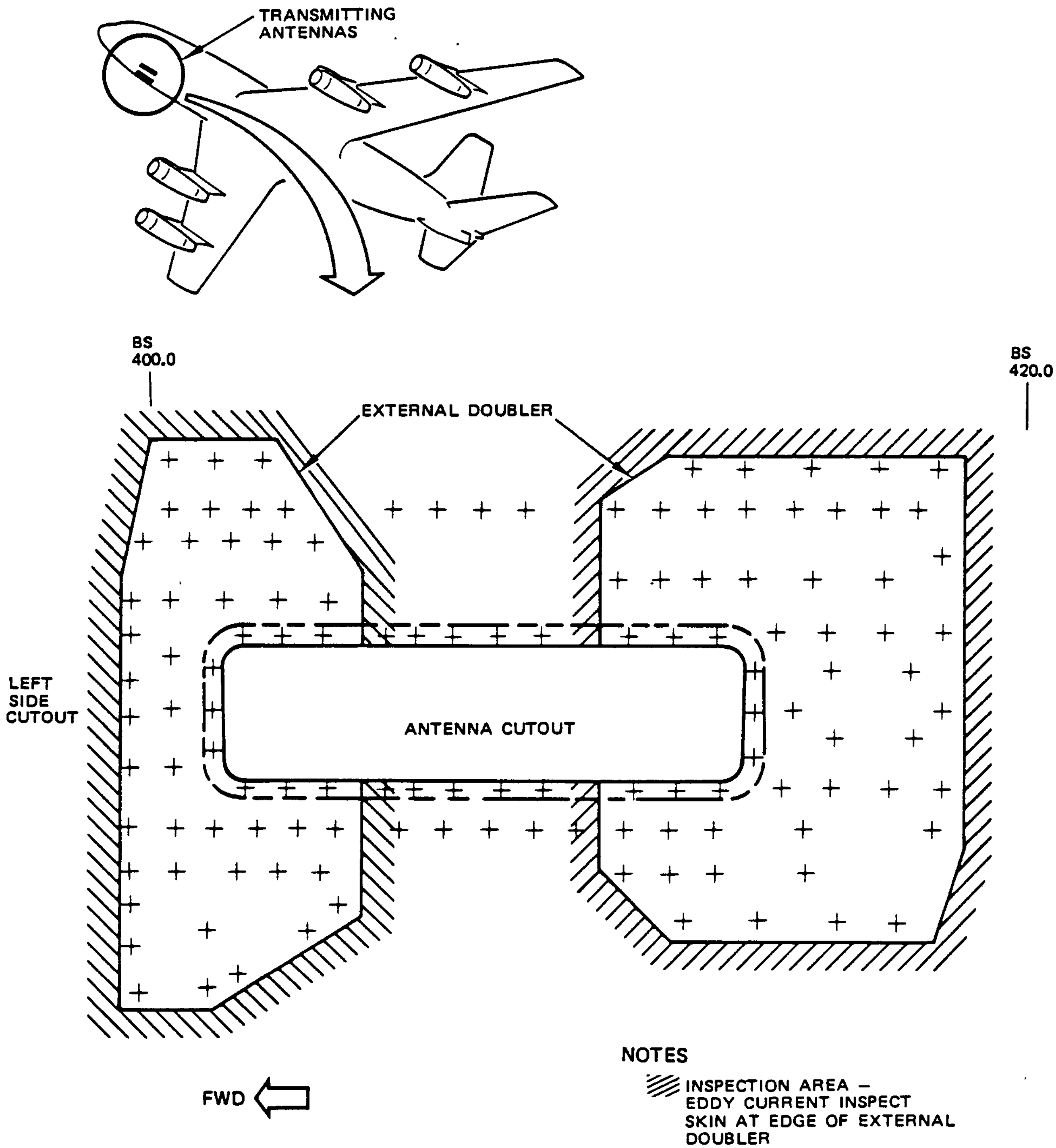
RADIO ALTIMETER TRANSMITTING ANTENNA CUTOUTS
(INITIAL CONFIGURATION)
BODY STATION 408
DETAIL I

Radio Altimeter Transmitting Antenna Cutouts at BS 408
Figure 6 (Sheet 3)



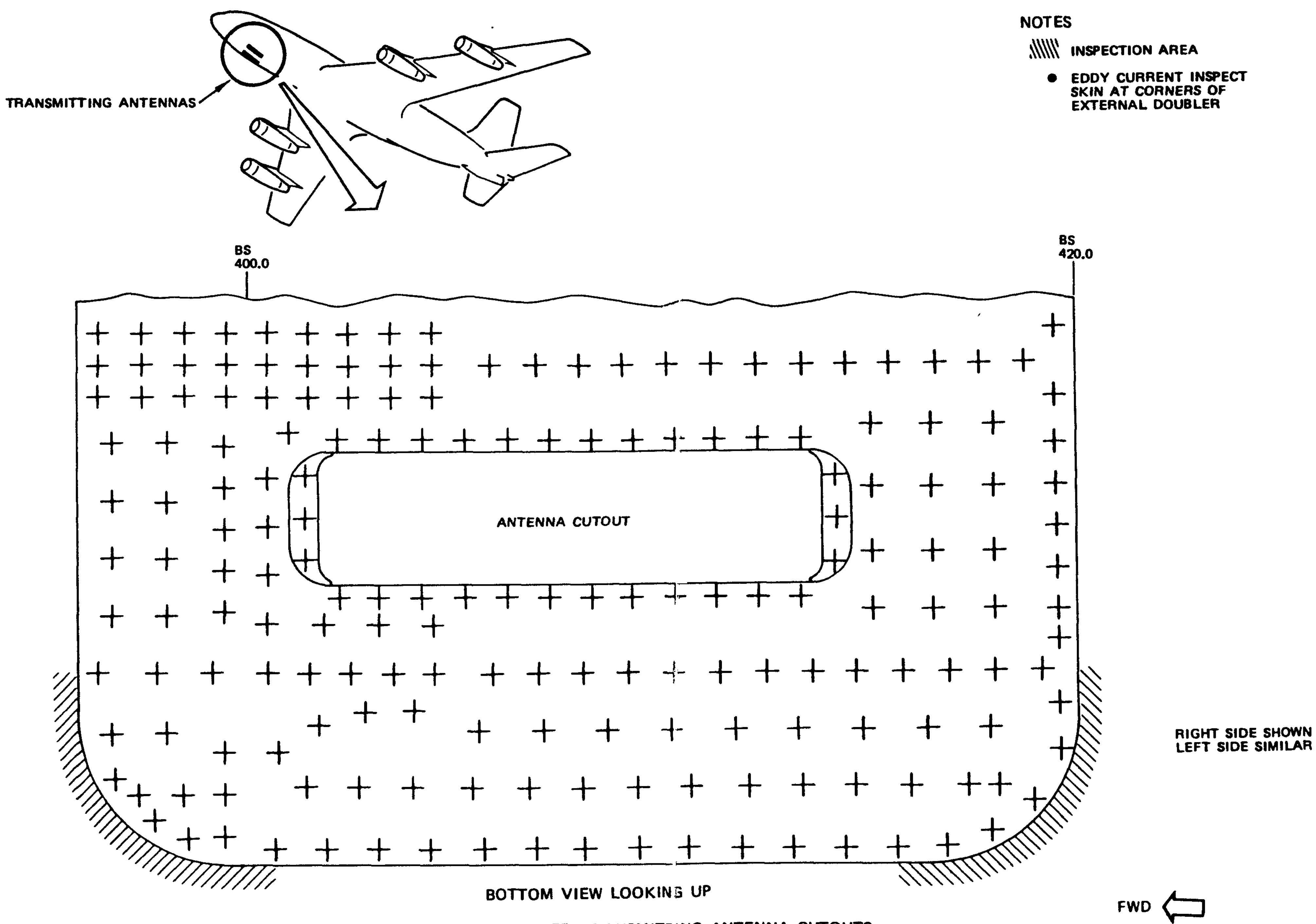
RADIO ALTIMETER TRANSMITTING ANTENNA CUTOUTS (INTERIM REPAIR CONFIGURATION)
BODY STATION 408
DETAIL II

Radio Altimeter Transmitting Antenna Cutouts at BS 408
Figure 6 (Sheet 4)



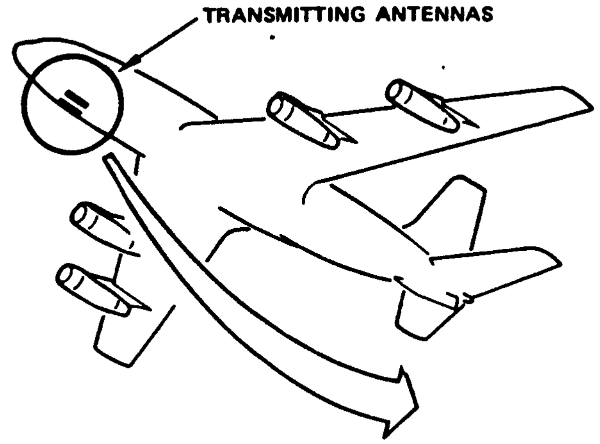
BOTTOM VIEW LOOKING UP
RADIO ALTIMETER TRANSMITTING
ANTENNA CUTOUTS
(INTERIM REPAIR CONFIGURATION)
BODY STATION 408
DETAIL II (CONT)

Radio Altimeter Transmitting Antenna Cutouts at BS 408
Figure 6 (Sheet 5)



RADIO ALTIMETER TRANSMITTING ANTENNA CUTOUTS
(REINFORCING MODIFICATION CONFIGURATION)
BODY STATION 408
DETAIL III

Radio Altimeter Transmitting Antenna Cutouts at BS 408
Figure 6 (Sheet 6)

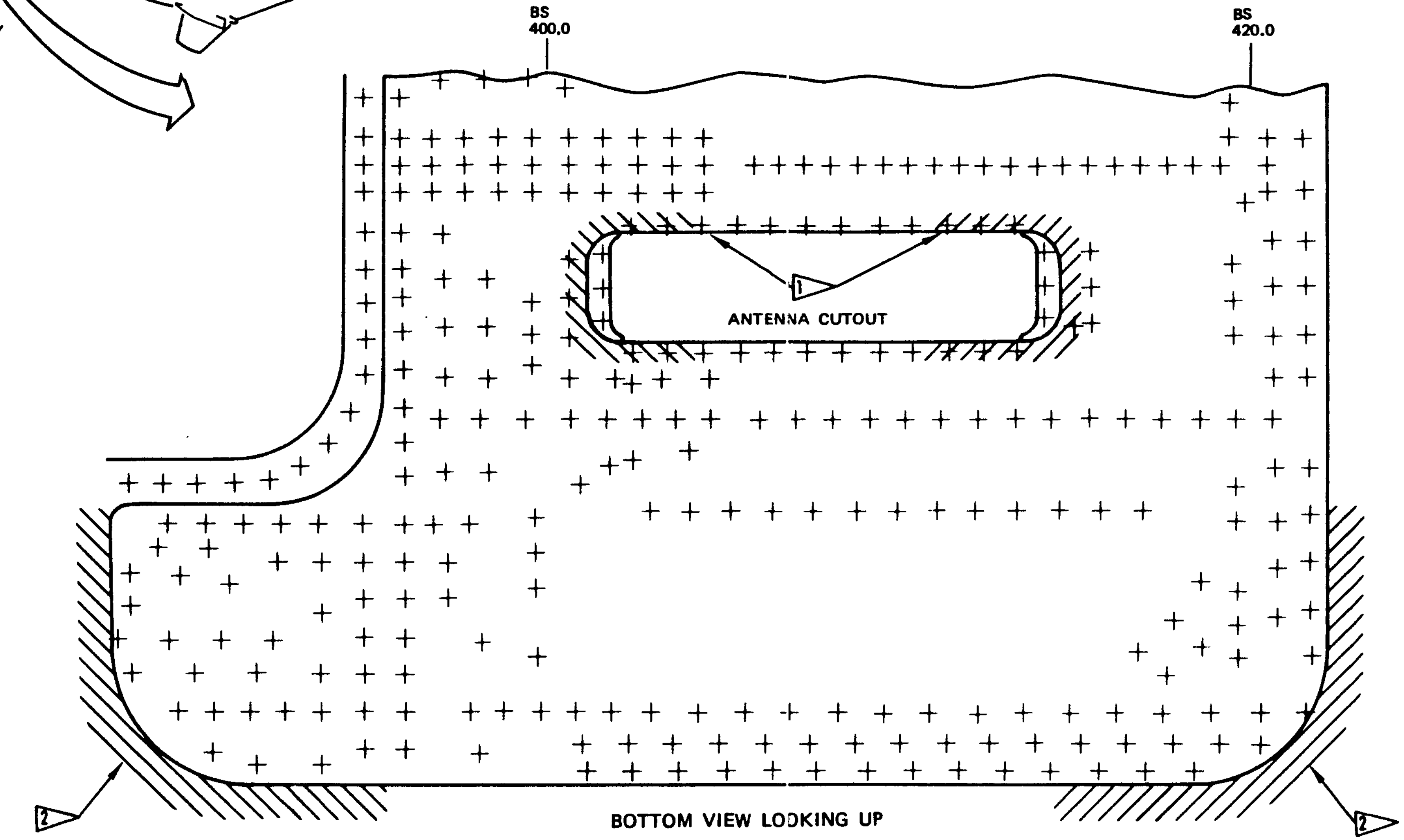


NOTES

INSPECTION AREA

1 EDDY CURRENT INSPECT SKIN AROUND PERIPHERY OF ANTENNA CUTOUTS AND AROUND THE END OF FASTENERS IN THE INSPECTION AREA

2 EDDY CURRENT INSPECT AROUND CORNERS OF MACHINE SKIN (4 PLACES)



RIGHT SIDE SHOWN LEFT SIDE SIMILAR

RADIO ALTIMETER TRANSMITTING ANTENNA CUTOUTS (PERMANENT REPAIR CONFIGURATION)
BODY STATION 408

DETAIL IV

FWD

Radio Altimeter Transmitting Antenna Cutouts at BS 408
Figure 6 (Sheet 7)

PART 6 - EDDY CURRENT

FUSELAGE - PLATES/SKIN

1. Purpose

A. To detect cracks in the critical row of fasteners (the upper row) of longitudinal skin lap joints using high frequency eddy current, without removal of fasteners.

B. The cracks characteristically originate on the inner surface of the outer skin at the edge of the countersink and propagate outward along the faying surface. See DETAIL VIII for an illustration of a typical crack. This inspection is capable of detecting cracks 0.050 inch (0.127 cm) or longer beneath the countersunk fastener heads in skin materials of 0.063 inch (0.160 cm) thick or less.

NOTE: A comparable procedure for use with fasteners removed is described in Part 6, 53-30-00, Fig. 1.

2. Equipment

NOTE: Refer to Part 1, 51-06-00 for information on equipment manufacturers.

A. Any eddy current instrument capable of operating at 100 kHz and satisfying the performance requirements of this procedure is suitable. The following equipment was used during the development of this procedure.

(1) Magnatest ED-520, Magnaflux Corp.

(2) MIZ-10A, MIZ-10B, Zetec Inc.

B. Probe - Use one of the following or similar probe:

(1) Absolute spring-loaded surface probe, 0.375-inch (0.952 cm) diameter case. P.N SS37-25, NDT Product Engineering.

NOTE: Twin coil differential probe requires the use of an instrument with differential capability. This probe reduces noise or spurious meter needle movement while maintaining sensitivity and requires less critical alignment over fasteners.

Countersink Inspection in Longitudinal Lap Joints - Without Fastener Removal
Figure 7 (Sheet 1)

C. Probe Holder - Manufacture per DETAIL II.

D. Probe Holder guide - Manufacture per DETAIL III.

E. Optical Center - Manufacture per DETAIL IV.

F. Reference Standard - Manufacture per DETAIL I.

3. Preparation for Inspection

A. Ensure inspection area is clean.

NOTE: It may be necessary to remove paint from around fasteners to ensure accurate visual centering of probe holder guide.

4. Instrument Calibration

A. Absolute Probe with Magnaflux ED-520.

(1) Perform initial calibration per Part 6, 51-00-00, Fig. 4.

(2) Insert optical center into probe holder guide.

(3) Moisten probe holder guide suction cups.

(4) Place probe holder guide with optical center on reference standard and center over fastener without a simulated defect. Ensure that suction cups on probe holder guide are secured to reference standard.

(5) Remove optical center from probe holder guide and replace with probe and probe holder.

(6) Adjust probe in holder to contact reference standard.

(7) Adjust balance control to bring meter needle on scale.

(8) Rotate probe holder 360 degrees. Ensure meter needle movement does not exceed 10 percent of full scale.

(9) Remove probe and probe holder from guide and center guide over fastener with sawcut per steps A.(2) thru A.(5).

(10) Rotate probe holder over sawcut and adjust instrument sensitivity to obtain a 40 percent of full scale meter deflection.

(11) Final adjust by slightly readjusting balance and liftoff control such that sawcut and a small amount of liftoff give opposite deflections of the needle.

Countersink Inspection in Longitudinal Lap Joints -
Without Fastener Removal
Figure 7 (Sheet 2)

B. Twin Coil Differential Probe with MIZ-10A or MIZ-10B.

(1) Connect probe to instrument and set frequency to 100 kHz.

(2) Ensure gain control has one complete turn on pot.

(3) With probe removed from holder, balance probe on reference standard 126 (PT. 6, 51-00-00, Fig. 4).

(4) Align probe coils as shown in DETAIL V to adjust phase.

(a) MIZ-10A - with probe tilted so that one coil has greater lift-off than the other, press automatic phase button to set phase.

(b) MIZ-10-B - repeatedly tilt the probe to surface to obtain greater lift-off from one coil over the other, while adjusting the manual phase control to obtain a minimum meter movement.

(5) Place probe flat on standard with coils aligned at 90° to simulated crack and adjust meter needle to mid scale.

(6) Slide probe over defect and set gain control to obtain a 20 percent response from simulated defect.

NOTE: As each coil crosses defect they will give opposite meter responses, so that a 20 percent upscale and a 20 percent downscale notch response is obtained.

(7) Set up on reference standard per steps A.(2) thru A.(5).

(8) Align the twin coils in plane shown in DETAIL VII.

(9) Adjust probe position to obtain approximately 0.010 inch (0.025 cm) clearance from reference standard. See DETAIL VI.

(10) Balance instrument and position meter needle to midscale.

(11) Rotate probe holder 360 degrees. Ensure meter response does not exceed 10 percent of full scale.

(12) Remove probe and probe holder from guide and center guide over fastener with sawcut per steps A.(2) thru A.(5).

(13) Rotate probe holder 360 degrees and note meter response. Adjust sensitivity to obtain a 40 percent of full scale positive or negative meter response from sawcut.

NOTE: The positive and negative response of the coils can vary slightly depending on how well they are matched to each other.

Countersink Inspection in Longitudinal Lap Joints -
Without Fastener Removal
Figure 7 (Sheet 3)

5. Inspection Procedure

A. Moisten probe holder guide suction cups.

B. Select fastener to be inspected. With optical center in probe guide, align circle in optical center with rivet head. Then press probe holder guide to attach guide to fuselage lap joint by means of the suction cups. See DETAIL VIII.

NOTE: Accurate alignment of the probe holder guide over fastener head is essential. Remove paint if circumference of rivet head is obscured.

C. Remove optical center from probe holder guide and insert probe holder into probe holder guide. If necessary, adjust meter needle to midscale by using balance control only.

NOTE: If using twin coil differential probe, align twin coil tips as shown in DETAIL VII.

D. Rotate probe holder through 360 degrees. Note meter needle deflection for crack indication.

E. Periodically recheck instrument response on reference standard.

F. repeat steps A. thru D. for each inspection fastener.

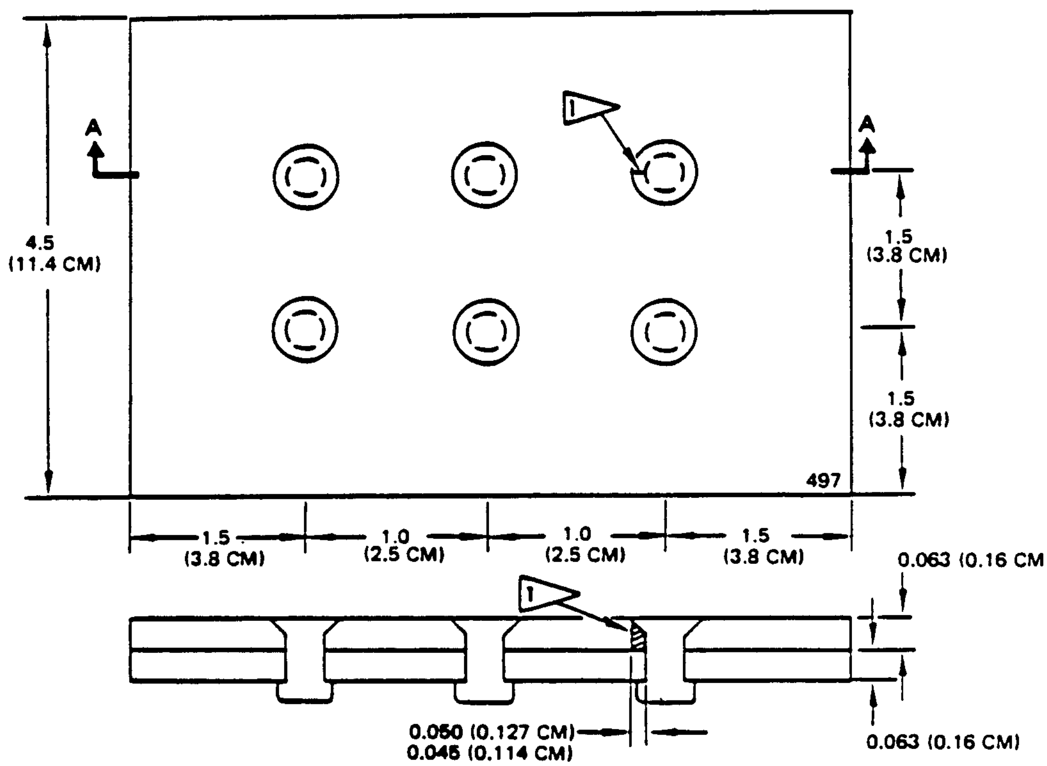
6. Inspection Results

A. Any location producing a 40 percent of full scale minimum meter response from the established baseline is a potential crack location requiring further investigation.

NOTE: Because of the small amount of probe movement during each scan, the meter response is slower than usually identified with detection f surface cracks.

Spurious indications could be encountered if the probe holder guide is not centered over fastener head.

Countersink Inspection in Longitudinal Lap Joints -
Without Fastener Removal
Figure 7 (Sheet 4)



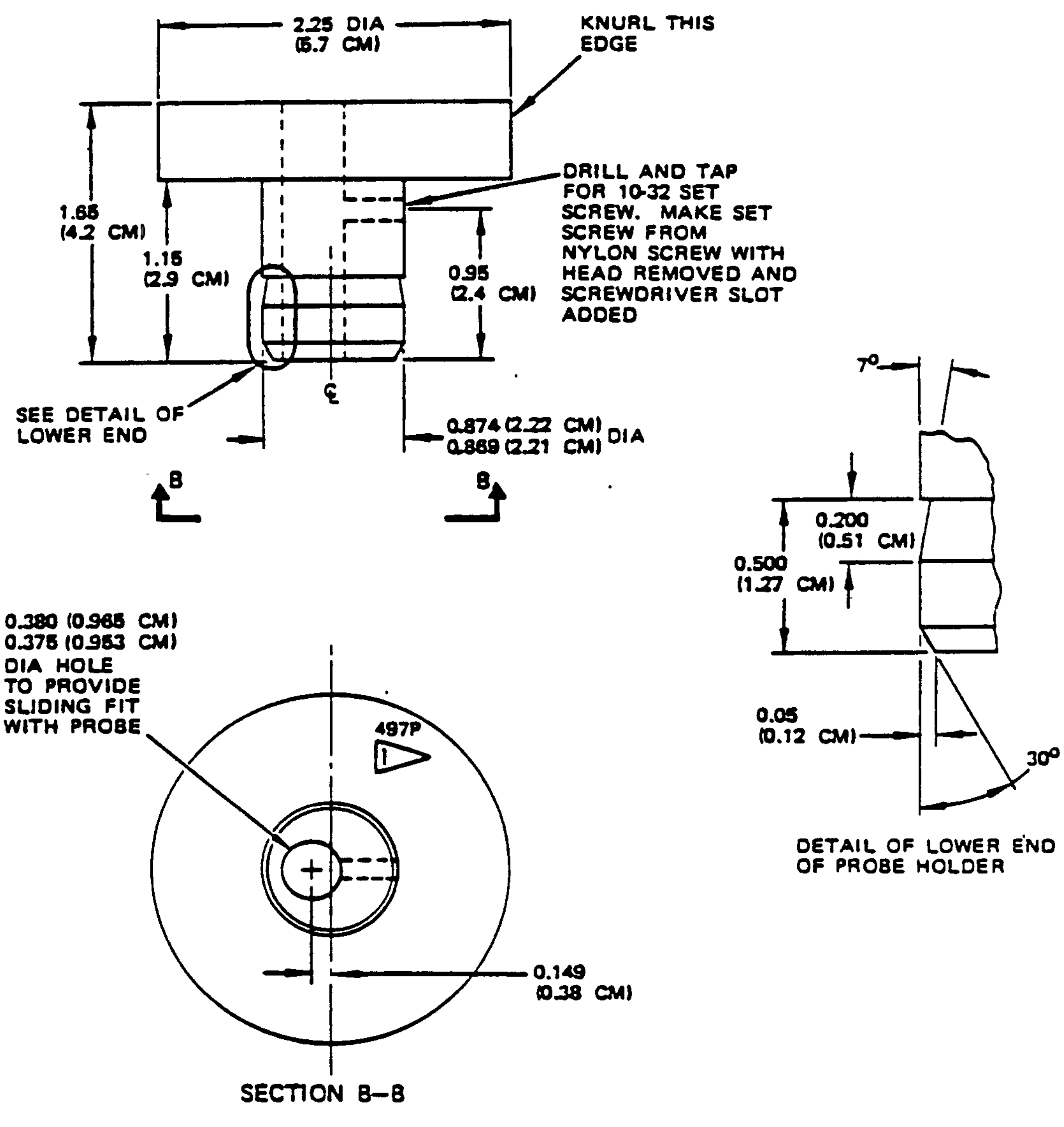
SECTION A–A

NOTES
- ALL DIMENSIONS ARE IN INCHES (CENTIMETERS IN PARENTHESES)
- TOLERANCE: X.X ± 0.05 (0.13 CM), X. XXX ± 0.005 (0.013 CM)
- MATERIAL: 2024–T3 OR T4 ALUMINUM
- FASTENERS: BACR15CE6D ( ) RIVETS (6 PLACES)
- ETCH OR STEEL STAMP WITH 497

[1] JEWELER'S SAWCUT 0.030 (0.080 CM) MAX WIDTH

REFERENCE STANDARD
DETAIL I

Countersink Inspection in Longitudinal Lap Joints-
Without Fastener Removal
Figure 7 (Sheet 5)



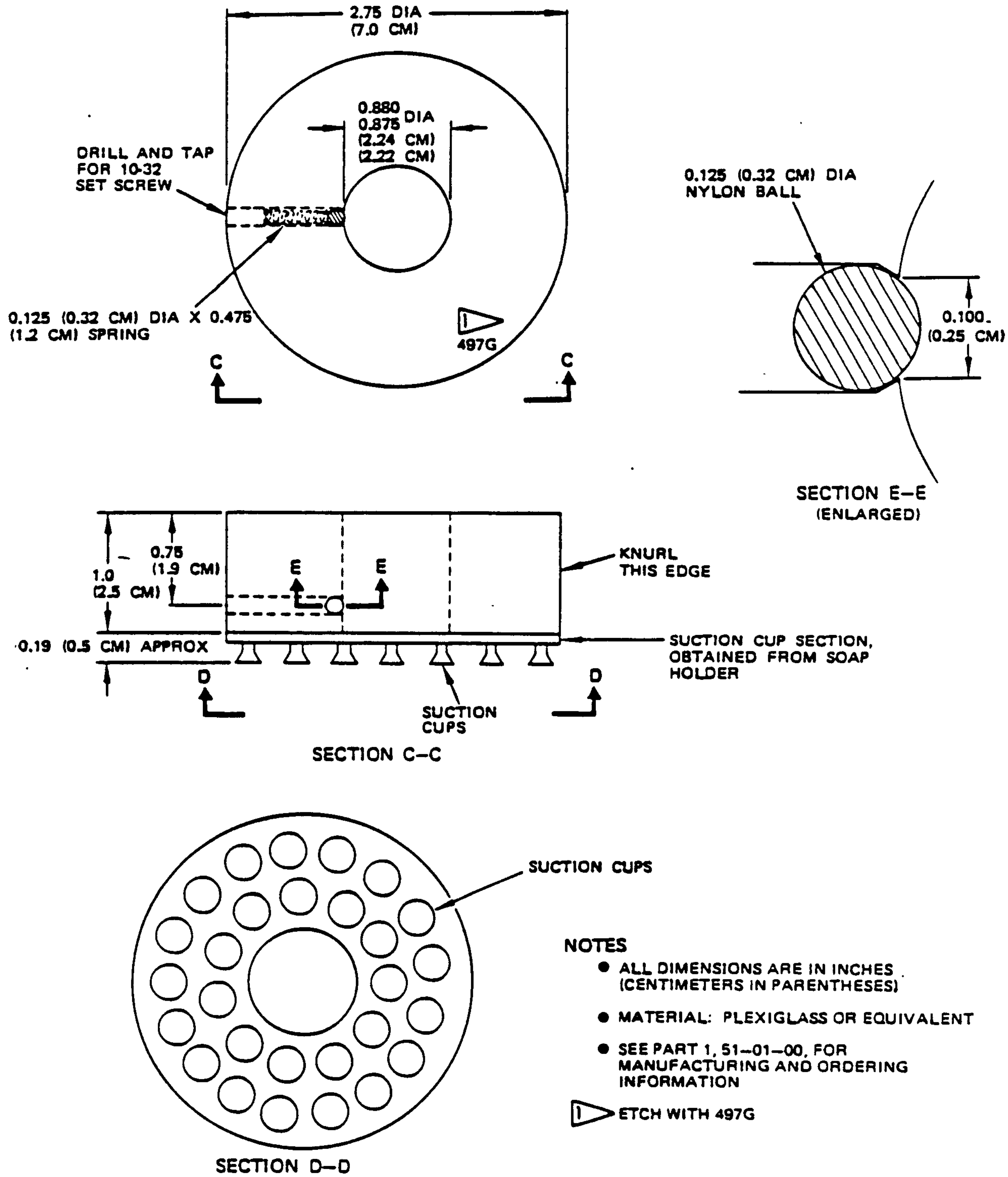
NOTES

- ALL DIMENSIONS ARE IN INCHES (CENTIMETERS IN PARENTHESES)
- MATERIAL: PLEXIGLASS OR EQUIVALENT
- SEE PART 1, 51-01-00, FOR MANUFACTURING AND ORDERING INFORMATION

[1] ETCH WITH 497P

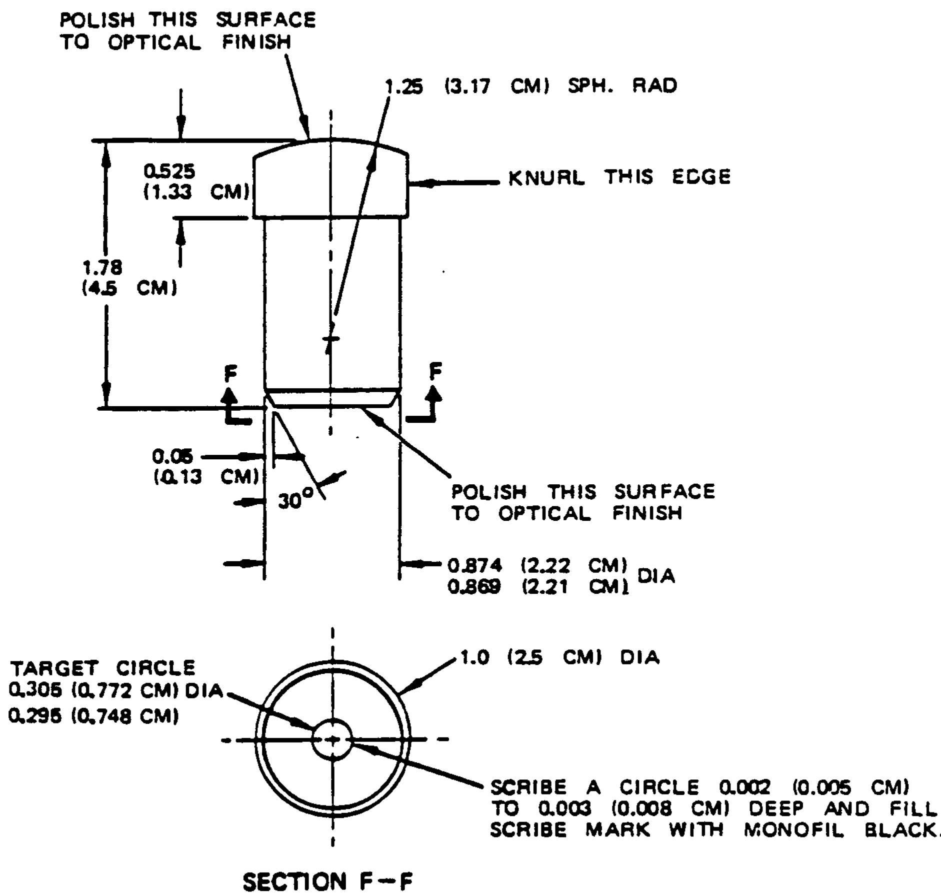
PROBE HOLDER
DETAIL II

Countersink Inspection in Longitudinal Lap Joints-
Without Fastener Removal
Figure 7 (Sheet 6)



PROBE HOLDER GUIDE
DETAIL III

Countersink Inspection in Longitudinal Lap Joints-
Without Fastener Removal
Figure 7 (Sheet 7)

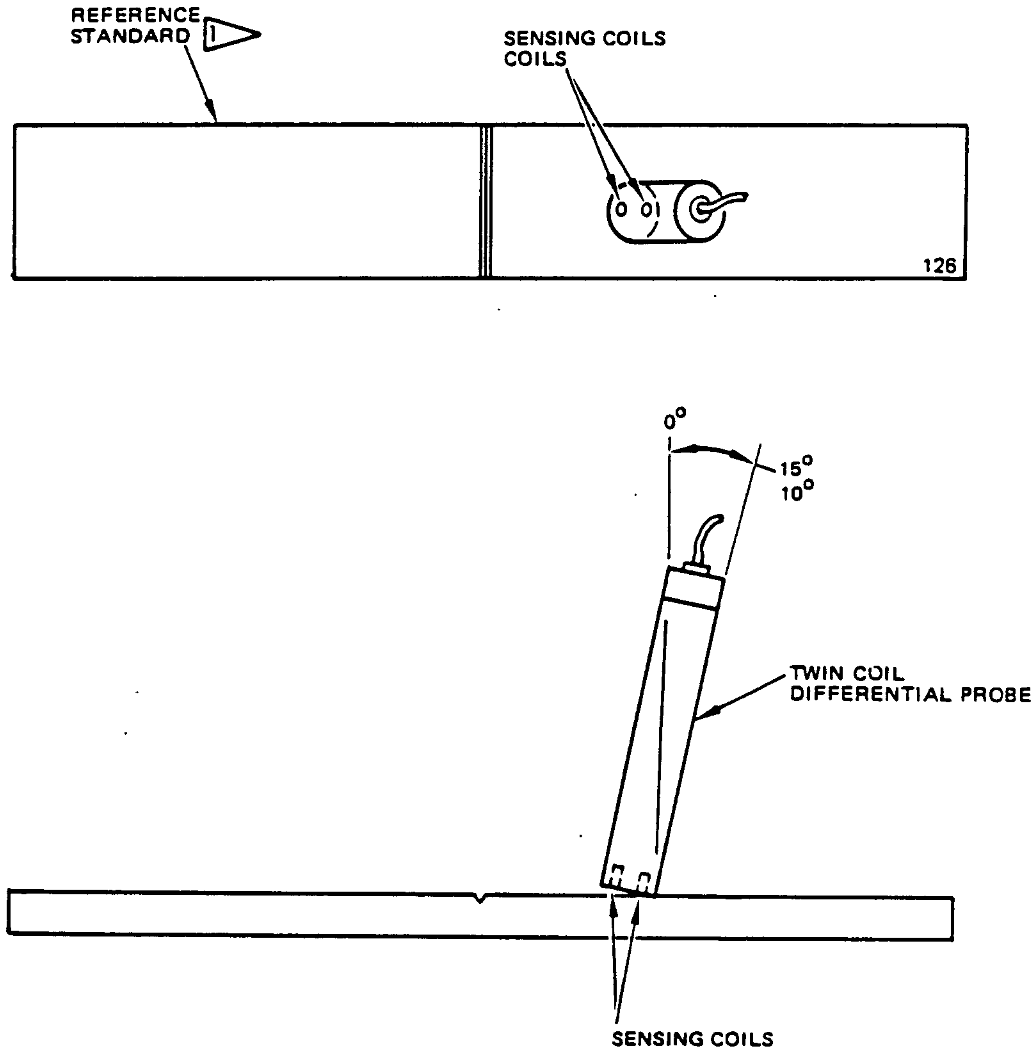


NOTES

- ALL DIMENSIONS ARE IN INCHES (CENTIMETERS IN PARENTHESES) EXCEPT AS NOTED
- MATERIAL: PLEXIGLASS OR EQUIVALENT
- BOEING P/N 497C
- SEE PART 1, 51-01-00, FOR MANUFACTURING AND ORDERING INFORMATION

OPTICAL CENTER
DETAIL IV

Countersink Inspection in Longitudinal Lap Joints-
Without Fastener Removal
Figure 7 (Sheet 8)



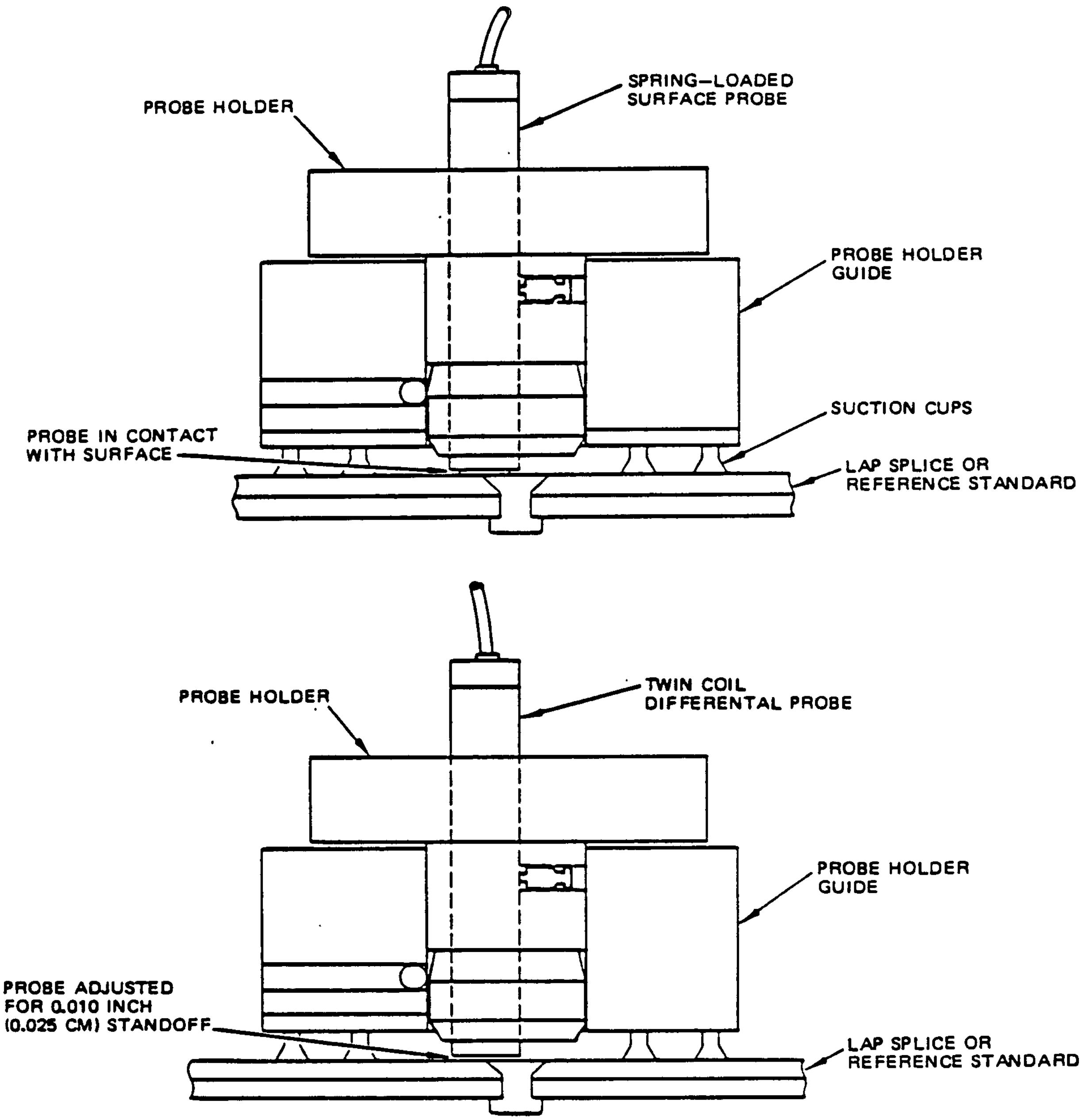
NOTES

- ALIGN SENSING COILS AT 90° TO SIMULATED CRACK

[1] REFERENCE STANDARD 126 (PT.6, 51—00—00, FIG. 4)

ALIGNMENT OF TWIN COIL PROBE FOR PHASE ADJUSTMENT
DETAIL V

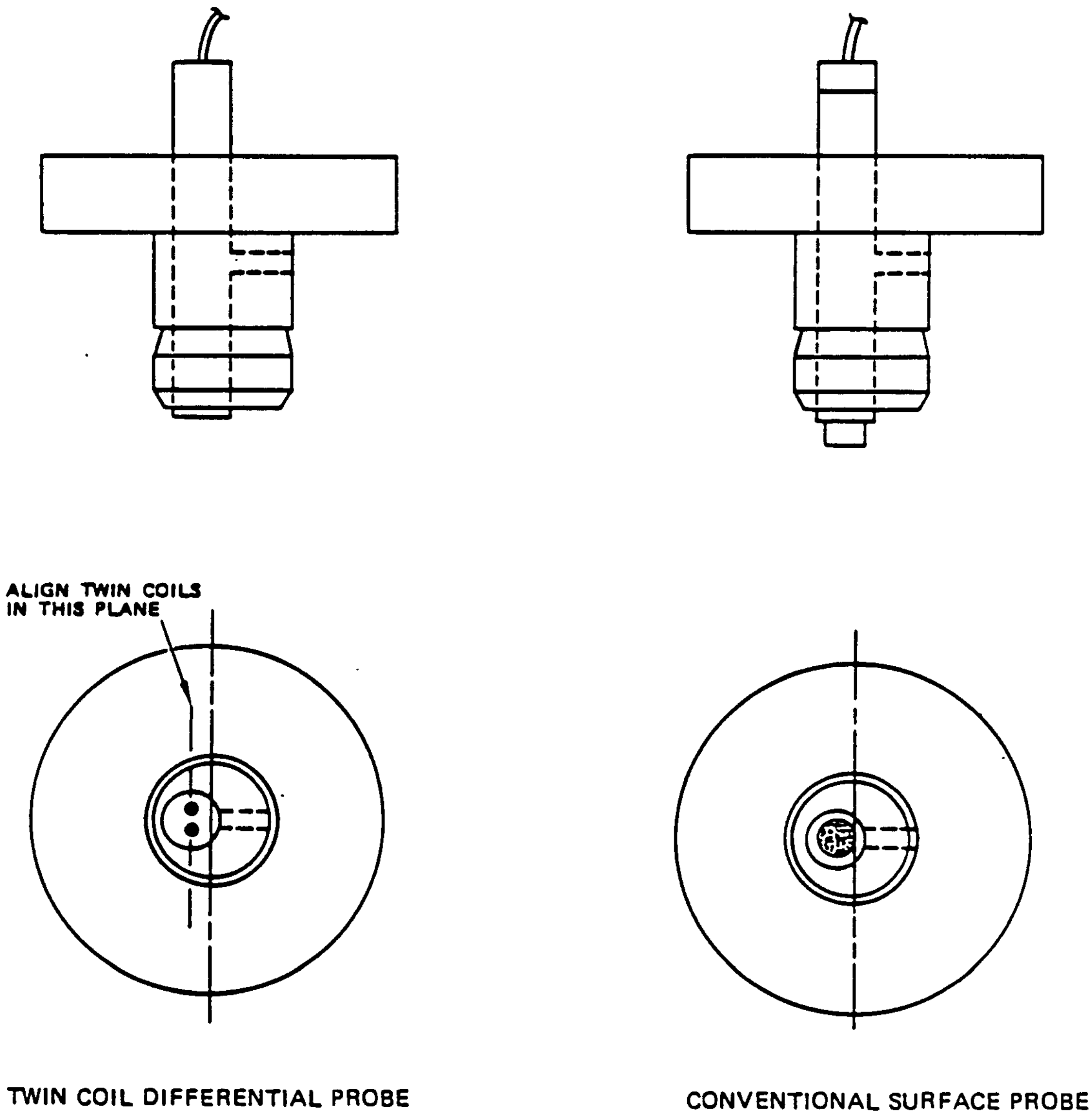
Countersink Inspection in Longitudinal Lap Joints-
Without Fastener Removal
Figure 7 (Sheet 9)



PROBE, HOLDER, AND GUIDE ASSEMBLED FOR CALIBRATION AND INSPECTION

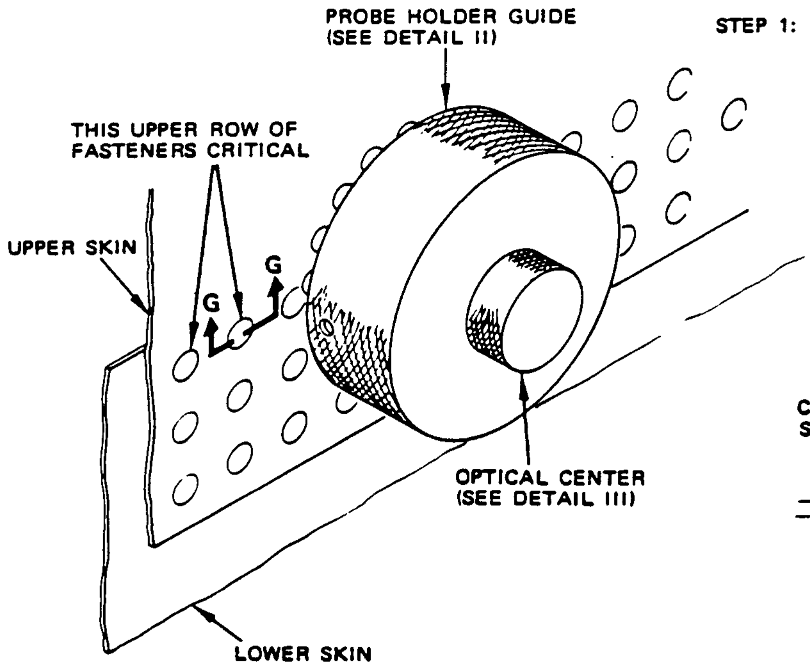
DETAIL VI

Countersink Inspection in Longitudinal Lap Joints-
Without Fastener Removal
Figure 7 (Sheet 10)

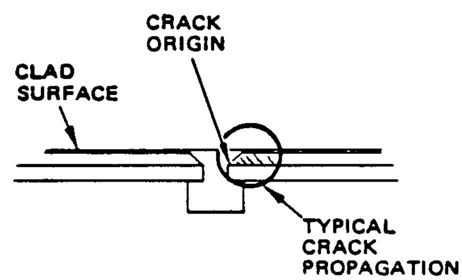


ALTERNATIVE PROBES
DETAIL VII

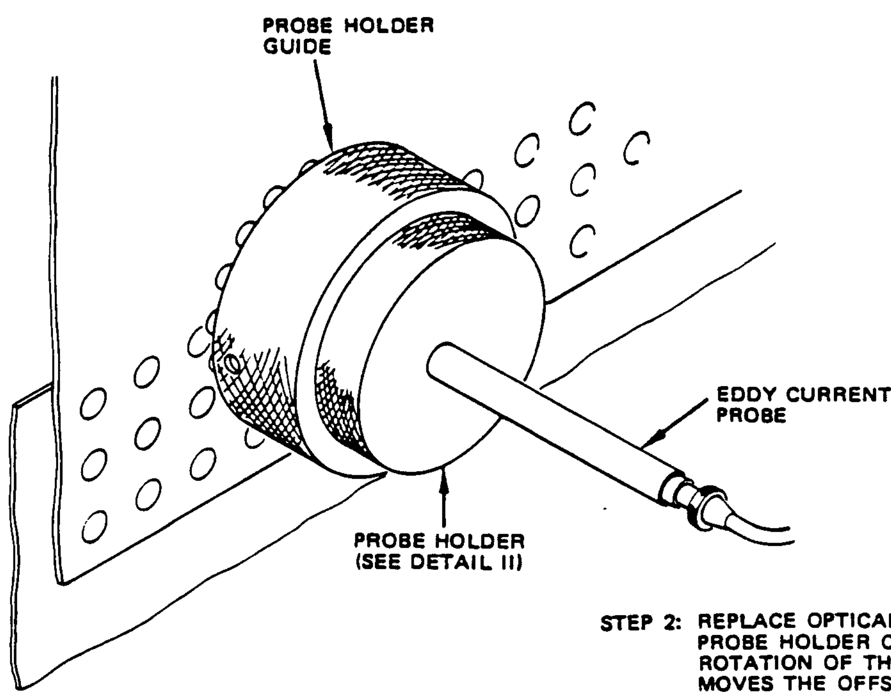
Countersink Inspection in Longitudinal Lap Joints-
Without Fastener Removal
Figure 7 (Sheet 11)



STEP 1: LOCATE PROBE HOLDER GUIDE EXACTLY OVER FASTENER TO BE INSPECTED USING THE OPTICAL CENTER. PRESS GUIDE TO ATTACH TO SKIN WITH SUCTION CUPS.



SECTION G–G



STEP 2: REPLACE OPTICAL CENTER WITH PROBE HOLDER CONTAINING PROBE. ROTATION OF THE PROBE HOLDER MOVES THE OFFSET PROBE AROUND THE PERIPHERY OF THE FASTENER. PROCEED WITH INSPECTION.

TYPICAL CRACK DETECTION
DETAIL VIII

Countersink Inspection in Longitudinal Lap Joints-
Without Fastener Removal
Figure 7 (Sheet 12)

ROTATING SURFACE PROBE METHOD FOR THE INSPECTION OF THE FUSELAGE - SKIN

1. Purpose

   A. To find cracks at the fuselage-fastener-countersink locations, without fastener removal using a rotating probe, eddy current method with screen display.

   B. These cracks usually start from the inner surface of the outer skin at the edge of the countersink. These cracks become larger out along the faying surface. This inspection can find cracks 0.10 inch (0.25 cm) or longer from under the fastener head.

   C. This procedure can be used for 5/32, 3/16 or 7/32 inch diameter countersink fasteners.

2. Equipment

   A. Instrument - A rotating-probe eddy-current instrument with a screen display is necessary to satisfy this inspection condition. The following instruments were used to develop this inspection:

      (1) Forster Defectoscop 2.831 or SD 2.832

      (2) Hocking AV100 SE

      (3) Staveley RECHII MK 1 or NDT19

      (4) Zetec MIZ-20

      (5) Elotest B1

      NOTE: Other instruments can be available and can be used if they satisfy the conditions of this procedure.

   B. Probe - The following probes will be satisfactory for conditions of this procedure.

   Probes available at NDT Engineering Corp:
   Forster Defectoscop - ROD.325
   Hocking AV100 SE - ROH.325
   Zetec MIZ-20 - ROZ.325
   Elotest B1 - ROE.325 for standard rotor
   - ROM.325 for mini rotor

   Probes available at Staveley:
   RECHII and NDT19 - SPO 2906 for 3/16 inch dia.
   - SPO 4243 for 7/32 inch dia.

   NOTE: These probes are not interchangeable between instruments.

Longitudinal Lap Joints
Figure 8 (Sheet 1)

C. Reference Standard - Manufacture reference standard 4066, as per Detail I.

D. Probe guide - Available at NDT Engineering:
No. ROG for all NDT Eng. probes

Available at Staveley:
No. SPO 2906 - 861392 supplied with SPO 2906 probe

NOTE: A probe guide is necessary to accurately align the probe with the fastener and to make sure that the probe contact surface is parallel to the skin.

3. Preparation for Inspection

A. Identify the inspection area (see Service Bulletin) and make sure that the fastener locations are free from dirt, grease, loose flakes of paint or corrosion.

B. Make sure that the fastener heads are seen clearly. If too much paint keeps the fastener heads from view, remove the paint.

NOTE: It is very important that the fastener head be clearly seen for accurate alignment of the probe over fastener head.

4. Instrument Calibration

A. Do the manufacturers start up procedures.

B. Attach the probe to the instrument.

C. Set the frequency to 300 kHz to 500 kHz on instruments with selectable frequency.

NOTE: Try different frequencies to find the optimum for your equipment.

D. Set the baseline to the center of the scope screen.

E. Turn on the HP (high pass) and the LP (low pass) filters if available. Use the maximum filtration related to the gain to reduce the noise level.

NOTE: If the inspection is to be done with the inspection area painted, put a cover over the reference standard with a single layer of 0.006 inch (0.015 cm) Teflon, 3M Electrical tape or something almost the same as tape to represent the paint. It also helps to put a layer of Teflon tape over the probe contact area to decrease the probe wear. This should be done before calibration.

Longitudinal Lap Joints
Figure 8 (Sheet 2)

F. Carefully align the probe guide over the fastener at the probe guide position 1 (Detail II).

NOTE: Use row A for 5/32 inch fasteners, row B for 3/16 inch fasteners, and row C for 7/32 inch fasteners.

G. Start the probe rotation unit and put it into the guide. Make sure that the unit is in contact with the fastener head (Detail II).

H. Look at the signal from the fastener and adjust the instrument to get a screen presentation as shown in Detail III, presentation 3.

NOTE: If a signal comes into view as shown in presentation 2, the probe is incorrectly aligned and must be positioned again. It is recommended that you deliberately not align the probe properly over the fastener to monitor the signal.

I. Position the probe guide over the fastener as shown in Detail II, probe position 2.

J. Put the rotating probe unit into the guide and monitor the signal gotten.

K. Adjust the instrument controls to get a signal response as shown in Detail III, presentation 1.

L. Move probe guide to a different fastener location on the reference standard and monitor the signal. Make sure that the signal is almost the same as Detail III, presentation 3.

M. Align the equipment over the fastener with the EDM defect and adjust the gain, filters and X-Y axis ratio to get a signal almost the same as the signal in Detail III, presentation 1.

NOTE: Practice the alignment over the fasteners because it is important to accurately put the probe over the fasteners head.

5. Inspection Procedure

A. Do the calibration as described in par. 4, make sure that the calibration is done on the row of fasteners that are the same size diameter as the fasteners that are to be inspected.

B. Identify the inspection location as shown in the service bulletin.

C. Make sure that the fastener heads are seen clearly. Put the probe guide accurately over the fastener head.

D. Put the rotating unit prove into the guide and monitor the scope signal.

E. Monitor the screen and record all signals which are almost the same as the signal you get from the reference standard defect signal. See Detail III presentation 1.

6. Inspection Results

A. All signals almost the same as that shown in Detail III, presentation 1 are possible crack indications and should be examined further.

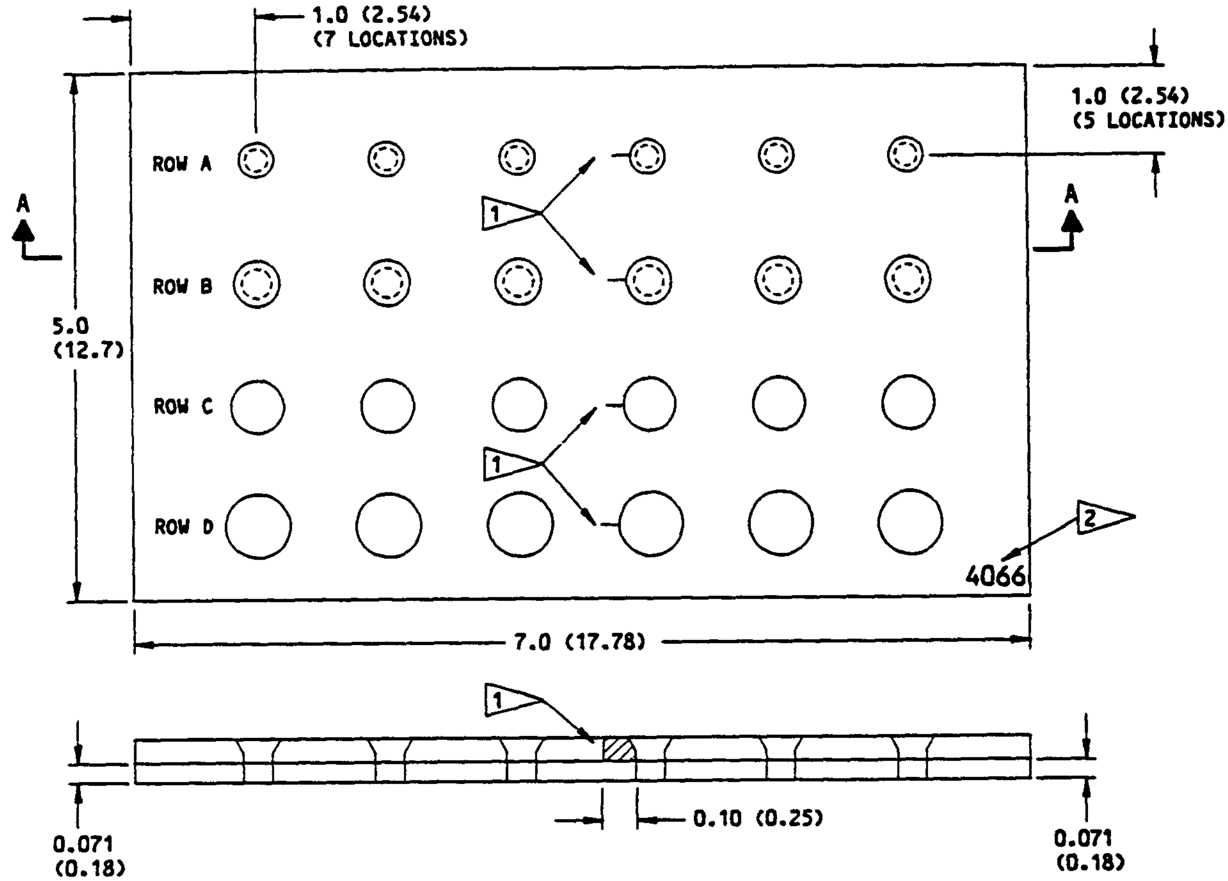
B. Crack indications are usually narrow sharp spikes, almost the same as the response from the reference standard. Wide rounded signals can be related to bad alignment or too much gain.

C. The following investigations must be done if a crack indication is noticed.

(1) Do a high frequency eddy current inspection around the fastener head. Use the circle template inspection described in Part 6, 53-30-07, Fig. 10. Use the reference standard 4066 to calibrate the equipment.

(2) If the circle template inspection shows surely the crack indication, remove fastener and do a countersink eddy current inspection as per Part 6, 53-30-00 Fig. 1.

Longitudinal Lap Joints
Figure 8 (Sheet 4)



REFERENCE STANDARD NO. 4066
DETAIL I

A-A

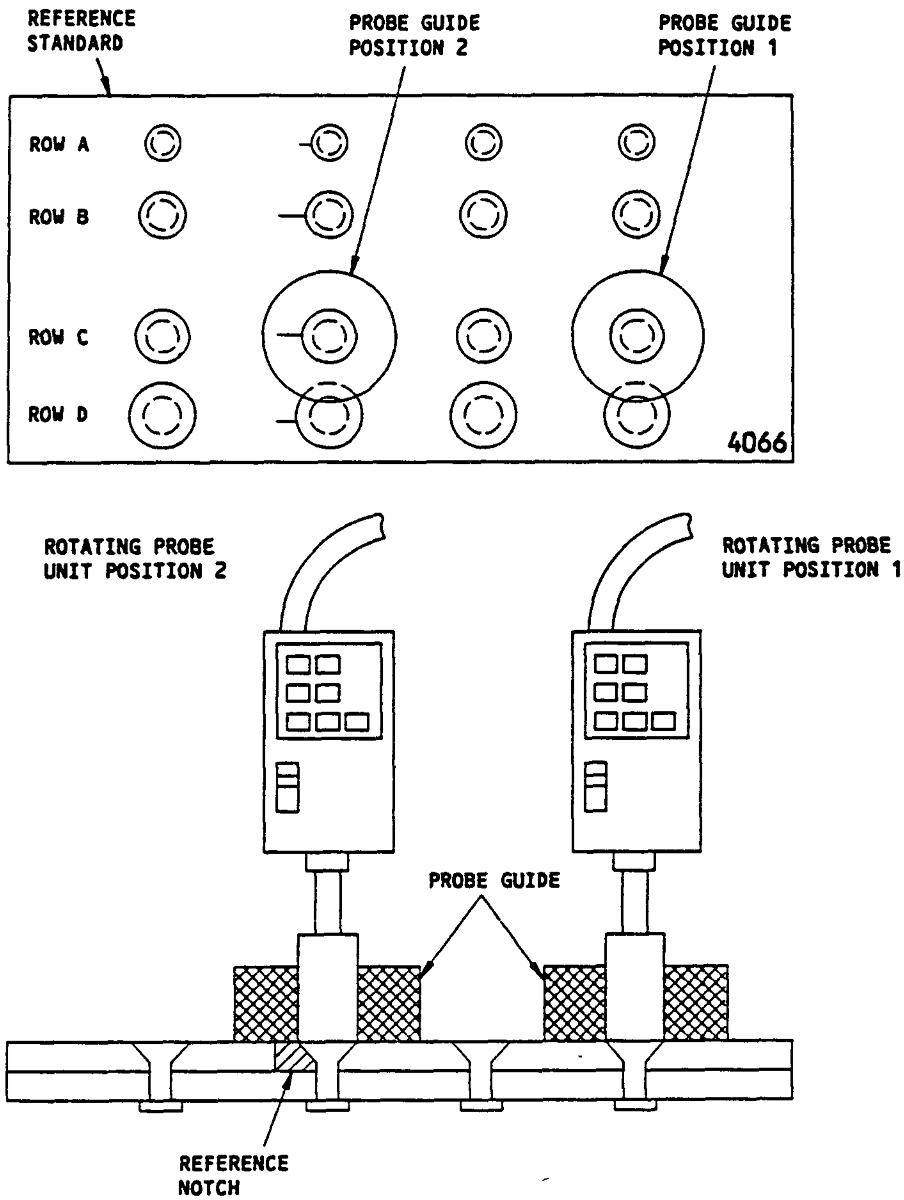
NOTES

- ALL DIMENSIONS ARE IN INCHES (CENTIMETERS IN PARENTHESES)
- MATERIAL: ALUMINUM 2024-T3 OR T4 CLAD
- FASTENERS: ROW A BACR15CE5D5, ROW B BACR15CE6D5, ROW C BACR15DS7D5, ROW D BACR15CE8D5
- TOLERANCE: X.X = 0.05 X.XX = 0.010 X.XXX = 0.005

1 EDM OR EQUIVALENT MAX. WIDTH 0.007 (0.018)

2 ETCH OR STAMP REF NO. 4066

Longitudinal Lap Joints
Figure 8 (Sheet 5)



CALIBRATION POSITIONS
DETAIL II

NOTES

- IT IS IMPORTANT THAT THE PROBE IS ACCURATELY ALIGNED OVER THE FASTENER
- THE CONTACT SURFACE OF THE PROBE MUST BE PARALLEL TO THE SKIN SURFACE
- THIS FIGURE SHOWS THE CALIBRATION FOR 7/32 INCH DIAMETER FASTENERS
  USE ROW A FOR 5/32 INCH FASTENERS AND ROW B FOR 3/16 INCH FASTENERS

Longitudinal Lap Joints
Figure 8 (Sheet 6)

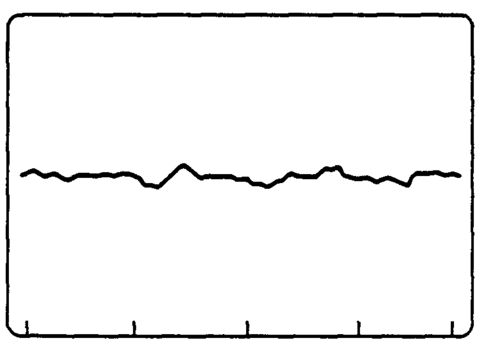
PRESENTATION 1

A TYPICAL SINGLE CRACK INDICATION THAT IS THE SAME AS THE REFERENCE STANDARD SIMULATED CRACK SIGNAL

NOTE: ROTATE THE PROBE UNIT THROUGH 90% THIS WILL MOVE THE SIGNAL ALONG THE TIME BASE.

PRESENTATION 2

THIS SIGNAL REPRESENTS INDICATIONS WHEN THE PROBE IS NOT CORRECTLY ALIGNED OVER THE FASTENER.
THE TWO SIGNALS ARE FROM THE PROBE IDENTIFYING TWO EDGES OF FASTENER HEAD.
THIS SIGNAL WILL ALSO APPEAR IF TWO CRACKS 180° APART ARE DETECTED.
ACCURATE THIS SIGNAL AGAIN IF TWO CRACKS EXIST IN THE FASTENER COUNTERSINK



PRESENTATION 3

THIS SIGNAL INDICATES ACCURATE ALIGNMAENT OVER FASTENER WITH NO CRACKS

OSCILLOSCOPE PRESENTATIONS
DETAIL III

Longitudinal Lap Joints
Figure 8 (Sheet 7)

PART 6 - EDDY CURRENT

SLIDING PROBE COUNTERSINK INSPECTION IN FUSELAGE - SKIN

1. Purpose

A. To find cracks in fuselage skin at the countersink fastener locations, without fastener removal, using the sliding-probe impedance-plane eddy-current method. This procedure can only be used where nonconductive anodized rivets are installed in the lap joint.

B. These cracks usually start from the inner surface of the outer skin at the edge of the countersink. The cracks become larger and move out along the faying surface. This inspection can find cracks 0.10 inch (0.25 cm) or longer under the fastener head.

C. This procedure is permitted for 5/32, 3/16 and 7/32 inch countersunk fasteners only.

D. You cannot do this procedure at a location where the fastener is an alodined rivet. Alodined rivets can be identified by the irregular signals they cause. Refer to par. 6.D.

2. Equipment

A. Instrument -- All impedance-plane eddy-current instruments that satisfy this procedure can be used. The instrument must have a permanent screen adjustment (screen persistence). The permanent screen adjustment (screen persistence) is necessary so the signals stay on the screen until manually erased. The procedure was developed using the following:

(1) Hocking AV10 and AV100

(2) Staveley NDT 19

(3) Zetec MIZ-20

NOTE: Other instruments can be available and can be used if they satisfy what is necessary for this procedure.

B. Probe -- A sliding probe that can operate at 20 kHz and made to scan along the fastener rows is necessary. The following were used to develop this procedure:

(1) Staveley SPO 3806

(2) Staveley SPO 3993

C. Reference Standard - Manufacture as specified in Detail I

NOTE: The rivet-to-skin interface on in-service airplanes is nonconductive to eddy currents if anodized rivets are installed. On the reference standard, good electrical flow between the skin and the rivets will give an incorrect and smaller fastener signal in the instrument display. To make sure that the reference standard is electrically equivalent to the airplane, use specially ordered rivets that have an anodize finish.

Fuselage Skin Countersink Fasteners Sliding Probe Inspection
Figure 9 (Sheet 1)

D. A nonconductive straightedge. Plexiglass works well.

3. Preparation for Inspection

A. Identify the inspection area (see service bulletin) and make sure that the fastener locations are free from dirt, grease, loose flakes of paint or corrosion.

B. Identify the size of the fastener that is to be inspected. Each size of fastener must be inspected independently.

C. Make sure that the fastener heads are seen clearly. If too much paint is on the fastener head, remove the paint.

NOTE: It is very important that the fastener heads can be clearly seen, to make sure of the accurate alignment of the probe over the fastener head.

4. Instrument Calibration

A. Turn on the instrument, connect the probe and do the manufacturers start up procedures.

B. Set the frequency to 20 kHz.

NOTE: If the inspection is to be done on the painted surface, put 0.006 inch (0.15 cm) of the nonconductive tape (3M teflon) over the reference standard.

C. Put the probe on the reference standard at probe position 1 (Detail II).

NOTE: Use row A for 5/32 inch fasteners, row B for 3/16 inch fasteners and row C for 7/32 inch fasteners.

D. Balance the instrument and move the signal dot to the balance point shown on Detail II.

(1) Set the instrument for permanent screen display (screen persistence).

E. Rock the probe from side to side at position 1 and adjust the phase angle (liftoff signal) to move horizontally from right to left (Detail II).

F. Use a nonconductive straightedge as a guide. Slide the probe over the center of a good fastener and observe the signal gotten.

G. Do the scan over the good fastener again and adjust the signal to get the response from a good fastener, as shown in Detail II.

NOTE: Different instrument and probe combinations can give small differences in the signal responses from that shown in Detail II.

Fuselage Skin Countersink Fasteners Sliding Probe Inspection
Figure 9 (Sheet 2)

H. Continue the scan along the fastener row beyond the fastener with the defect and observe the signal response.

NOTE: If you get Alodine rivet signals from the reference standard that are almost the same as the Alodine signals shown in Detail VI, the calibration cannot be done. The rivets must be removed and anodized rivets must be installed in the reference standard. See Detail I for the reference standard data.

I. Adjust instrument controls to get a signal almost the same as that from the defect fastener as shown in Detail II.

NOTE: Depending on the instrument, adjustment of the gain, filters and X-Y axis ratio can be necessary to get the correct response signals.

Do not scan too fast over fasteners. This will reduce the inspection sensitivity. Use the reference standard to make a satisfactory scanning speed.

J. The defect signal must be almost the same as that shown in Fig. 2. It is important to get a good vertical and horizontal separation between the good and defect signals.

5. Inspection Procedure

A. Calibrate as per par. 4. above. Use the correct fastener diameter for inspection area.

B. Put the nonconductive straightedge on airplane skin below the fastener row. This is to permit the probe to slide across the center of each fastener head.

NOTE: It is important to be aligned with the center of fastener row. See Detail III for effects of misalignment.

C. Slide the probe along the fastener row and monitor the signal response. If necessary balance the probe again on airplane as per par. 4.D.

D. The scanning speed must be sufficiently slow to permit the signal dot to follow the given pattern. To scan quickly can result in a reduced inspection sensitivity.

E. Monitor the display for signal changes from the reference standard good fastener signal. Look for a vertical and horizontal separation from the good fastener signal that is easily identified.

NOTE: Fastener signals which are different from the reference standard but do not resemble the defect signal, must be examined visually. Look for a change in the fastener size or the type. Check for steel fasteners with a magnet.

F. Be careful and look for Alodined rivets. Alodined rivets will cause signals that are smaller than normal. Do not use the sliding probe to examine areas with Alodined rivets because it is possible that cracks in areas with Alodined rivets will not cause reject signals to occur.

Fuselage Skin Countersink Fasteners Sliding Probe Inspection
Figure 9 (Sheet 3)

G. Keep the permanent screen adjustment "ON" so that the signals can be compared on the screen. Do a manual erase after 5 to 10 rivet signals have been compared on the screen.

6. Inspection Results

A. All signals almost the same as the defect signal in the reference standard, with an increase in the vertical and horizontal separation from the good fastener, must be investigated more.

B. The following investigation must be done if a crack indication is seen, or if a satisfactory response signal cannot be gotten from the fastener:

(1) Do a high-frequency eddy-current inspection around the fastener head, using a circle template and shielded pencil probe, as described in Part 6, 53-30-07, Fig. 10. Use reference standard 4066 to calibrate the equipment.

(2) If the circle template inspection makes sure of the crack indication, remove the fastener and do a countersink eddy current inspection as per Part 6, 53-30-00, Fig. 1.

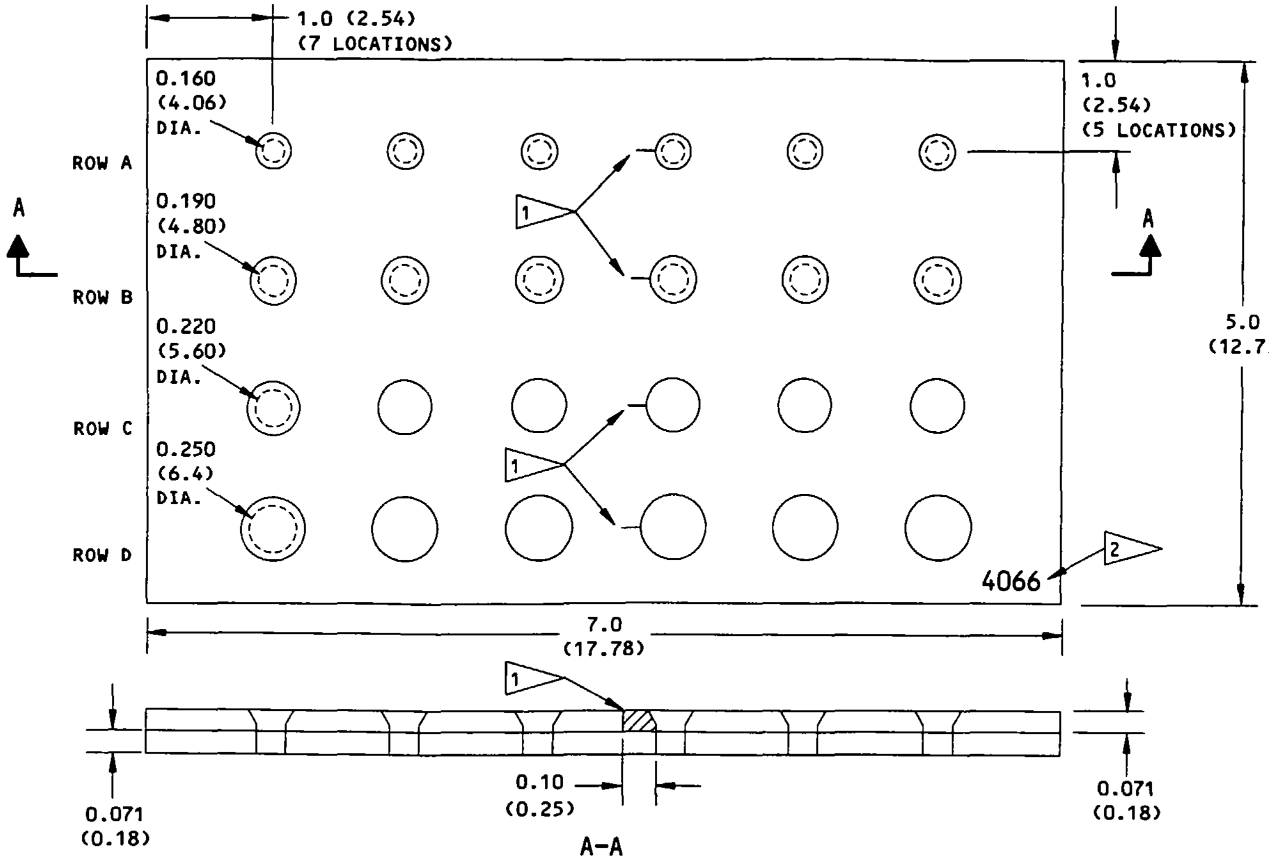
C. Details IV and VI show other signals which can be found and the reason for the signal. These fasteners must be inspected as specified in par. 6.B. above.

D. Alodined rivets that have conductivity with the skin can cause incorrect inspection results. These rivets can be identified by the unusual sliding probe signals they cause (see Detail VI). It is possible to have Alodined rivets in reference standards and also on airplanes. If you find unusual eddy current signals as shown in Detail VI, do the steps that follow:

(1) If the unusual signals occur from the reference standard, remove the rivets from the locations that cause the unusual signals and install anodized rivets. See Detail I for anodized rivets suppliers.

(2) If the unusual signals occur from the airplane, tell Boeing.

Fuselage Skin Countersink Fasteners Sliding Probe Inspection
Figure 9 (Sheet 4)



RIVET CODE	ALLFAST FASTENING SYSTEMS INC. PART NUMBER	SIERRA PACIFIC SUPPLY CO. PART NUMBER
ROW A	AF1049U1D5C5	NAS1097D5-5D
ROW B	AF1049U1D6C5	NAS1097D6-5D
ROW C	AF1049U1D7C5	NAS1097D7-5D
ROW D	AF1049U1D8C5	NAS1097D8-5D

ANODIZED RIVET DATA
TABLE I

NOTES:

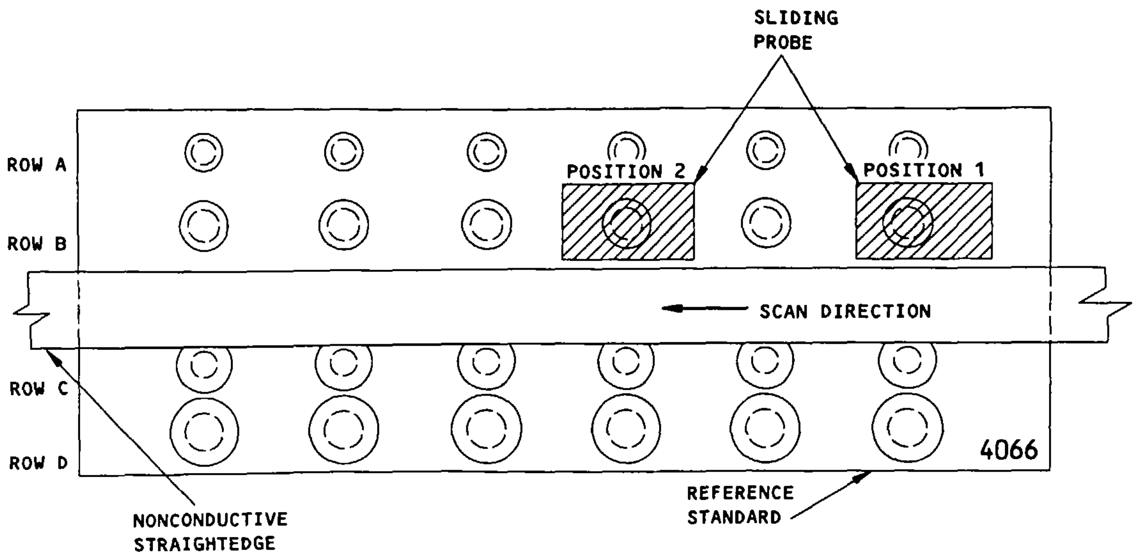
- ALL DIMENSIONS ARE IN INCHES (CENTIMETERS IN PARENTHESES).
- TOLERANCES (UNLESS SPECIFIED DIFFERENTLY):
  INCHES
  X.XXX = ±0.005
  X.XX = ±0.010
  X.X = ±0.05
- MATERIAL: 2024-T3 OR T4 ALUMINUM CLAD
- RIVETS THAT HAVE CONDUCTIVITY WITH THE SKIN CAUSE INCORRECT EDDY CURRENT SIGNALS. USE SPECIALLY-ORDERED RIVETS THAT HAVE AN ANODIZE FINISH TO PREVENT RIVET CONDUCTIVITY. SEE TABLE I. REFER TO PART 1, 51-01-00 FOR DATA ABOUT FASTENER SUPPLIERS.

1 EDM OR EQUIVALENT MAXIMUM WIDTH 0.007 (0.018)

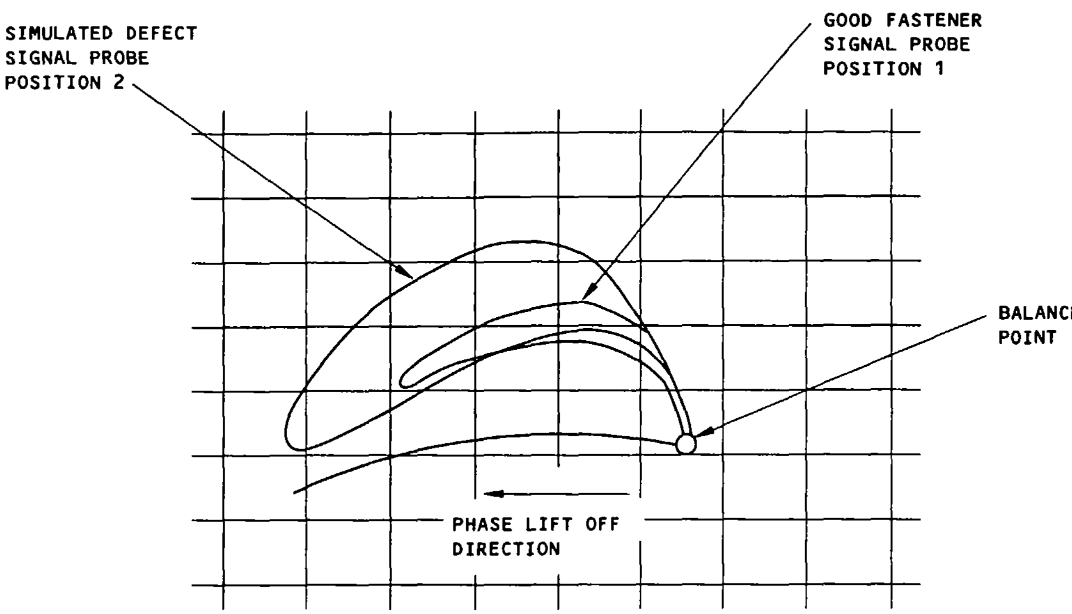
2 ETCH OR STAMP REF NO. 4066

REFERENCE STANDARD NO. 4066
DETAIL 1

Fuselage Skin Countersink Fasteners Sliding Probe Inspection
Figure 9 (Sheet 5)



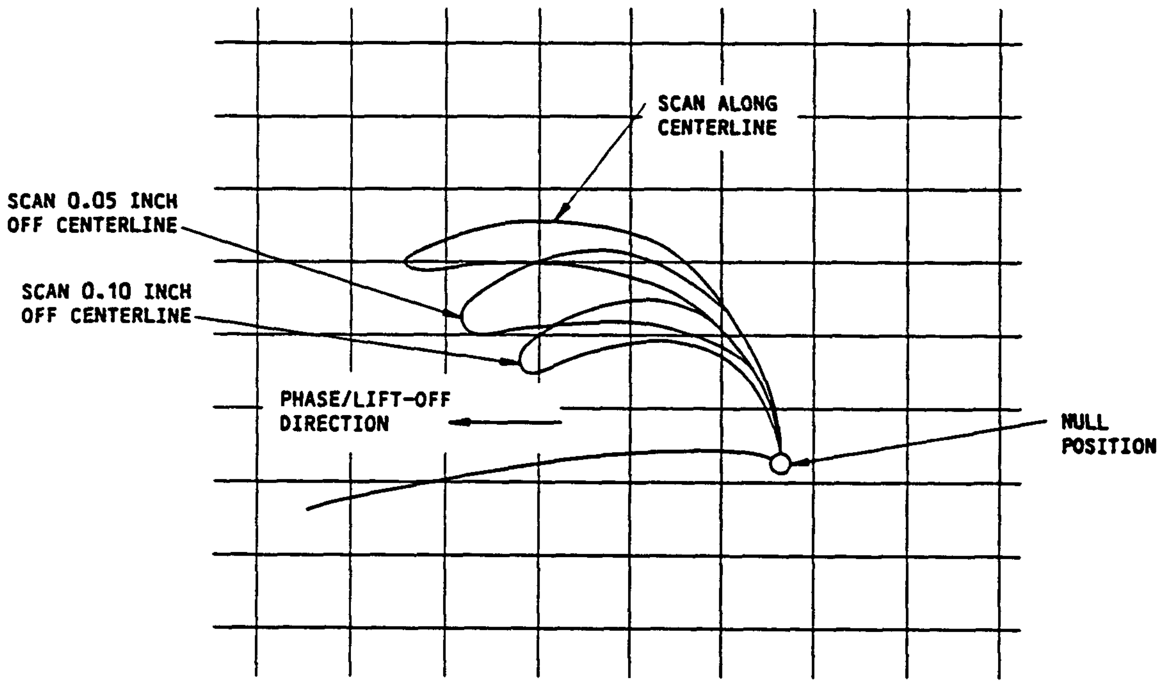
NOTE: CALIBRATION SHOWN FOR 3/16 INCH FASTENERS. USE ROW A FOR 5/32 INCH FASTENERS AND ROW C FOR 7/32 INCH FASTENERS.



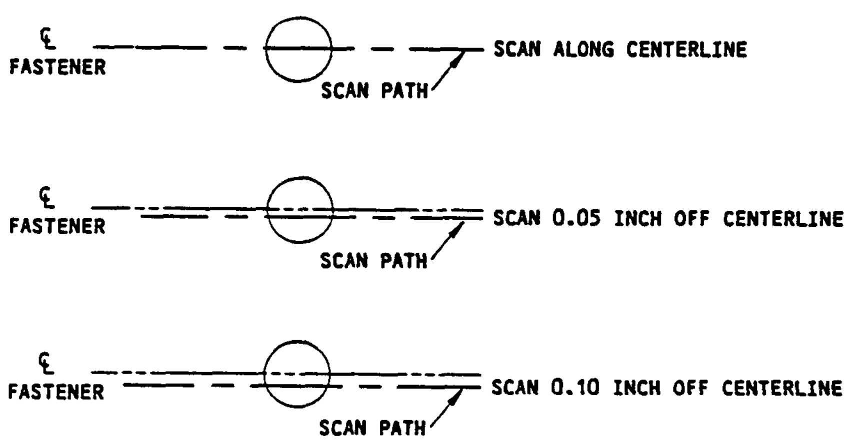
IMPEDANCE PLANE DISPLAY

INSTRUMENT CALIBRATION
DETAIL II

Fuselage Skin Countersink Fasteners Sliding Probe Inspection
Figure 9 (Sheet 6)



OSCILLOSCOPE PRESENTATION

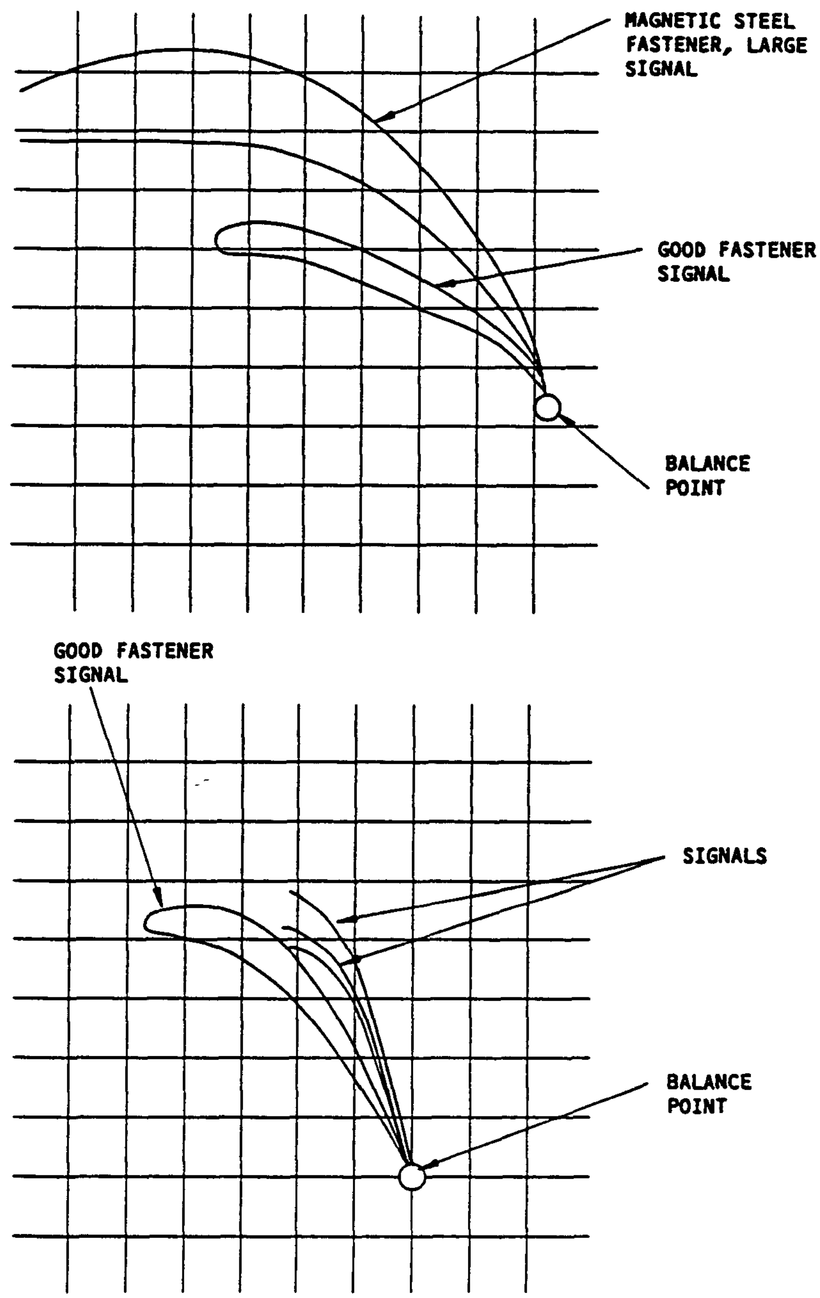


NOTES

- PROBE SCAN PATH MUST REMAIN AS CLOSE AS POSSIBLE TO THE CENTERLINE OF THE FASTENERS
- SCAN ALIGNMENT IS MORE IMPORTANT WHEN THE SPO2210 PROBE IS USED

SCAN MISALIGNMENT EFFECT
DETAIL III

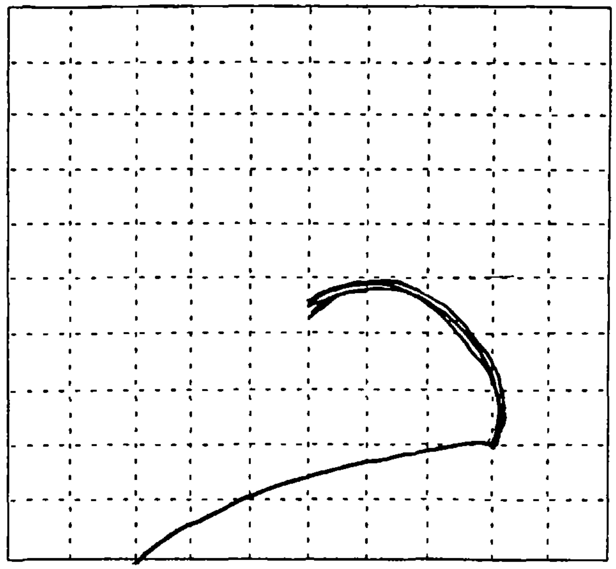
Fuselage Skin Countersink Fasteners Sliding Probe Inspection
Figure 9 (Sheet 7)



OSCILLOSCOPE PRESENTATIONS
DETAIL IV

Fuselage Skin Countersink Fasteners Sliding Probe Inspection
Figure 9 (Sheet 8)

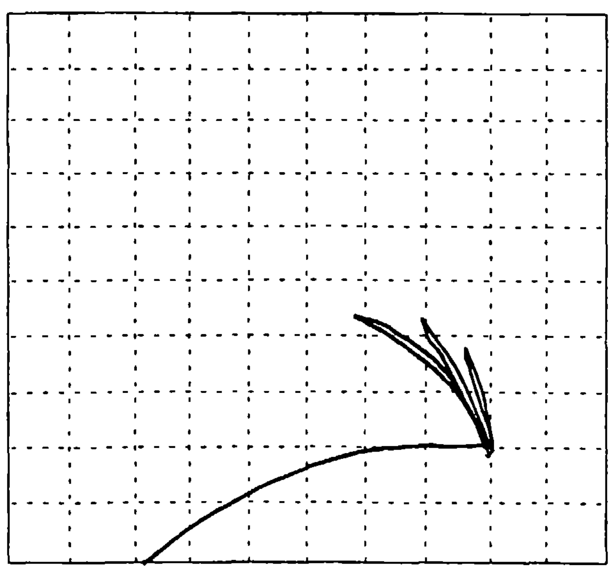
THE SLIDING PROBE INSPECTION IS PERMITTED IF SIGNALS SUCH AS THESE OCCUR FROM THE AIRPLANE OR REFERENCE STANDARD



THE SIGNALS THAT OCCUR FROM ANODIZED RIVET LOCATIONS ON THE AIRPLANE OR REFERENCE STANDARD ARE ALMOST THE SAME.

ANODIZED RIVET SIGNALS (TYPICAL)
DETAIL V

THE SLIDING PROBE INSPECTION CANNOT BE USED IF SIGNALS SUCH AS THESE OCCUR FROM THE AIRPLANE OR REFERENCE STANDARD; REFER TO PAR. 6.C.



THE SIGNALS THAT OCCUR FROM ALODINED RIVET LOCATIONS ON THE AIRPLANE OR REFERENCE STANDARD ARE IRREGULAR AND WILL BE DIFFERENT THAN ANODIZED RIVET LOCATIONS AS SHOWN. NOTE THAT THE HORIZONTAL MOVEMENT, HEIGHT AND SHAPE OF THE SIGNALS FROM ALODINED RIVETS ARE DIFFERENT.

ALODINED RIVET SIGNALS (TYPICAL)
DETAIL VI

EXAMPLE SIGNALS FROM ANODIZED AND ALODINED RIVETS

Fuselage Skin Countersink Fasteners Sliding Probe Inspection
Figure 9 (Sheet 9)

EFFECTIVITY
MODEL: 707/720 LINE NO: ALL

PART 6 - EDDY CURRENT

OVERSIZE TEMPLATE METHOD FOR COUNTERSUNK INSPECTION OF THE FUSELAGE - SKIN

1. Purpose

   A. To find the cracks at the fuselage countersink fastener locations, without fastener removal, using oversize template high frequency eddy current method.

   B. The cracks usually start from the inner surface of the outer skin, at the countersink and become larger, out along the faying surface.

2. Equipment

   A. Instrument - All instruments can be used that can operate at high frequency and will do the requirements of this procedure. A Hocking Locator-UH was used to develop this procedure.

   B. Probe - Shielded probes are recommended and are necessary for inspection around magnetic steel fasteners. Shielded or unshielded probes can be used for aluminum fasteners. The following probes were used to develop this procedure:

      (1) Shielded pencil probe P/N MP-30 NDT Engineering Corp.

      (2) Unshielded pencil probe P/N 29P101 Hocking

   C. Reference Standard - Manufacture as per Detail I, Reference Standard No. 4066

   D. Probe Guide - Use a drafters circle template (Detail II)

3. Preparation for Inspection

   A. Make sure that the inspection location is clean and free of dirt, grease, loose flakes of paint or corrosion.

   B. Make sure that the fastener is seen clearly. If too much paint is on the fastener head, remove the paint.

      NOTE: It is important that the fastener head is seen clearly, to permit accurate alignment of probe guide over the fastener head.

Fuselage Countersink Fastener Oversize Template Inspection
Figure 10 (Sheet 1)

4. Instrument Calibration

A. Set the frequency, if it is necessary for the instrument to be between 100 kHz and 500 kHz.

B. Do the manufacturers procedures for start up, balance and lift-off (0.003 to 0.006 inch). See Part 6, 51-00-00, Fig. 4 for more information.

NOTE: If the inspection is to be done without paint removal, put 0.006 inch of tape over the reference standard to represent the paint.

C. Put the probe guide on reference standard over an unnotched fastener and look to make sure that the probe is centered over fastener head.

NOTE: Use row A for 5/32 inch fasteners, row B for 3/16 inch fasteners, row C for 7/32 inch fasteners and row D for 1/4 inch fasteners.

Use a template hole which permits the probe to turn closely around the fastener head.

D. With the probe guide held tightly in position, put the probe within the template and balance the instrument. Scan the probe around the circumference of the fastener head. Look at the instrument response. If necessary, adjust the guide hole size to make sure of a minimum meter response.

E. Align the probe guide over the fasteners with the notch and scan around the fastener head. Make sure that the guide hole size is correct for maximum notch response. Adjust the sensitivity to 70% of the meter range.

NOTE: The inspector must note the difference between the fast response of the notch signal and the slower movement caused by the off center condition.

F. If the instrument has an alarm, set the alarm response to 50% of the notch signal amplitude.

G. For instruments without alarms, find the scan rate at which a minimum of a 50% notch response is received.

5. Inspection Procedure

A. Identify the fastener inspection location and find the fastener size.

NOTE: A magnet must be used to find all steel fasteners, which must be inspected with a shielded probe.

B. Center the probe guide over the inspection fastener, to make sure of the correct template hole size.

Fuselage Countersink Fastener Oversize Template Inspection
Figure 10 (Sheet 2)

C. Do a scan inspection around the fastener head with a pencil probe. Monitor the instrument.

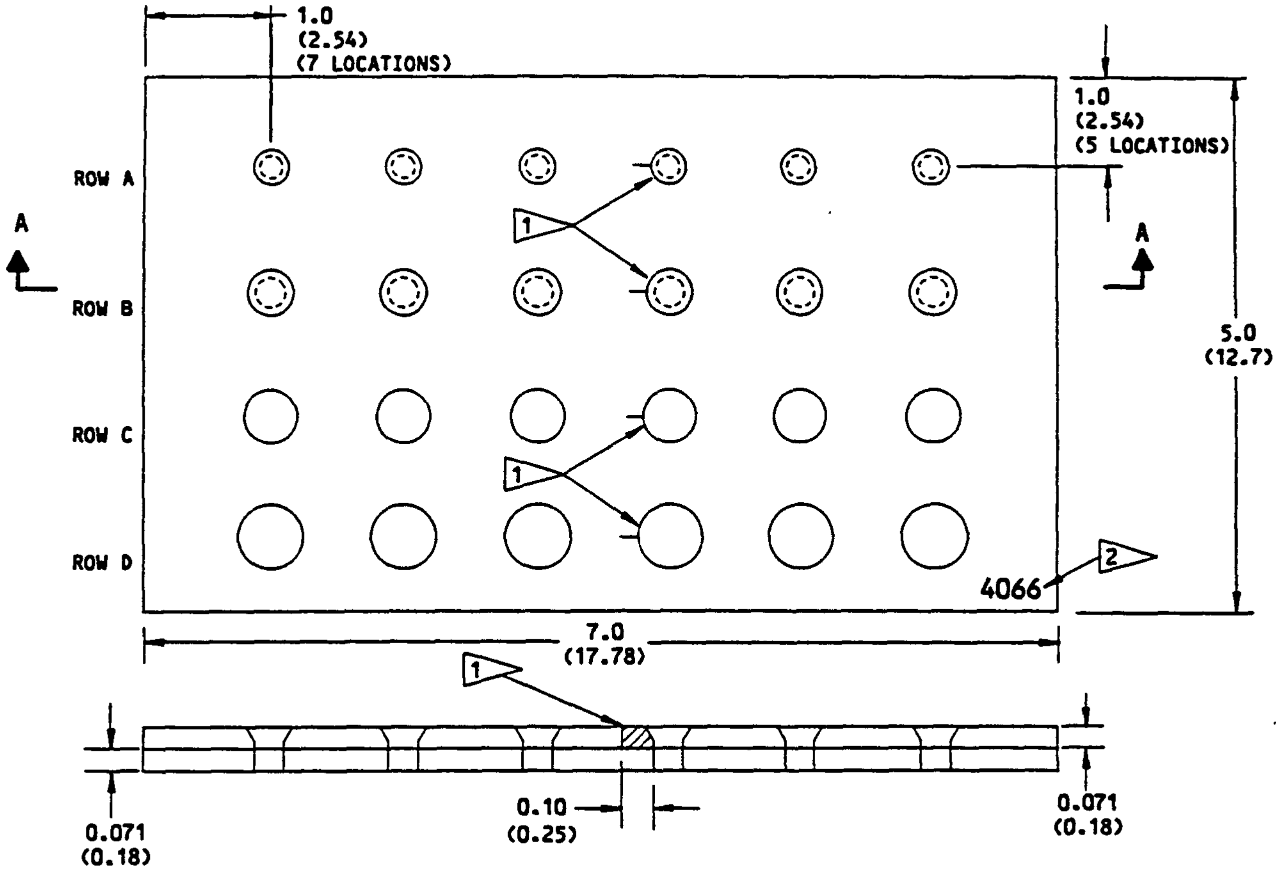
D. Look for a fast needle deflection almost the same as the response from the reference standard.

6. Inspection Results

A. Crack indications will give a fast needle movement.

B. For all crack indications that give a response of 50% or more, it is necessary for fastener removal and then to do the countersink eddy current inspection as per Part 6, 53-30-00, Fig. 1.

Fuselage Countersink Fastener Oversize Template Inspection
Figure 10 (Sheet 3)



SECTION A-A

NOTES

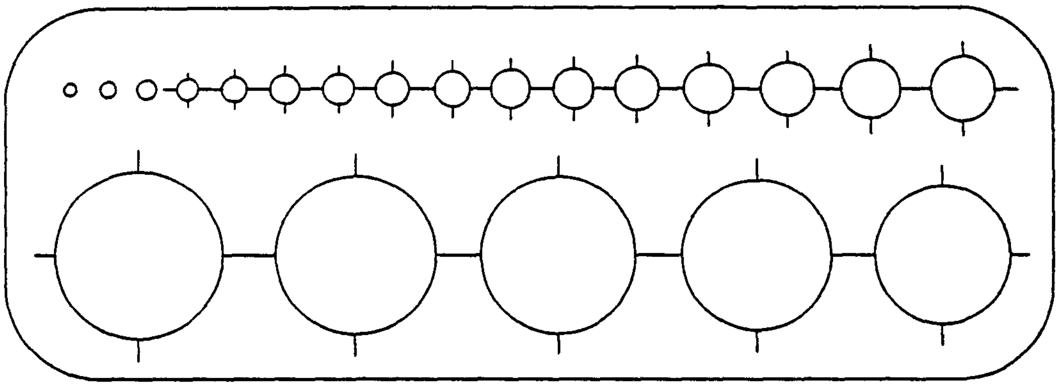
- ALL DIMENSIONS IN INCHES (CENTIMETERS IN PARENTHESES)
- MATERIAL: ALUMINUM 2024-T3 OR T4 CLAD
- FASTENERS: ROW A BACR 15CE5D5,
  ROW B BACR 15CE6D5,
  ROW C BACR 15DS7D5,
  ROW D BACR 15CE8D5 (OR EQUIVALENT)
- TOLERENCE: X.X - 0.05
  X.XX - 0.010
  X.XXX - 0.005

1 EDM OR EQUILAVENT MAXMIUM WIDTH 0.007 (0.018)

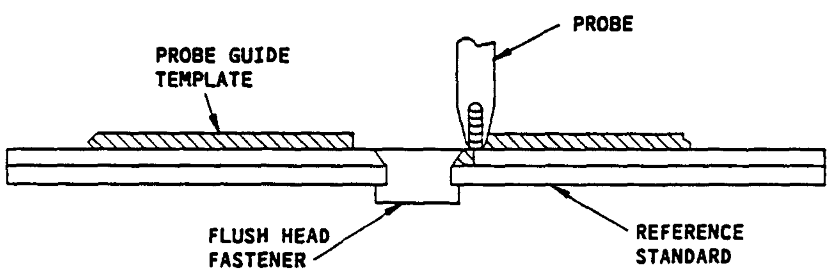
2 ETCH OR STAMP REF NO. 4066

REFERENCE STANDARD NO. 4066
DETAIL I

Fuselage Skin Countersink Fasteners Sliding Probe Inspection
Figure 10 (Sheet 4)



PROBE GUIDE
(DRAFTER'S CIRCLE TEMPLATE)



CALIBRATION AND INSPECTION SET-UP
DETAIL II

Fuselage Countersink Fastener Oversize Template Inspection
Figure 10 (Sheet 5)

PART 6 - EDDY CURRENT

FUSELAGE - PLATES/SKIN

1. Purpose

A. To detect cracks in fuselage outer skins less than 0.090 inch thick that propagate from countersunk fastener holes and remain after oversizing.

B. This procedure gives specific instructions for 5/32 and 3/16 countersunk holes oversized to 7/32. It also gives general guidelines for other size holes and oversizes.

C. The procedure used is dependent on original countersink and oversize hole diameters. Refer to the list below to determine applicable procedure:

(1) For 5/32-inch countersunk fastener holes oversized to 7/32 inch, refer to the procedure below.

(2) For 3/16-inch countersunk fastener holes oversized to 7/32 inch, refer to Part 6, 53-30-00, Fig. 1, Fig. 3, or Fig. 4, Countersink in Aluminum Parts.

Fig. 1 Manual Method - Meter Response

Fig. 3 Rotating Method - Impedance Plane Response

Fig. 4 Manual Method - Impedance Plane Response

Use the 7/32-inch countersink reference standard 194A and a 7/32 eddy-current probe. No further reference to this case will be made in this procedure except for par. 6., Inspection Results.

(3) For other size holes and oversizes, use the following general rule:

(a) If approximately 0.030 inch or more of the original countersink still exists after oversizing, inspect per 1.C.(2) above except use the appropriate countersink probe and countersink references standard for the oversized hole diameter.

(b) If less than 0.030 inch of the original countersink still exists after oversizing, inspect per the below procedure and use a reference standard similar to 296 except with a hole diameter equal to the oversized hole diameter.

Fuselage Skin Countersink Fastener
Oversized Hole Procedure
Figure 11 (Sheet 1)

2. Equipment

NOTE: Refer to Part 1, 51-01-00 for data on equipment and reference standard manufactures.

A. Any eddy current instrument that can operate between 100 and 500 kHz and satisfy the performance requirements of this procedure can be used. Instruments with visual and/or audible alarms are recommended. The following equipment was used to develop this procedure.

(1) Locator UH, Hocking Instruments

(2) MIZ 10-A, MIZ 10-B, Zetec, Inc.

B. Probe - Any shielded or unshielded probe that can satisfactorily find the calibration notch can be used. The following probes were used in the development of this procedure:

(1) 0.125 inch dia., 3 inch long shielded pencil probe, P/N MP-30, NDT Prod. Engr.

(2) 0.187 inch dia., 3 inch long unshielded pencil probe, P/N UP-30, NDT Prod. Engr.

(3) Unshielded Locator Probe, P/N 29P101, Hocking Instruments

C. Reference Standard - P/N 296 as shown in Detail I.

D. Probe Guide - Drafter's non-metallic circle template as shown in Detail II.

3. Preparation for Inspection

A. Make sure inspection area is clean.

4. Instrument Calibration

A. Set instrument frequency between 100 and 500 kHz.

B. Balance instrument and adjust lift-off per the manufactures instructions such that probe to part spacings of up to 0.006 inch (approx. 2 sheets of ordinary paper) give less than a 5 percent of full scale needle response.

C. Place one of the probe guide holes over the hole in the reference standard. Use a hole that positions the probe to scan just past the edge of the hole (see Detail II).

D. With probe guide held tightly in position, scan around the circumference of the reference standard hole. Monitor the instrument response. The operator should be able to clearly identify the difference between the sudden instrument response from the reference standard notch and the slow instrument response from an off-center condition.

E. Set the instrument sensitivity to obtain a 30 to 60 percent of full scale meter deflection when the probe is moved over the reference notch. If this cannot be obtained, try a smaller sized template hole.

F. If the instrument has an alarm, set the alarm to operate at 50 percent of the reference standard notch signal amplitude.

5. Inspection Procedure

A. Calibrate the instrument as specified in par. 4.

B. Place the probe guide hole used during calibration over the hole to be inspected.

C. Scan around the hole with the probe while monitoring the instrument.

6. Inspection Results

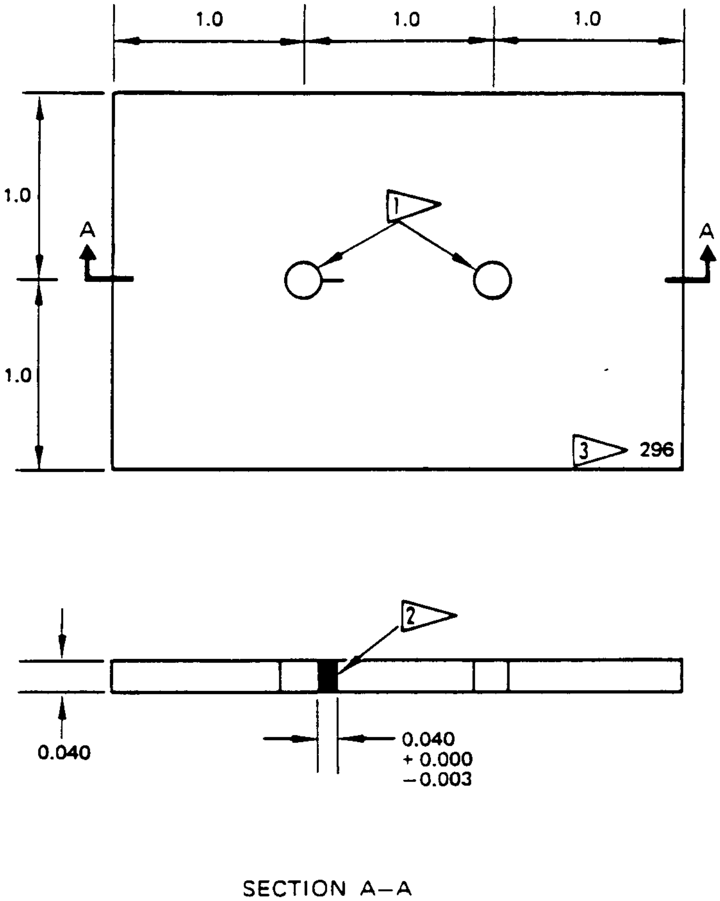
A. Any response 50 percent or greater than the reference standard notch is a potential crack and requires further investigation.

B. Potential cracks can be verified in the following manners:

(1) Visually inspect the area with 10X to 25X magnification and adequate lighting.

(2) Perform a high sensitivity fluorescent penetrant inspection. Refer to the Overhaul Manual, D6-51702, Section 20-20-02.

Fuselage Skin Countersink Fastener
Oversized Hole Procedure
Figure 11 (Sheet 3)



NOTES

- ALL DIMENSIONS IN INCHES
- TOLERANCE: X.X + 0.05 X.XXX + 0.005 (UNLESS NOTED)
- MATERIAL. 2024 – T3 OR T4 AL CLAD

1 DRILL 7/32 INCH HOLE *

2 EDM NOTCH OR EQUIVALENT 0.007 INCH MAX. WIDTH

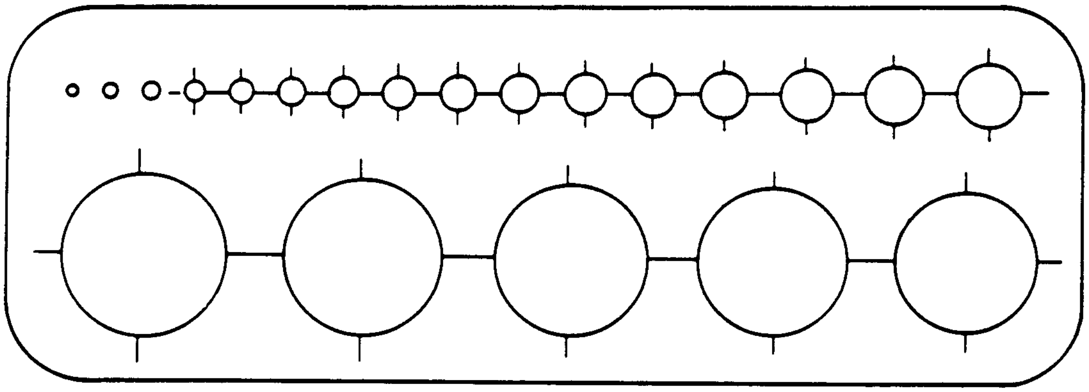
3 ETCH OR STAMP WITH 296

* LARGER HOLE SIZES CAN BE USED TO INSPECT FASTENER HOLES THAT HAVE BEEN OVERSIZED TO GREATER THAN 7/32. REFER TO PARA. 1.c.3.b.

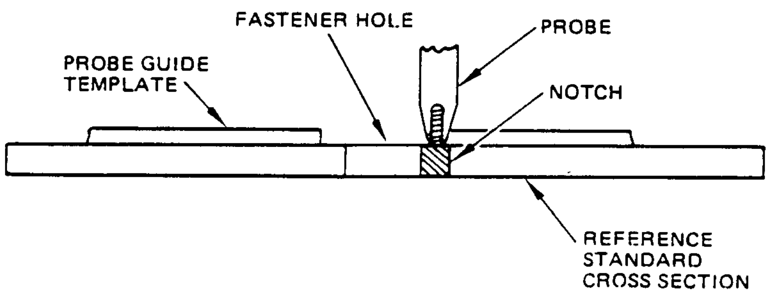
REFERENCE STANDARD 296

DETAIL I

Fuselage Skin Countersink Fastener
Oversized Hole Procedure
Figure 11 (Sheet 4)



PROBE GUIDE
(DRAFTER'S CIRCLE TEMPLATE)



INSTRUMENT CALIBRATION
DETAIL II

Fuselage Skin Countersink Fastener
Oversized Hole Procedure
Figure 11 (Sheet 5)

PART 6 - EDDY CURRENT

SPLICE PLATE INSPECTION AT THE BUTT SPLICES AT BS 1241 AND BS 1364

1. Purpose

A. This subsurface eddy current inspection can be used to examine the internal splice plates for cracks at the butt splices. The inspection scan is done on the outer surface of the skin to find cracks that are in a vertical direction at the butt splices. This inspection procedure is for instruments that have meter display or impedance plane display.

The inspection areas are as follows:

(1) The butt splice area at Body Station 1241 from stringer 1 to 10 on the left and right sides of the airplane. Examine the splice plate for cracks in the area between the vertical row of fasteners immediately forward and aft of the butt splice. See Details I and II.

(2) The butt splice area at Body Station 1364 from stringer 6 to 10 on the right side of the airplane only. Examine the splice plate for cracks in the area between the vertical row of fasteners immediately forward and aft of the butt splice. See Details I and III.

2. Equipment

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

A. Instruments

All eddy current instruments that have meter display or impedance plane display are permitted for use if they:

(1) Can operate at frequencies from 2 kHz to 5 kHz.

(2) Can find the reference notch in the reference standards as specified in the calibration instructions of this procedure.

The instruments specified below were used to help prepare this procedure:

(a) NDT 19E, Nortec/Staveley

(b) AV 100 Hocking/Krautkramer

(c) MIZ 10A/B, Zetec

Splice Plate Inspection at the Butt Splices at BS 1241 and BS 1364
Figure 12 (Sheet 1)

B. Probes

It is necessary to use a shielded spot probe to do this inspection. The probe must operate at frequencies from 2 kHz to 5 kHz. The maximum diameter of the probe is 0.44 inch (11 mm). Some fastener edge to edge distances make it necessary to use a probe with a diameter of 0.31 (7.8 mm) or less. The probes specified below operated satisfactorily when this procedure was prepared. Other probes can be used if they agree with the conditions of this procedure.

(1) SPO-5328 0.44 Diameter, Nortec/Staveley

(2) SPO-1391, 1kHZ-3kHZ, Nortec/Staveley

(3) LS203-1, NDT Engineering

(4) SPO-5327 0.31 Diameter, Nortec/Staveley

C. Reference Standards - Make reference standards ANDT1029A and ANDT1029B as specified in Details IV and V.

3. Prepare for the Inspection

Prepare for the subsurface inspection of the splice plates at Stations 1241, stringer 1 to 10 (left and right sides of the airplane) and Station 1364, stringer 6 to 10, (right side of the airplane only) as follows:

A. Make sure that the instrument, probe, reference standard, and inspection areas are at the same temperature.

B. Get access to the inspection areas shown in Details I, II and III on the external side of the airplane.

C. Make sure that the skins are clean at the forward and aft rows of the fasteners immediately adjacent to the butt splices. See Details I thru III.

4. Calibration

NOTE: Refer to the instrument's instruction manual for the instrument operation instructions.

A. Calibrate instruments that have an impedance plane display to do the subsurface inspection as specified below.

(1) Refer to Table 1 to find which reference standard and frequency to use for the applicable airplane and inspection area.

Splice Plate Inspection at the Butt Splices at BS 1241 and BS 1364
Figure 12 (Sheet 2)

(2) Set the instrument frequency to the applicable frequency specified in Table 1.

(3) Put the probe at position 1 on the applicable reference standard (ANDT1029A or ANDT1029B). See Detail VI, position 1.

(4) Balance the instrument and adjust the balanced signal so that it is at 20 percent full screen height. See Detail VI, View A.

(5) Set lift-off so that the signal goes horizontally to the left. See Detail VI, View A.

(6) Move the probe slowly so the butt splice on the reference standard to make a scan (from probe position 1 to position 2). Make sure the center of the probe goes across the center line of the fasteners. See Detail VI, position 1 and 2. Adjust the instrument sensitivity to get a vertical indication that is 60 percent of full screen height (40 percent of full screen height higher than the balance position). See Detail VI, View A.

NOTE: The vertical gain can be higher than the horizontal gain. This will make the signal more stable and give a more vertical signal on the screen.

B. Calibrate instruments that have a meter display to do the subsurface inspection as specified below.

(1) Refer to Table 1 to find which reference standard and frequency to use for the applicable airplane and inspection area.

(2) Set the instrument to the applicable frequency specified in Table 1.

(3) Put the probe at position 1 on the applicable reference standard (ANDT1029A or ANDT1029B). See Detail VI, position 1.

(4) Balance the instrument and adjust the balanced signal so that the meter needle is at 20 percent of full scale. See Detail VI, View B.

(5) Set lift-off at position 1, Detail VI. Set lift-off so that the meter needle moves nor more than 5 percent of full scale for probe to part distances of up to 0.006 inch (the thickness of two sheets of paper).

Splice Plate Inspection at the Butt Splices at BS 1241 and BS 1364
Figure 12 (Sheet 3)

(6) Move the probe slowly to the butt splice on the reference standard to make a scan (from probe position 1 to position 2). Make sure the center of the probe goes across the center line of the fasteners. See Detail VI, probe positions 1 and 2. Adjust the instrument sensitivity to get a meter response which is 60 percent of full scale (40 percent of full scale higher than the balance position). See Detail VI, View B.

5. Inspection Procedure

Do the subsurface inspection of the internal splice plates at Stations 1241 and 1364 as follows:

A. Refer to Table 1 and calibrate the equipment as specified in paragraph 4 for the applicable airplane and inspection area.

B. Put the probe on the skin away from the center line of the fasteners and balance the instrument.

C. Move the probe slowly to the butt splice to make a scan. Make sure the center of the probe goes across the center line of the fasteners.

NOTE: Do not permit the edge of the probe to go across the edge of the fasteners or too close to the edge of the skin. This will cause an upscale or vertical indication. Some probes have very good shielding which will permit the probe edge to go to the edge of the skin without a vertical or upscale indication.

D. Do a scan as specified in paragraph 5.C between the fasteners in the first vertical row immediately aft and forward of the butt splice at these locations:

(1) At Body Station 1241 from stringer 1 to 10 on the left and right sides of the airplane.

(2) At Body Station 1364 from stringer 6 to 10 on the right side only.

NOTE: Do not do an inspection on the lap splices at stringer 1, 6, and 10.

Splice Plate Inspection at the Butt Splices at BS 1241 and BS 1364
Figure 12 (Sheet 4)

6. Inspection Results

NOTE: Make sure the vertical or upscale indications are not caused by the probe scan done across a fastener edge or too close to the skin edge.

A. Inspection results for instruments that have impedance plane display:

(1) Vertical indications that are 20 percent, or more, higher than the balance position are possible crack indications. Crack indications occur during a short scan. Compare all indications to the indications from the reference notch on the reference standard.

NOTE: A slow, vertical indication can be caused by a large separation between the layers. For example, the separation between the skins at the lap splices can cause a vertical indication. This type of indication shows on the impedance plane screen during a long scan. Compare these indications to the reference notch indications that show quickly on the screen during a short scan.

B. Inspection results for instruments that have meter display:

(1) Upscale indications that are 20 percent, or more, higher than the balance position are possible crack indications. Crack indications occur during a short scan. Compare all indications to the indications from the reference notch on the reference standard.

NOTE: A slow, upscale indication can be caused by a large separation between the layers. For example, the separation between the skins at the lap splices can cause an upscale indication. This type of indication shows on the meter during a long scan. Compare these indications to the reference notch indications that show quickly on the meter during a short scan.

C. If necessary, do more analysis in the area of crack indications as follows:

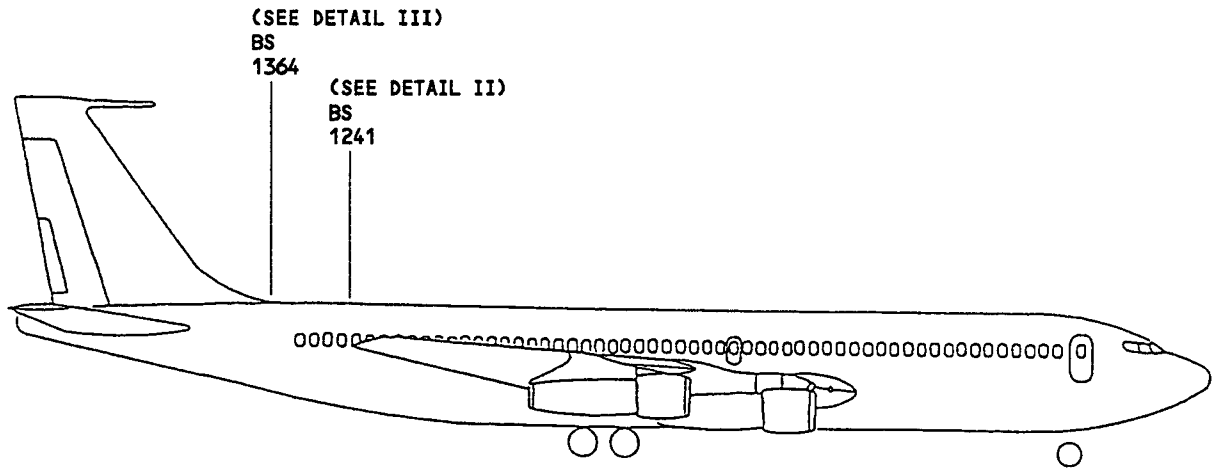
(1) Remove the fasteners and do an eddy current inspection of the fastener holes as specified in Part 6, 51-00-00, figure 16.

Splice Plate Inspection at the Butt Splices at BS 1241 and BS 1364
Figure 12 (Sheet 5)

AIRPLANE VARIABLE NUMBER	INSPECTION AREA	REFERENCE STANDARD	INSTRUMENT FREQUENCY
707 AIRPLANES			
ALL	STATION 1241 STRINGER 1-6 (LEFT AND RIGHT)	ANDT1029A	3KHZ TO 5KHZ
1-415, 501-799, 2001-4399	STATION 1241 STRINGER 6-10 (LEFT AND RIGHT)	ANDT1029A	3KHZ TO 5KHZ
416-499, 801-1999 5001 AND ON	STATION 1241 STRINGER 6-10 (LEFT AND RIGHT)	ANDT1029B	2KHZ TO 3KHZ
1-415, 501-799, 2001-4999	STATION 1364 STRINGER 6-10 (RIGHT ONLY)	ANDT1029A	3KHZ TO 5KHZ
416-499, 801-1999 5001 AND ON	STATION 1364 STRINGER 6-10 (RIGHT ONLY)	ANDT1029B	2KHZ TO 3KHZ
720 AIRPLANES			
ALL	STATION 1241 STRINGER 1-6 (LEFT AND RIGHT)	ANDT1029A	3KHZ TO 5KHZ
ALL	STATION 1241 STRINGER 6-10 (LEFT AND RIGHT)	ANDT1029B	2KHZ TO 3KHZ
ALL	STATION 1364 STRINGER 6-10 (RIGHT ONLY)	ANDT1029B	2KHZ TO 3KHZ

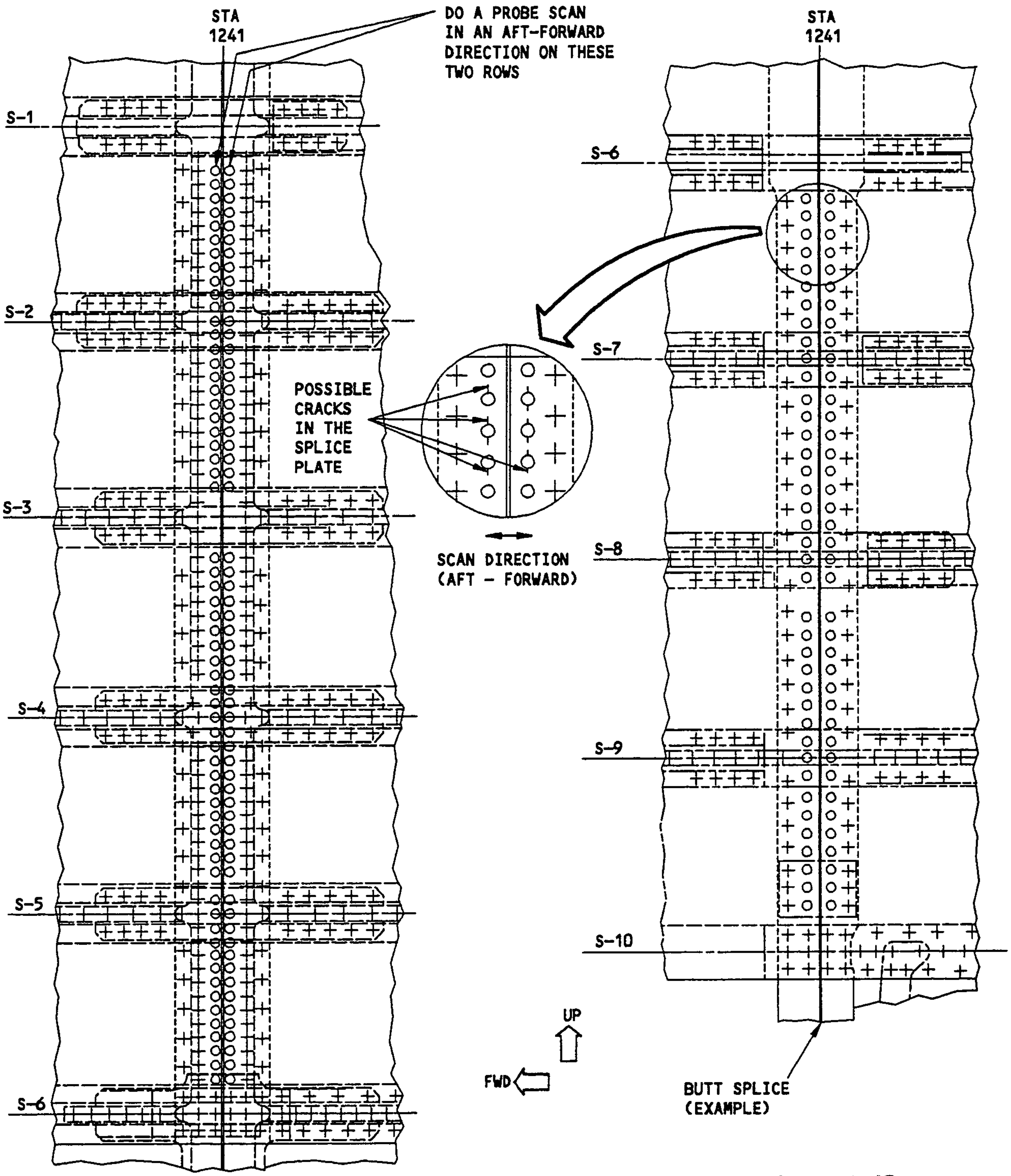
TABLE 1

Splce Plate Inspection at the Butt Splices at BS 1241 and BS 1364
Figure 12 (Sheet 6)



INSPECTION AREAS AT STATIONS 1241 AND 1364
DETAIL I

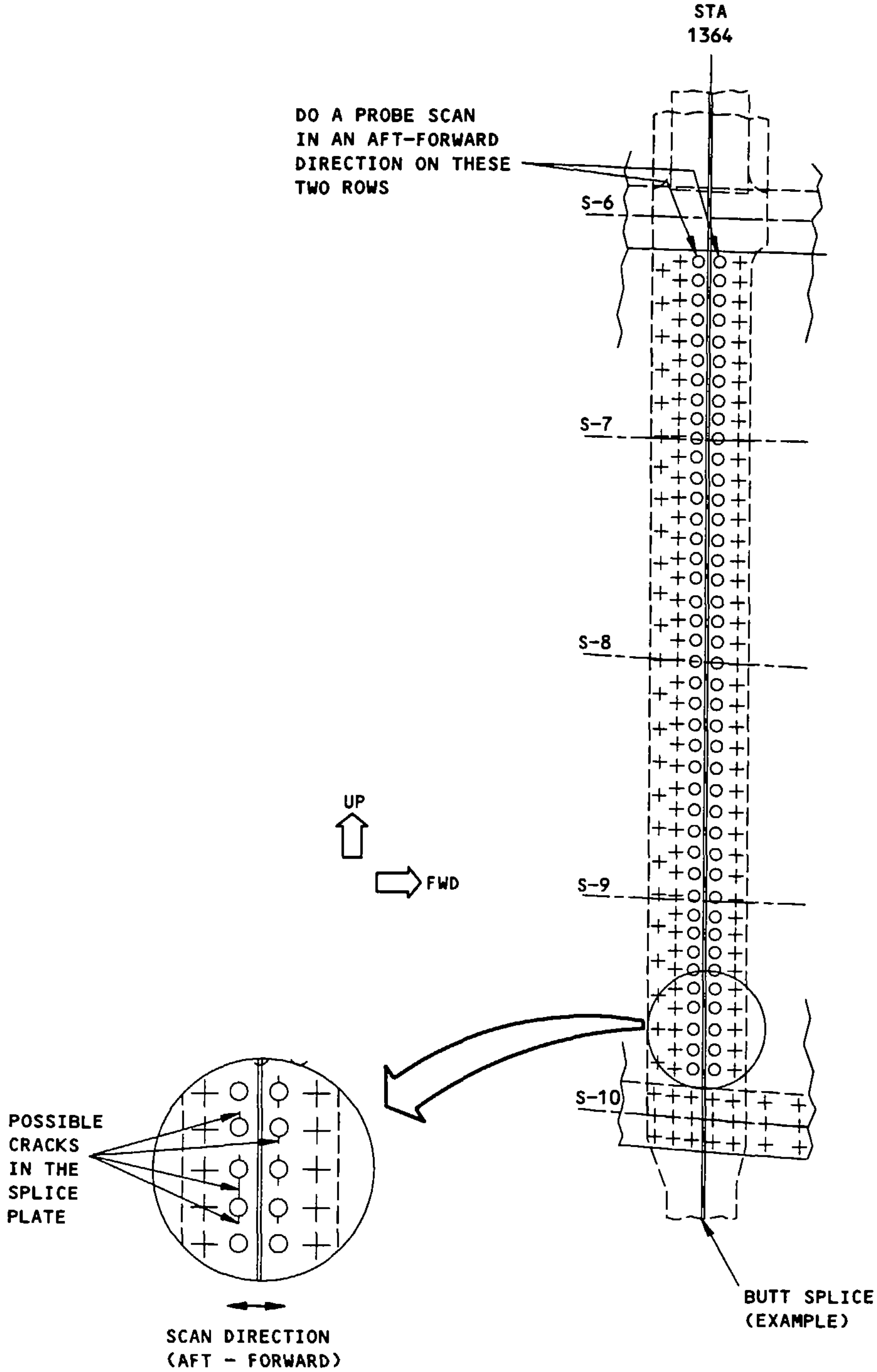
Splice Plate Inspection at the Butt Splices at BS 1241 and BS 1364
Figure 12 (Sheet 7)



INSPECTION AREA AT STATION 1241 BETWEEN STRINGERS S-1 AND S-10
(LEFT SIDE IS SHOWN, RIGHT SIDE IS EQUIVALENT)

DETAIL II

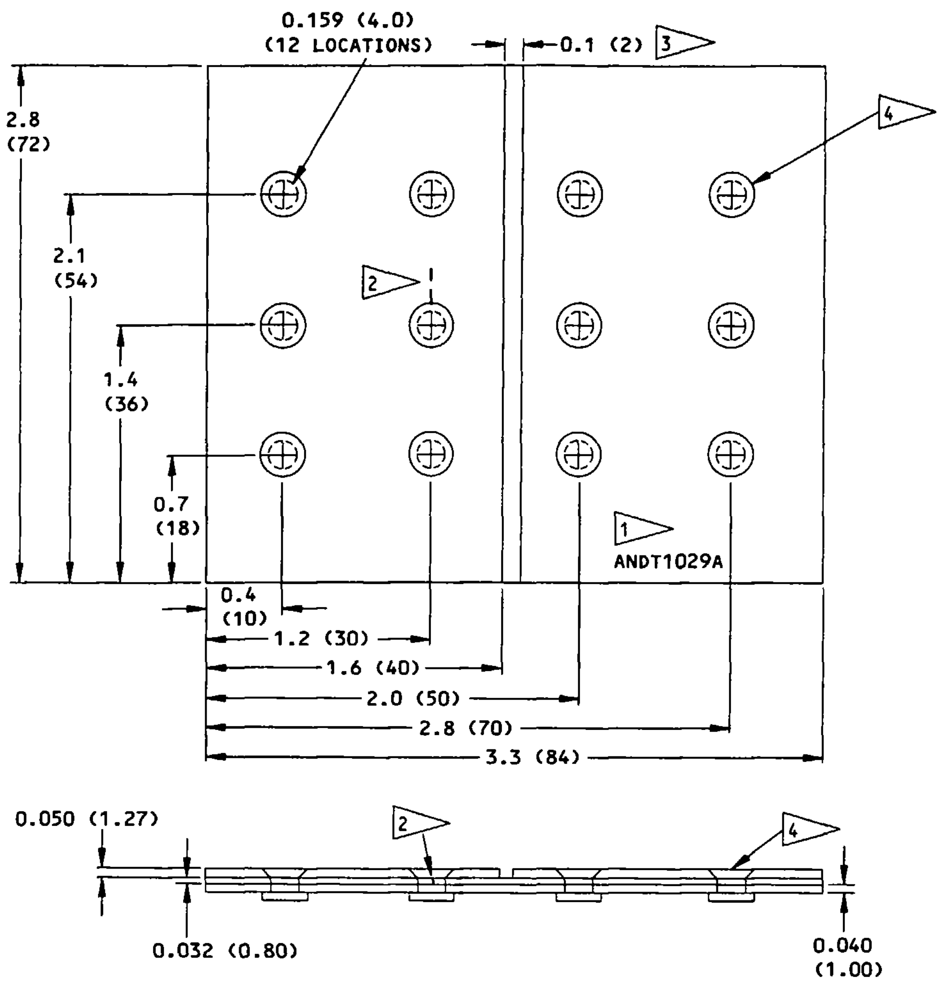
Splice Plate Inspection at the Butt Splices at BS 1241 and BS 1364
Figure 12 (Sheet 8)



INSPECTION AREA AT STATION 1364 (RIGHT SIDE)
BETWEEN STRINGERS S-6 AND S-10

DETAIL III

Splice Plate Inspection at the Butt Splices at BS 1241 and BS 1364
Figure 12 (Sheet 9)



NOTES:

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

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

- MATERIAL: 2024-T3 OR T4 CLAD ALUMINUM
- SURFACE ROUGHNESS = 125 Ra OR BETTER

1 ETCH OR STEEL STAMP THE REFERENCE STANDARD NUMBER. PUT A LETTER "A" IN FRONT OF THE REFERENCE STANDARD NUMBER TO SHOW THAT IT HAS ALODINED RIVETS. SEE FLAGNOTE 4.

2 EDM NOTCH OR SAWCUT:

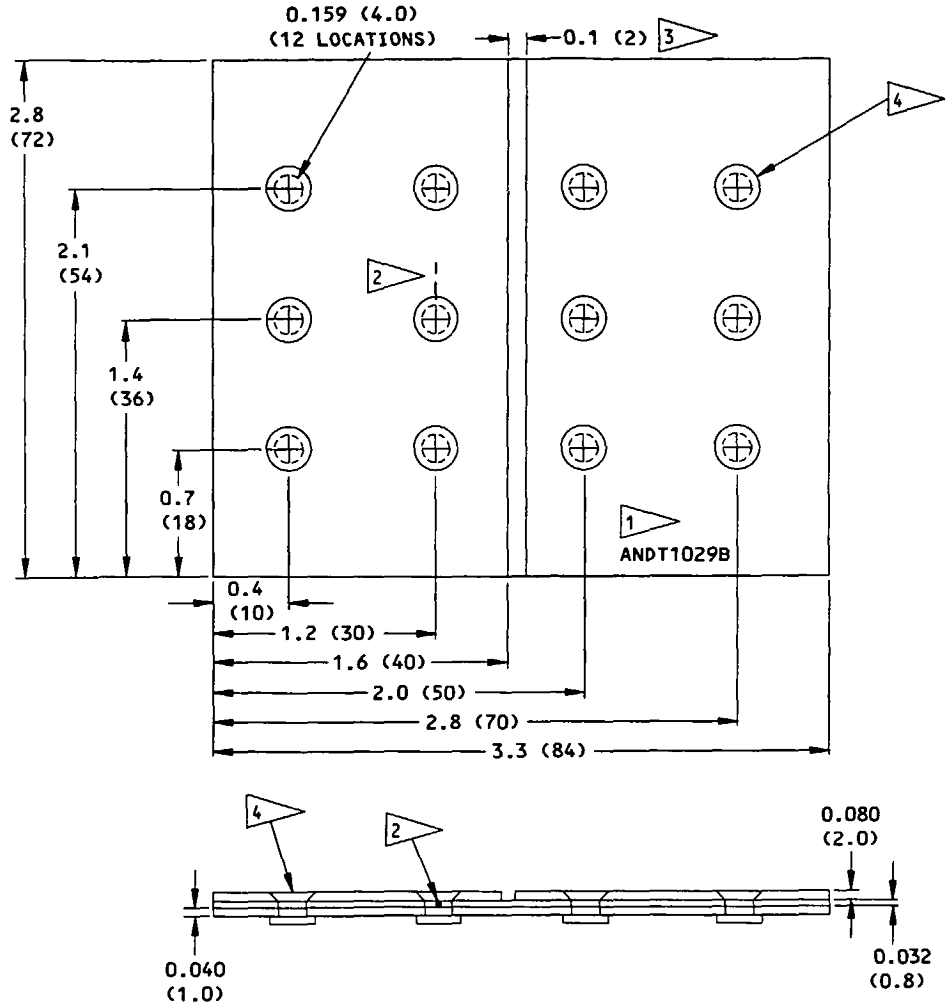
LENGTH: 0.35 (8.9) ±10%
DEPTH: THRU THICKNESS
WIDTH: 0.025 (0.64) MAXIMUM
LOCATION: PUT THE NOTCH WITHIN ±0.005 (±0.10) OF THE CENTER OF THE HOLE.

3 GAP TOLERANCE: +0/-0.08 (+0/-2)

4 ALUMINUM RIVET BACR15CE5D5 (12 LOCATIONS). ALTERNATIVE MATERIAL CODES: AD OR DD OR KE. THESE RIVETS MUST HAVE A CONVERSION COATED (ALODINED) FINISH. TO MAKE SURE THE FINISH IS ALODINE, REFER TO PART 1, 51-06-01. INSTALL THE RIVETS AS SPECIFIED IN PART 1, 51-01-04.

REFERENCE STANDARD ANDT1029A
DETAIL IV

Splice Plate Inspection at the Butt Splices at BS 1241 and BS 1364
Figure 12 (Sheet 10)



NOTES:

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

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

- MATERIAL: 2024-T3 OR T4 CLAD ALUMINUM
- SURFACE ROUGHNESS = 125 Ra OR BETTER

1 ETCH OR STEEL STAMP THE REFERENCE STANDARD NUMBER. PUT A LETTER "A" IN FRONT OF THE REFERENCE STANDARD NUMBER TO SHOW THAT IT HAS ALODINED RIVETS. SEE FLAGNOTE 4.

2 EDM NOTCH OR SAWCUT:

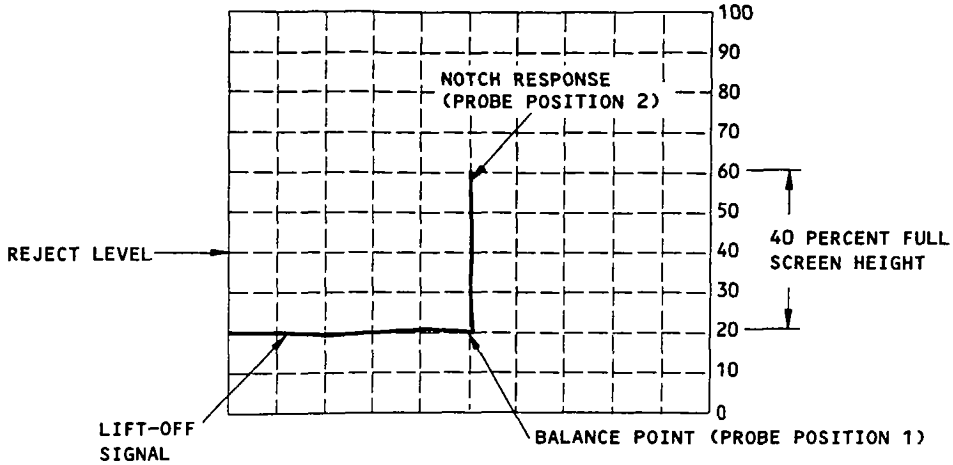
LENGTH: 0.35 (8.9) ±10%
DEPTH: THRU THICKNESS
WIDTH: 0.025 (0.64) MAXIMUM
LOCATION: PUT THE NOTCH WITHIN ±0.005 (±0.10) OF THE CENTER OF THE HOLE.

3 GAP TOLERANCE: +0/-0.08 (+0/-2)

4 ALUMINUM RIVET BACR15CE5D5 (12 LOCATIONS). ALTERNATIVE MATERIAL CODES: AD OR DD OR KE. THESE RIVETS MUST HAVE A CONVERSION COATED (ALODINED) FINISH. TO MAKE SURE THE FINISH IS ALODINE, REFER TO PART 1, 51-06-01. INSTALL THE RIVETS AS SPECIFIED IN PART 1, 51-01-04.

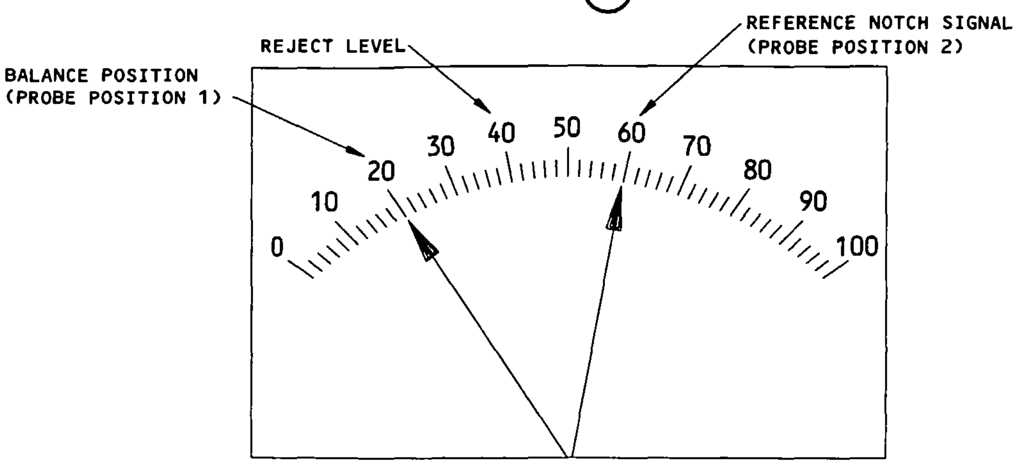
REFERENCE STANDARD ANDT1029B
DETAIL V

Splice Plate Inspection at the Butt Splices at BS 1241 and BS 1364
Figure 12 (Sheet 11)



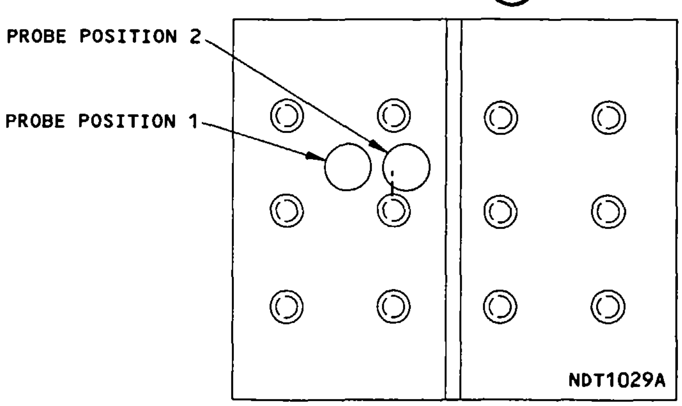
IMPEDANCE PLANE INSTRUMENT DISPLAY

VIEW (A)



METER INSTRUMENT DISPLAY

VIEW (B)



NOTE:
REFERENCE STANDARD NDT1029A IS SHOWN. NDT1029B IS ALMOST THE SAME. THE FREQUENCIES USED DURING CALIBRATION ON THESE REFERENCE STANDARDS ARE DIFFERENT.

PROBE POSITIONS AND INSTRUMENT DISPLAYS FOR CALIBRATION
DETAIL VI

Splice Plate Inspection at the Butt Splices at BS 1241 and BS 1364
Figure 12 (Sheet 12)

EFFECTIVITY
MODEL: 707/720 SSI DOCUMENT (D6-44860 REFERENCE) 53-A00-15, 53-A10-15 53-A20-15, 53-A30-15 53-A40-15

PART 6 - EDDY CURRENT
SPLICE PLATE INSPECTION AT THE BUTT SPLICE AT BS 960

1. Purpose

   A. This subsurface eddy current inspection can be used to examine the internal splice plates for cracks at the butt splice at station 960. The inspection is done on the outer surface of the skin to find cracks that are in a vertical direction.

   B. The inspection area is adjacent to the butt splice at Body Station 960 from stringers 1 thru 10 on the left and right sides of the airplane. Examine between the vertical row of fasteners immediately forward and aft of the butt splice for cracks. See Details I and II.

2. Equipment

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

   A. Instruments - All eddy current instruments that have meter display or impedance plane display are permitted for use if they:

      (1) Can operate at frequencies of 200 Hz and 2 kHz.

      (2) Can find the reference notch in the reference standards as specified in the calibration instructions of this procedure.

      The instruments specified below were used to help prepare this procedure:

      (a) NDT 19E, Nortec/Staveley
      (b) AV 100, Hocking/Krautkramer
      (c) MIZ 10A/B, Zetec

   B. Probes - One shielded spot probe and one shielded ring probe are necessary to do this inspection. The shielded spot probe must operate at a frequency of 2 kHz. The shielded ring probe must operate at 200 Hz. The maximum diameter of the shielded spot probe is 0.44 inch (11 mm).

      Some fastener edge-to-edge distances make it necessary to use a probe with a diameter of 0.31 inch (7.8 mm) or less. The inner diameter of the shielded ring probe must be between 0.29 inch (7.36 mm) and 0.33 inch (8.38 mm).

Splice Plate Inspection at the Butt Splice at BS 960
Figure 13 (Sheet 1)

The probes specified below operated satisfactorily when this procedure was prepared. Other probes can be used if they agree with the conditions of this procedure.

(1) SPO-5328, Nortec/Staveley (spot probe) 0.44 inch diameter (11 mm).

(2) SPO-1391, 1KHZ-3KHZ Nortec/Staveley (spot probe) 0.42 inch diameter (10.6 mm).

(3) SPO-5327, Nortec/Staveley (spot probe) 0.31 inch diameter (8 mm).

(4) SPO-996R (reflection ring probe) Nortec/Staveley

(5) DP-320/780-R 6, Zetec (reflection ring probe)

NOTE: A reflection probe is more stable than a bridge probe and uses lower gain.

C. Reference Standard - Make reference standard NDT1034 as specified in Detail III.

3. Prepare for the Inspection

Prepare for the subsurface inspection of the splice plates at station 960 from stringer 1 thru 10 (left and right sides of the airplane) as follows:

NOTE: To keep the instrument drift to a minimum, the temperature of the airplane and the equipment must be approximately the same.

A. Get access to the inspection areas shown in Detail I and II from the external side of the airplane.

B. Make sure that the skins are clean at the first row of fasteners immediately adjacent to the butt splice. See Detail I and II.

4. Calibration

NOTE: Refer to the instrument's instruction manual for the instrument operation instructions.

A. Calibrate the instrument on reference standard NDT1034, location "A", if applicable. (Refer to Table I to identify if the calibration instructions for location "A" are applicable to your airplane) as follows:

NOTE: This calibration is done with a spot probe. See Detail IV.

(1) Set the instrument frequency to 2 kHz.

Splice Plate Inspection at the Butt Splice at BS 960
Figure 13 (Sheet 2)

(2) Put the probe at position 1 on NDT1034, location "A". See Detail IV, view III.

(3) Do steps 4.A.(3)(a) and 4.A.(3)(b) that follow if an impedance plane instrument is used.

(a) Balance the instrument and adjust the balanced signal so that it is at 20 percent full screen height. See Detail IV, view I.

(b) Set the phase rotation control so the lift-off signal goes horizontally to the left. See Detail IV, view I.

(4) Do steps 4.A.(4)(a) and 4.A.(4)(b) that follow if a meter display instrument is used.

(a) Balance the instrument and adjust the balanced signal so that the meter needle is at 20 percent of full scale. See Detail IV, view II.

(b) Set lift-off at position 1, Detail IV. Set lift-off so that the meter needle moves no more than 5 percent of full scale for probe to part distances of up to 0.006 inch (the thickness of two sheets of paper).

(5) Move the probe slowly to the edge of location "A" on the reference standard to make a scan (from probe position 1 to position 2). Make sure the center of the probe goes across the center line of the fasteners. Do not let the edge of the probe go to the edge of location "A" on the reference standard. See Detail IV, position 1 and 2. Adjust the instrument gain to get an indication that is 60 percent of full scale or screen height (40 percent of full scale or screen height higher than the balance position). See Detail IV, views I, II and III.

NOTE: The vertical gain can be higher than the horizontal gain. This will make the signal more stable and give a more vertical signal on the screen.

(6) Put the probe at position 3 on reference standard NDT1034, Location "A". See Detail IV, position 3.

(7) Move the probe slowly to the right side edge of location "A" on the reference standard (from position 3 to 4). Stop the probe scan when the signal from the edge effect goes to 10 percent of full scale or screen height. Monitor the distance from the edge of the probe to the edge of the skin (location "A"). During the inspection, do not permit the probe to go this close to the edge of the skin.

Splice Plate Inspection at the Butt Splice at BS 960
Figure 13 (Sheet 3)

B. Calibrate the instrument on reference standard NDT1034, location "B" or "C", if applicable. (Refer to Table I to identify if the calibration instructions for location "B" or "C" are applicable to your airplane) as follows:

NOTE: This calibration is done with a ring probe. See Detail V. A ring probe is not used on location "A" on reference standard NDT1034.

(1) Refer to Table I to identify the correct reference standard location to use for the applicable airplane and inspection area.

(2) Set the instrument frequency to 200 Hz.

(3) Put the ring probe at ring probe position 1 on the applicable reference standard location. Make sure the fastener is in the center of the ring probe. See Detail V, view III.

(4) Do steps 4.B.(4)(a) and 4.B.(4)(b) that follow if an impedance plane instrument is used.

(a) Balance the instrument and adjust the balanced signal so that it is at 20 percent full screen height. See Detail V, view I.

(b) Set the phase rotation control so the lift-off signal goes horizontally to the left. See Detail V, view I.

(5) Do steps 4.B.(5)(a) and 4.B.(5)(b) if a meter display instrument is used.

(a) Balance the instrument and adjust the balanced signal so that it is at 20 percent of full scale. See Detail V, view II.

(b) Set lift-off at probe position 1. See Detail V, view II. Make sure the fastener is in the center of the ring probe. Set lift-off so that the meter needle moves no more than 5 percent of full scale for probe to part distances of up to 0.006 inch (the thickness of two sheets of paper).

(6) Move the probe to probe position 2 on the applicable reference standard location. Make sure the fastener is in the center of the ring probe. Adjust the instrument gain to get an indication that is 60 percent of full scale or screen height (40 percent of full scale or screen height higher than the balance position). See Detail V, views I, II, and III.

Splice Plate Inspection at the Butt Splice at BS 960
Figure 13 (Sheet 4)

5. Inspection Procedure

A. Refer to Table I and identify which location (location "A", "B" or "C") on reference standard NDT1034 to calibrate your equipment to do the subsurface inspection of the internal splice plates at BS 960. When you refer to Table I, it will be necessary to know the airplane variable number and the stringer area where the inspection will be done.

B. Calibrate the equipment as specified in paragraph 4 on reference standard NDT1034, location "A", "B" or "C" as applicable.

C. Do the subsurface inspection of the internal splice plates at BS 960 as follows if you used a spot probe during calibration at location "A" on reference standard NDT1034.

NOTE: Reference standard NDT1034 has alloy steel fasteners. The fasteners on the aircraft could possibly have aluminum rivets and alloy steel fasteners. This will not be a problem during the spot probe inspection if the spot probe scan is not done across the edge of a fastener.

(1) Put the probe on the skin away from the center line of the fasteners and balance the instrument.

(2) Move the probe slowly to the butt splice to make a scan. Make sure the center of the probe goes across the center line of the fasteners.

NOTE: Do not permit the edge of the probe to go across the edge of the fasteners or to get too close to the edge of the skin. This will cause an upscale or vertical indication. Some probes have very good shielding which will permit the probe edge to go to the edge of the skin without a vertical or upscale indication.

(3) Do a scan as specified in 5.C.2 between the first vertical row of fasteners immediately aft and forward of the butt splice at BS 960. Do this scan from stringer 1 to 10 on the left and right sides of the airplane.

NOTE: Do not do an inspection on the lap splices at stringers 1, 6, and 10.

D. Do the subsurface inspection of the internal splice plates at BS 960 as follows if you used a ring probe during calibration at locations "B" or "C" on reference standard NDT1034.

NOTE: This ring probe inspection is to be used on magnetic fasteners that have a head diameter that is 0.262 inch (6.6 mm) to 0.305 inch (7.7 mm).

Splice Plate Inspection at the Butt Splice at BS 960
Figure 13 (Sheet 5)

(1) Put the probe around a fastener at the start of the inspection area at Station 960 (see Detail II). Make sure the fastener is in the center of the ring probe.

(2) Balance the instrument.

(3) Continue to do paragraph 5.D.1 on the remaining fasteners in the inspection area. See Detail II.

6. Inspection Results

NOTE: Make sure the vertical or upscale indications are not caused because the probe scan was done across a fastener edge or too close to the skin edge.

A. Inspection results for instruments that used a spot probe:

(1) Vertical or upscale indications that are 20 percent or more higher than the balance position are possible crack indications. Crack indications occur during a short scan. Compare all indications to the indications from the reference notch on the reference standard.

(2) Do an edge effect check on reference standard NDT1034 as specified in paragraphs 4.A.6 and 4.A.7. See if the indication could be caused by the edge effect from the skin or the edge of a fastener hole.

NOTE: A slow, vertical indication can be caused by a large separation between the layers. For example, the separation between the skins at the lap splices can cause a vertical indication. This type of indication shows during a long scan. Compare these indications to the reference notch indications that show quickly during a short scan.

(3) Examine crack indications more from the internal side of the airplane. Calibrate the equipment as specified in paragraph 4. Do a horizontal scan on the upper ring flange between the collars or rivet ends where the crack indication showed.

Splice Plate Inspection at the Butt Splice at BS 960
Figure 13 (Sheet 6)

B. Inspection results for instruments that used a ring probe:

If an impedance plane instrument is used refer to step 1 below:

(1) Vertical or upscale indications that are 20 percent or more higher than the balance position are possible crack indications. Compare all indications to the indications from the reference notch on the reference standard.

(2) Examine crack indications more from the internal side of the airplane. Calibrate the equipment as specified in paragraph 4. Do a horizontal scan on the upper ring flange between the collars or rivet ends where the crack indication showed.

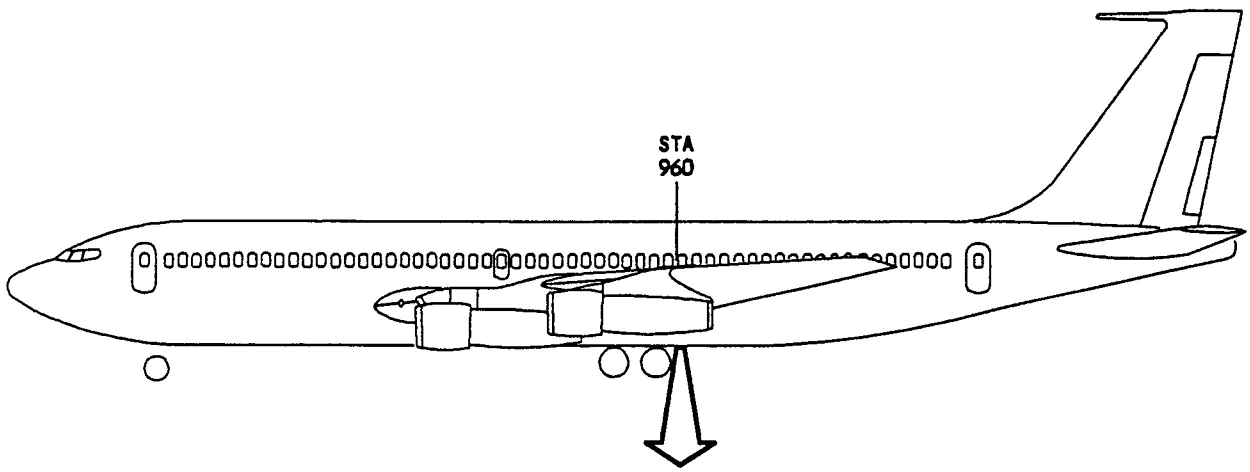
Splice Plate Inspection at the Butt Splice at BS 960
Figure 13 (Sheet 7)

707 AIRPLANES			
AIRPLANE VARIABLE NUMBER	STATION 960 INSPECTION AREA	LOCATION ON REFERENCE STANDARD NDT1034	INSTRUMENT FREQUENCY
1-1999	STRINGER 1-10 (LEFT AND RIGHT)	A	2 kHz
2001 AND ON...	STRINGER 6-10 (LEFT AND RIGHT)	B	200 Hz
2001 AND ON...	STRINGER 1-6 (LEFT AND RIGHT)	C	200 Hz
720 AIRPLANES			
ALL	STRINGER 1-10 (LEFT AND RIGHT)	A	2 kHz

CALIBRATION AND INSPECTION DATA FOR IDENTIFIED AIRPLANES

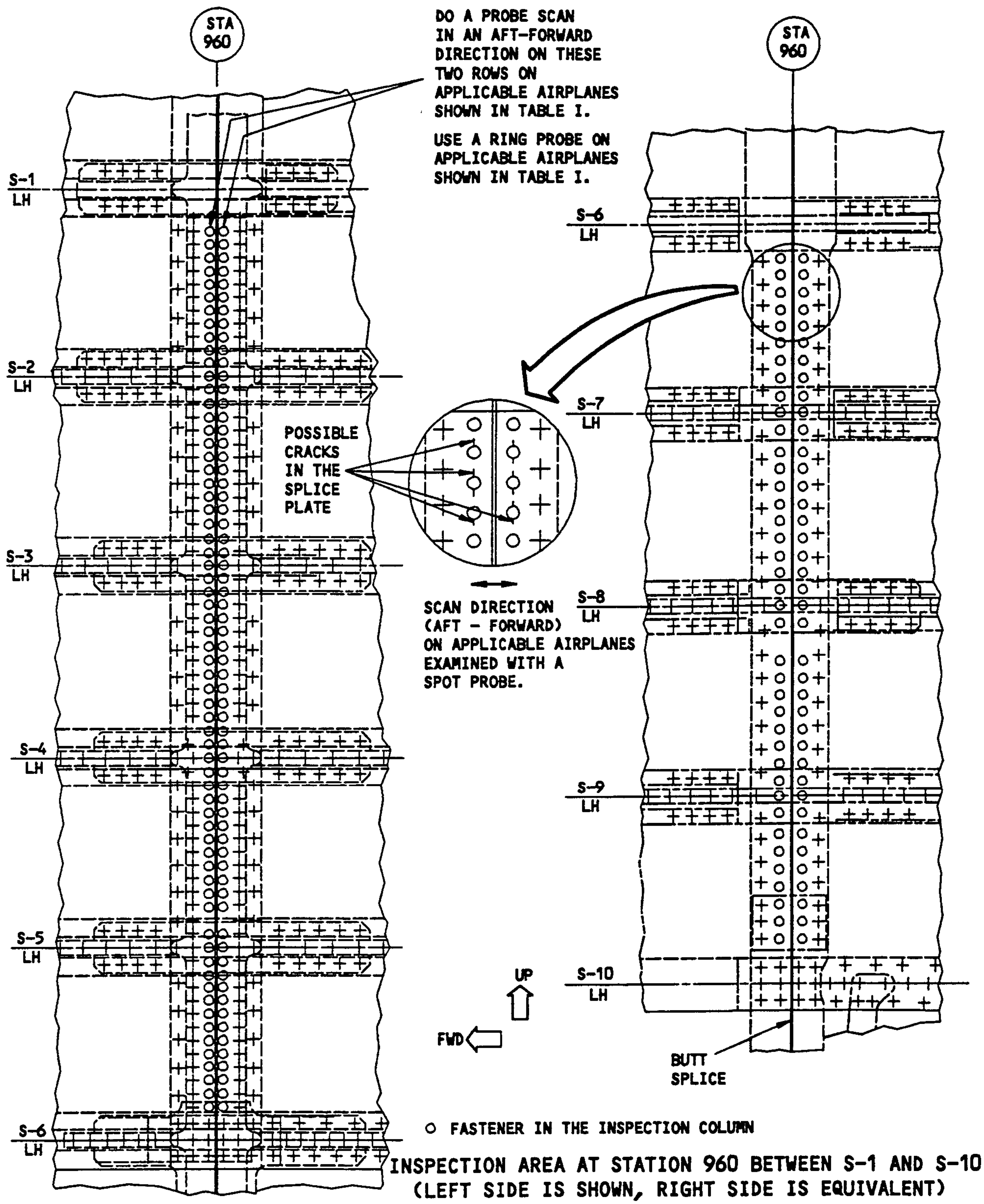
TABLE I

Splice Plate Inspection at the Butt Splice at BS 960
Figure 13 (Sheet 8)



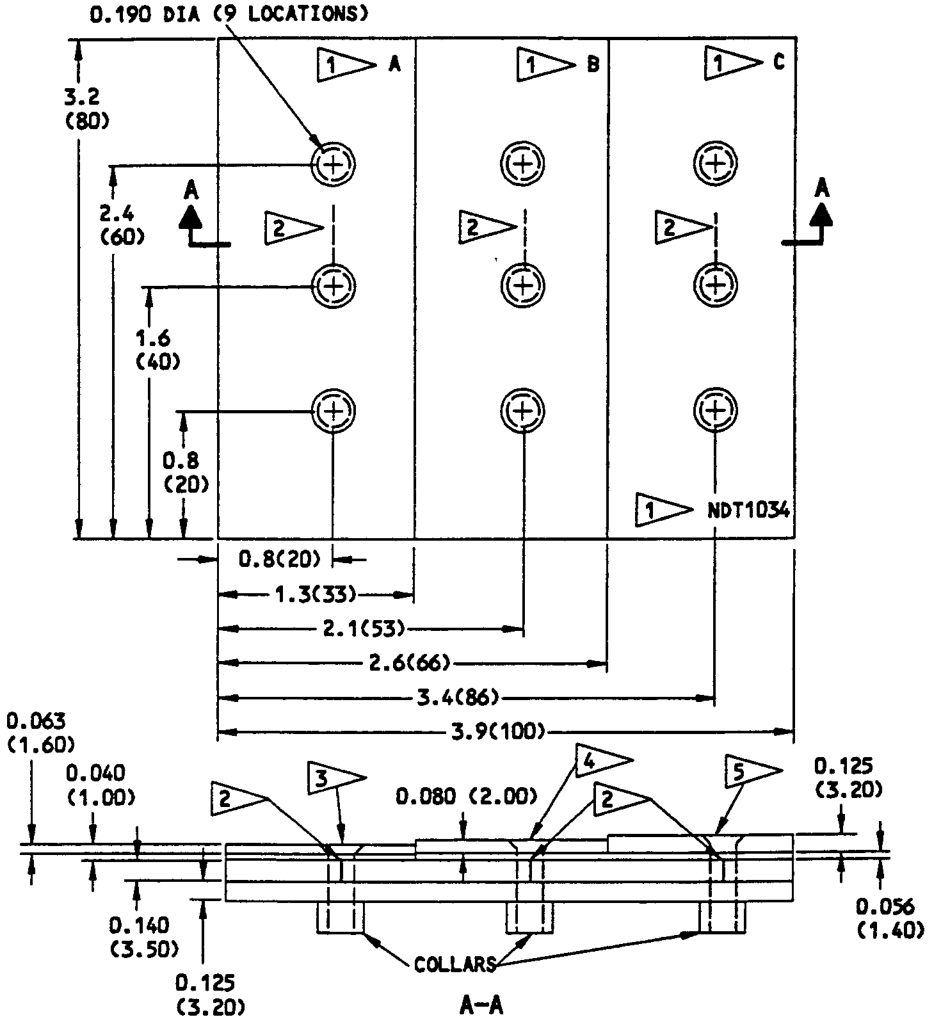
INSPECTION AREA AT STATION 960 BETWEEN S-1 AND S-10
(LEFT SIDE IS SHOWN, RIGHT SIDE IS EQUIVALENT)
DETAIL I

Splice Plate Inspection at the Butt Splice at BS 960
Figure 13 (Sheet 9)



INSPECTION AREA AT STATION 960 BETWEEN S-1 AND S-10
(LEFT SIDE IS SHOWN, RIGHT SIDE IS EQUIVALENT)
DETAIL II

Splice Plate Inspection at the Butt Splice at BS 960
Figure 13 (Sheet 10)



NOTES:

ALL DIMENSIONS ARE IN INCHES (MILLIMETERS ARE IN PARENTHESES)

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

SURFACE ROUGHNESS = 125 R_a OR BETTER

MATERIAL: 2024-T3 OR T4 CLAD

1 ETCH OR STEEL STAMP THE REFERENCE STANDARD NUMBER OR THE LETTER SHOWN.

2 EDM NOTCH OR SAWCUT. THE NOTCH IS TO BE LOCATED WITHIN ±0.005 (±0.10) OF THE CENTER OF THE HOLE.
NOTCH DIMENSIONS: LENGTH: 0.50 (12.7) ±10%
DEPTH: 0.140 (3.5) (THROUGH THICKNESS)
WIDTH: 0.025 (0.63) MAXIMUM

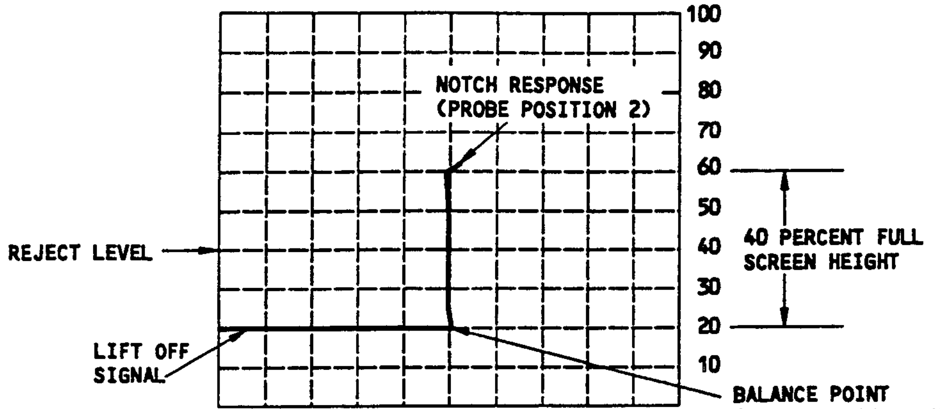
3 BACB30GY6-6 BOLT WITH BACC30K6 OR EQUIVALENT COLLARS (3 LOCATIONS)

4 BACB30GY6-7 BOLT WITH BACC30K6 OR EQUIVALENT COLLARS (3 LOCATIONS)

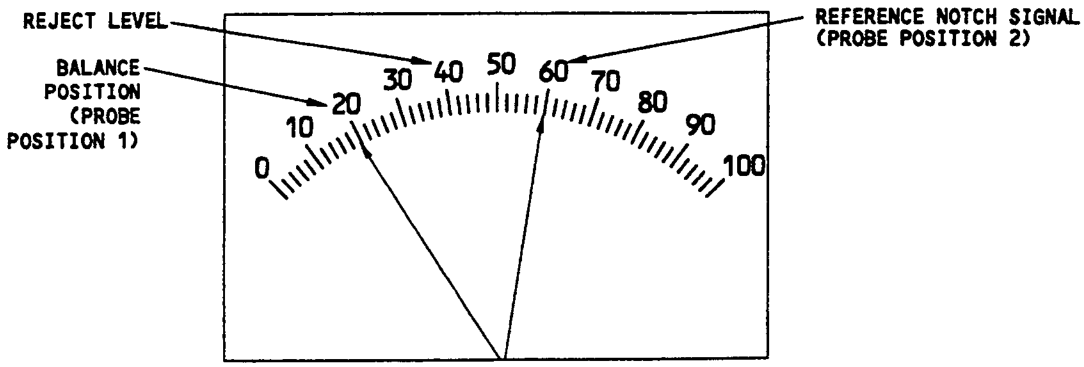
5 BACB30GY6-8 BOLT WITH BACC30K6 OR EQUIVALENT COLLARS (3 LOCATIONS)

REFERENCE STANDARD NDT1034
DETAIL III

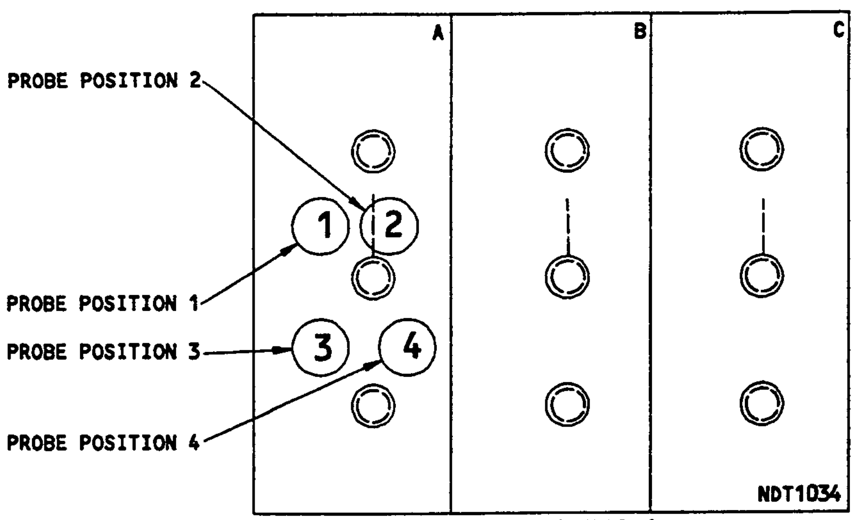
Splice Plate Inspection at the Butt Splice at BS 960
Figure 13 (Sheet 11)



IMPEDANCE PLANE INSTRUMENT DISPLAY
VIEW I



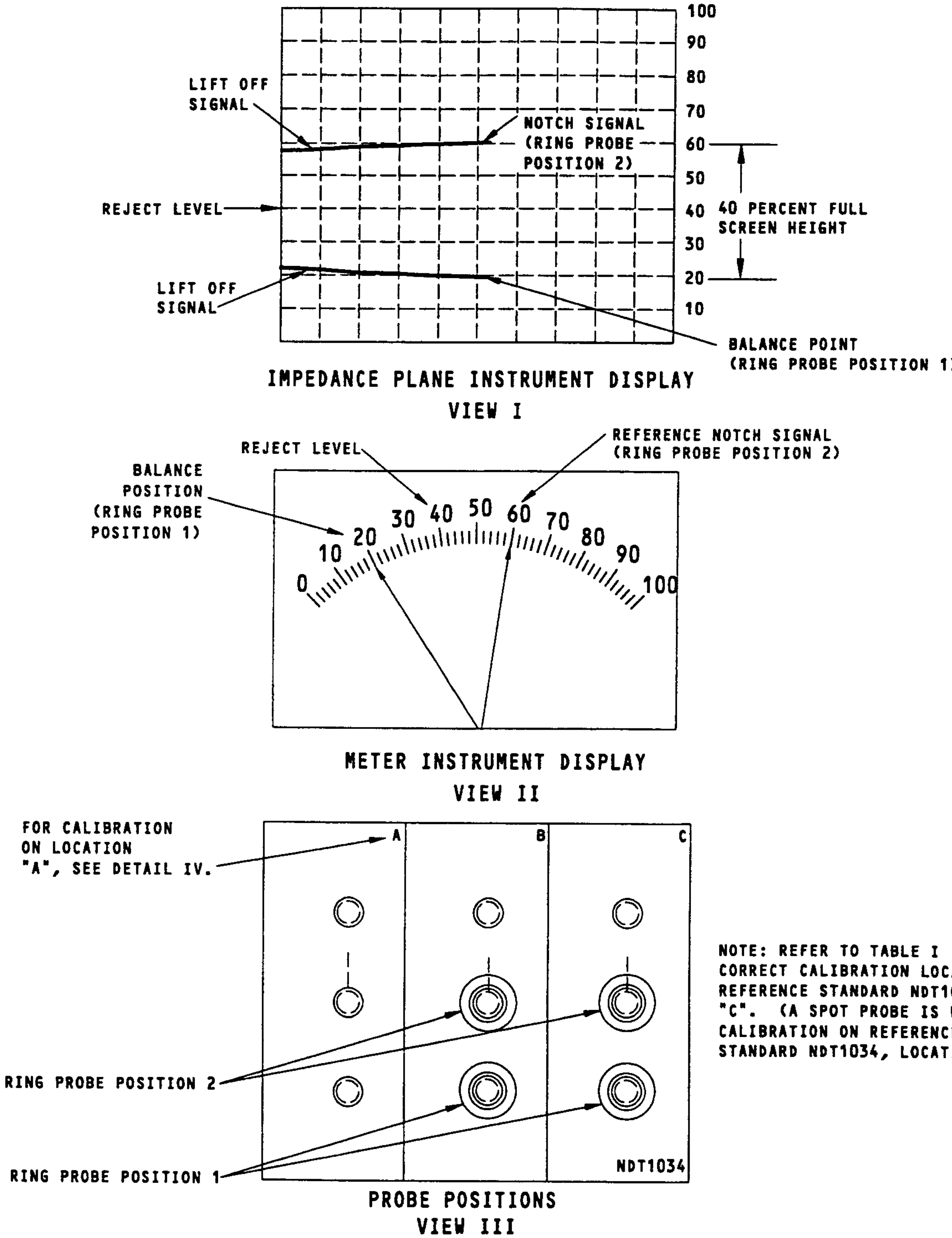
METER INSTRUMENT DISPLAY
VIEW II



PROBE POSITIONS
VIEW III

PROBE POSITIONS AND INSTRUMENT DISPLAYS FOR CALIBRATION
DETAIL IV

Splice Plate Inspection at the Butt Splice at BS 960
Figure 13 (Sheet 12)



NOTE: REFER TO TABLE I FOR THE CORRECT CALIBRATION LOCATION ON REFERENCE STANDARD NDT1034 "B" OR "C". (A SPOT PROBE IS USED FOR CALIBRATION ON REFERENCE STANDARD NDT1034, LOCATION A)

RING PROBE POSITIONS AND INSTRUMENT DISPLAYS FOR CALIBRATION
DETAIL V
Splice Plate Inspection at the Butt Splice at BS 960
Figure 13 (Sheet 13)

E17917

PART 6 - EDDY CURRENT
FUSELAGE SKIN SCRIBE LINE CRACK INSPECTION - LOWER SKIN AT THE EDGES OF LAP JOINTS, EXTERNAL DOUBLERS AND STRUCTURE

1. Purpose

A. Use this surface inspection procedure to find cracks in the lower skin panels of the fuselage at the lap joints. This procedure looks for cracks that can occur from scribe lines on the outside surface of the skin. This procedure looks for cracks in the lower skin panels that are:

(1) 0.200 inch (5.08 mm) long (or more).

(2) Are in the forward and aft direction.

B. This procedure can also be used to find cracks in fuselage skins at the edges of external doublers.

C. This is a high frequency eddy current (HFEC) inspection.

D. The inspection area to examine is an area that begins at the edge of the upper skin of the lap joint or external doubler and extends to 0.063 inch (1.60 mm) from the edge. See Fig. 1 for the inspection area.

E. This inspection uses three specially designed, optional probes on the outside surface of the lower skin.

2. Equipment

A. General

(1) Use inspection equipment that can be calibrated on the reference standard as specified in Par. 4.

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

B. Instrument

(1) Use an eddy current instrument that:

(a) Operates at a frequency from 50 to 70 kHz.

(b) Has an impedance plane display.

(2) The instruments that follow were used to help prepare this procedure.

(a) Phasec 2200, Phasec 2; Hocking

(b) Elotest B1; Rohmann GmbH

(c) Nortec 1000/2000; Staveley Instruments

C. Probe

(1) The probes that follow can be used to do inspections at the edges of aluminum structure.

(a) SPC-345, which is made by EC/NDT. This is a sliding probe that is specially designed to do this procedure on all areas but the butt joint gaps and areas with steel doublers.

(b) NEC-1006, which is made by NDT Engineering Corp. This is a specially designed, right angle, shielded, pencil probe that can be used as an alternative to the sliding probe. This pencil probe can be used to examine all areas but the edges of steel structure.

(2) Use a specially designed sliding probe, SPC-520B (0.125 inch (3.18 mm) wide), to do inspections at the edges of steel structure.

D. Reference Standard

(1) Use reference standard NDT3065 to calibrate for inspections at the edge of aluminum structure. See Fig. 2.

(2) Use reference standard NDT3065-STL to calibrate for inspections at the edge of steel structure. See Fig. 3.

3. Preparation for Inspection

CAUTION: REMOVE SEALANT CAREFULLY TO PREVENT DAMAGE TO THE SURFACE OF THE SKIN. SEE THE STANDARD OVERHAUL PRACTICES MANUAL (SOPM) FOR MORE INSTRUCTIONS IF NECESSARY.

A. Remove the sealant from the inspection surface at the lower skin of the lap joint and doubler edges before inspection.

B. Service experience has shown that crack indications can be missed because of human-factors such as:
- Not fully understanding the inspection procedures.
- Incorrect or defective NDT reference standards.
- Incorrect equipment set-up and calibration before the inspection.
- Incorrect monitoring of the NDT instrument display.
- Not sufficient time permitted to do the inspections.
- Not sufficient access to the inspection areas.
- Incorrect records made of areas not examined or remaining to be examined because of work shift changes or breaks during the inspection that result in areas missed.
- Incorrect records made of inspection results.

Take steps to make sure that the human factors specified above, as well as other human-factors, do not occur during this inspection.

C. Get sufficient access to the inspection area. The inspector must keep the probe in touch with the inspection surface at the correct angle.

4. Instrument Calibration

A. Set the instrument frequency to 50 to 70 KHz.

B. Set the vertical gain 12 to 16 dB higher than the horizontal gain.

C. If the inspection area is painted, put a nonconductive shim on the reference standard (See NOTE). The thickness of the shim must be equivalent (±0.003 inch (0.08 mm)) to the paint thickness on the inspection area.

NOTE: Use reference standard NDT3065 to do this procedure at lap joints and aluminum doublers. Use NDT3065-STL to do this procedure at the edges of 301 (1/2 hard) CRES doublers.

D. Put a piece of thin tape on the tip of the probe to prevent scratches to the surface.

E. Put the probe on the inspection surface (lower piece) of reference standard NDT3065 or NDT3065-STL between notch locations identified as “A” and “B”. See Figure 4, Detail I for probe NEC-1006, Detail III for probe SPC-345 and Detail IV for probe SPC-520B. Make sure the side of the SPC-345 probe that has the line is against the edge of the reference standard. Make sure the line on the side of the SPC-520B probe is aligned as shown in Fig. 4, flag note 3.

NOTE: Only the SPC-345 and SPC-520B probes have a line. The line on the probe identifies the eddy current coil location.

F. Make sure the probe is against the edge of the upper piece and is perpendicular to the inspection surface at all times during the calibration.

G. Balance the instrument.

H. Set the instrument balance point to the lower center area of the screen display as shown in Figure 4, Detail II for SPC-345 and NEC-1006 probes and Detail V for SPC-520B probes.

I. Lift the probe off the surface and adjust the instrument phase control to get the lift-off signal to move horizontally from right to left. Make sure the probe is against the top piece during the lift-off adjustment.

J. Move the probe across the notch identified as “B” in the reference standard.

K. Find the probe position on the notch that gives the maximum signal height and adjust the instrument gain to get the signal to 40% of full screen height (FSH) higher than the balance point. See Figure 4, Detail II for SPC-345 and NEC-1006 probes and Detail V for SPC-520B probes.

L. For probe NEC-1006, turn the probe 180 degrees and do steps 4.J. and 4.K. again. If the signal is less than 40% of FSH, do the calibration again. If there is a difference in the signal heights when the probe is turned, make sure you position the probe for calibration that gives the lowest signal. Use the same probe position to do the scan inspection on the airplane that you used during the calibration.

M. For SPC-345 and NEC-1006 probes, set the audible alarm to 50% of the signal height (20% of FSH higher than the balance point) as shown in Figure 4, Detail II. For SPC-520B probes, set the alarm level to 70% of FSH as shown in Fig. 4, Detail V.

N. Move the probe across the notch in the reference standard to find the maximum scan speed. The speed is too fast if the signal decreases more than 10% of the signal height or the alarm does not operate.

O. Move the probe across the notch identified as "A" and monitor the signal. The signal must be equal to or more than the signal from notch "B"

P. The EDM notches identified as "C" and "D" are not used for this inspection procedure.

5. Inspection Procedure

A. Calibrate as specified in paragraph 4.

B. Put the probe against the edge of the upper skin of the lap splice or external doubler at a location where there is no visible scribe line and balance the instrument. See Fig. 1 for a typical probe position. For the SPC-345 or SPC-520B probes, make sure the side of the probe that has a line is aligned with the edge of the structure as shown in Fig. 1. If there is no location on the skin panel to be examined where there is no visible scribe line, do the steps that follow:

NOTE: Only the SPC-345 and SPC-520B probes have a line. The line on the probe identifies the eddy current coil location.

(1) Put the probe approximately 0.50 inch (13 mm) away from the edge of the upper skin or doubler.

(2) Balance the instrument.

(3) Move the probe to the edge of the upper skin or doubler and monitor the signal on the screen display.

(a) If the signal does not move in the upward direction, balance the instrument again and go to par. 5.C. Use this location to balance the instrument when you examine the skin panel.

(b) If the signal moves in the upward direction as the probe is moved to the edge of the upper skin or doubler, do par. 5.B.(1) thru par. 5.B.(3) again at a different location. Continue to do par. 5.B.(1) thru par. 5.B.(3) until the signal does not move in the upward direction. If there is no location where the signal does not move in the upward direction as the probe is moved toward the edge of the skin or doubler, use a balance point that is away from the skin edge when you examine the skin panel.

C. Keep the probe against the edge of the upper skin of the lap splice or the external doubler and perpendicular to the surface at all times during the inspection scan.

D. Make a scan of the areas specified by the applicable service bulletin or inspection instructions.

E. Move the probe to do a scan at all visual scribe lines found that are 1.0 inch (25 mm) or less from the edge of the lap joint or external doubler.

6. Inspection Results

A. When the SPC-345 or NEC-1006 probes are used, signals that are 20% of FSH (or higher) than the balance point, are possible crack indications. When the SPC-520B probe is used, signals that are 40% of FSH (or higher) than the balance point, are possible crack indications. Make a mark on the skin surface of all possible crack indications with a grease pencil, felt pen or wax pencil.

B. Compare the signal that occurs during the inspection to the signal you got from the notch in the reference standard.

C. Do more analysis of signals that are possible cracks as follows:

(1) Put the probe on the lower skin, away from the area of the possible crack and approximately 0.50 inch (13 mm) away from the edge of the upper skin.

(2) Balance the instrument.

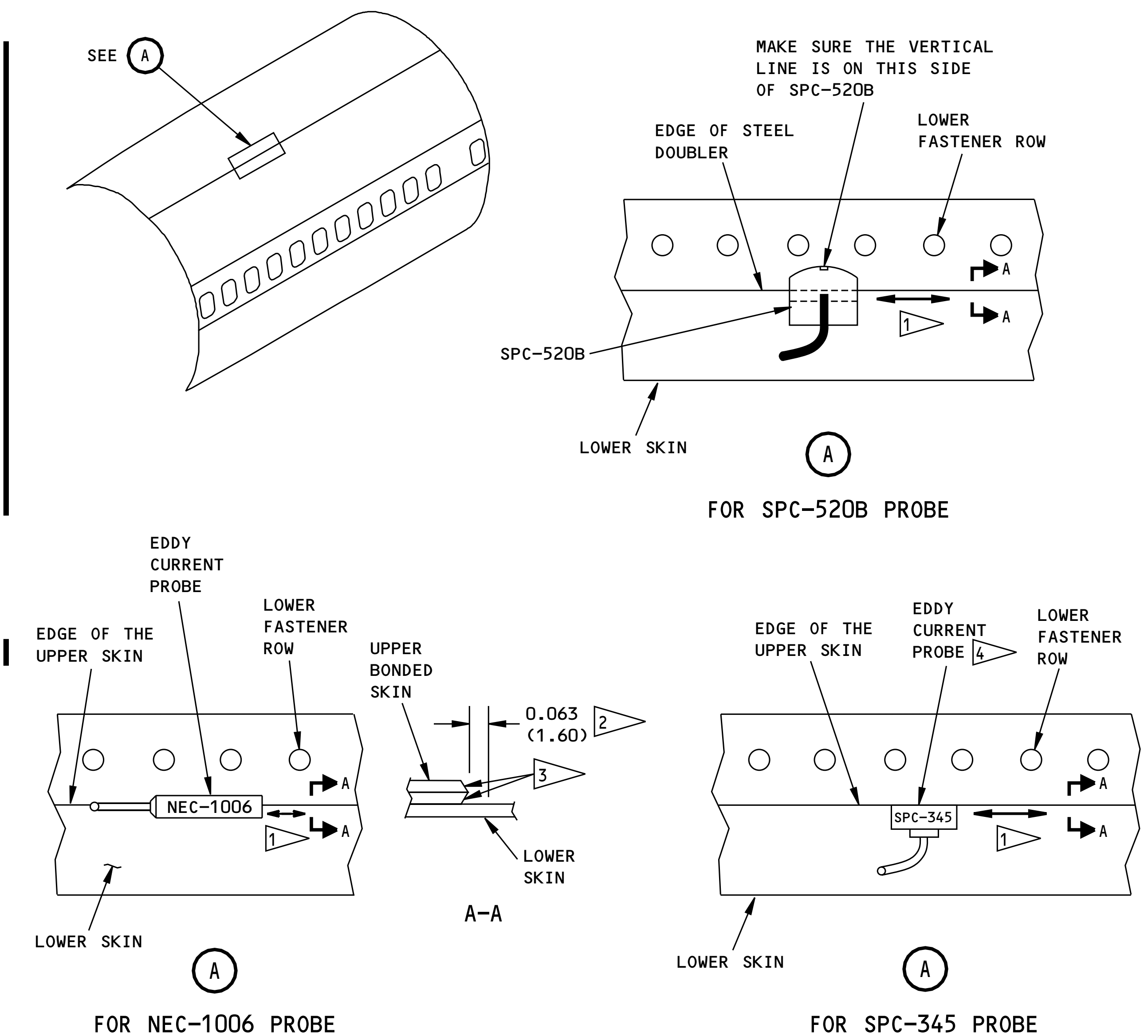
(3) Move the probe to the edge of the upper skin in an area away from the possible crack location and monitor the signal on the screen display. The edge of the upper skin will cause the signal (edge effect) to go in the downward direction from the balance point.

(4) Move the probe to and from the edge of the upper skin as you move the probe into the area of the possible crack signal and monitor the signal on the screen display. A possible crack will cause the signal to go in the upward direction.

D. If the crack indication is at a scribe line that is 0.063 inch (1.60 mm) or less below the edge of the upper skin, do an ultrasonic phased array inspection to make sure there is a crack. Refer to Part 4, 53-30-06.

(1) If a crack indication occurs during the phased array inspection, refer to the applicable Service Bulletin for instructions. If a crack indication does not occur during the phased array inspection, accept the eddy current crack indication as false.

NOTE: False eddy current indications can be caused by a decrease in the conductive clad material.



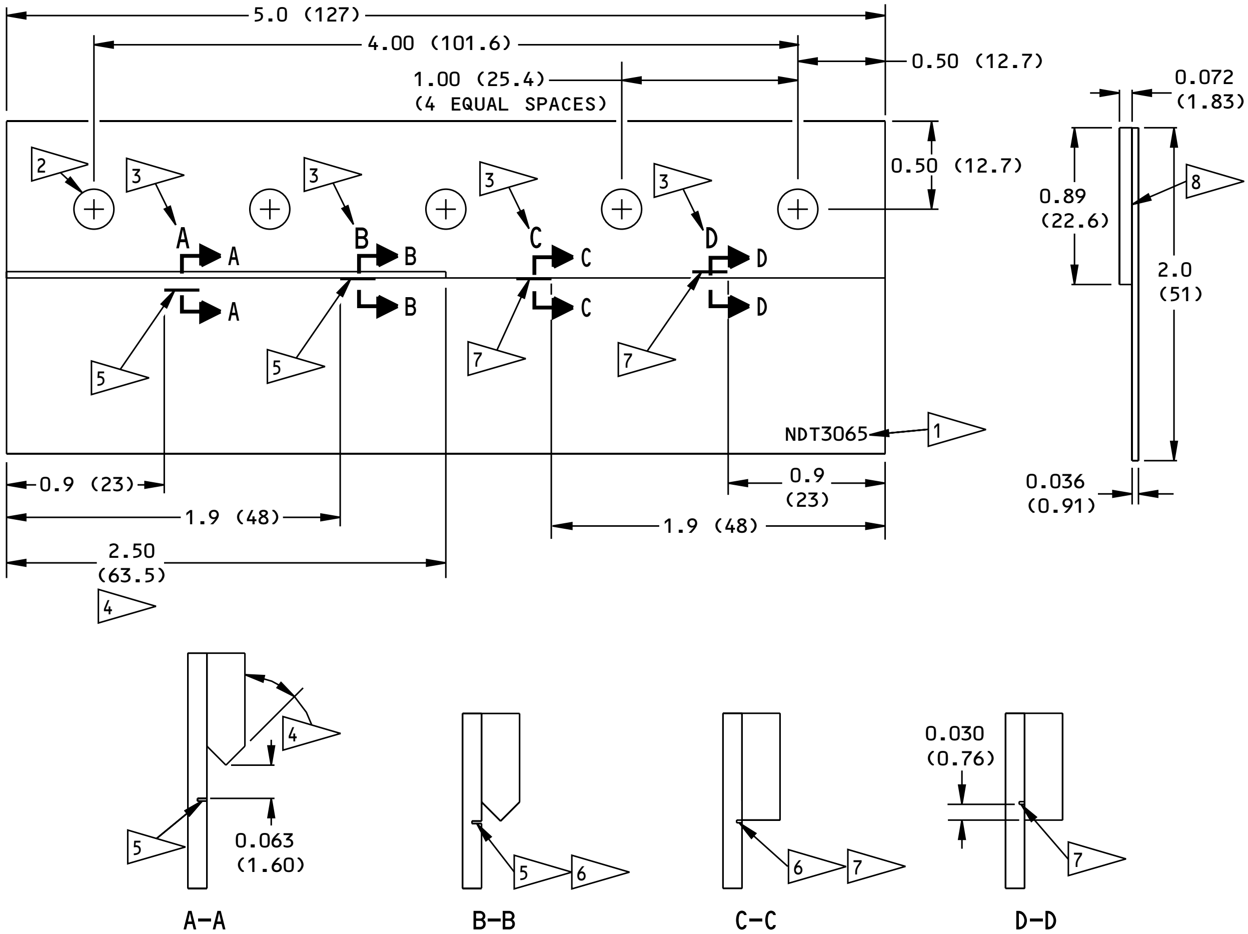
NOTES:

- DIMENSIONS ARE IN INCHES (MILLIMETERS ARE IN PARENTHESES)

1. POSSIBLE CRACK DIRECTION IN THE LOWER SKIN.
2. APPROXIMATE INSPECTION AREA.
3. CHAMFER LOCATION, SIZE AND SHAPE CAN BE DIFFERENT
4. MAKE SURE THE VERTICAL LINE ON THE SPC-345 PROBE IS AGAINST THE EDGE OF THE UPPER SKIN.

PROBE ON THE LOWER SKIN OF THE LAP SPLICE

Inspection Areas
Figure 1



NOTES:

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

INCHES	MILLIMETERS
X.XXX = ±0.005	X.XX = ±0.1
X.XX = ±0.025	X.X = ±0.5
X.X = ±0.050	X = ±1

- SURFACE ROUGHNESS: 63 Ra OR BETTER
- MATERIAL: ALUMINUM (CLAD OR BARE)

1 ETCH OR STEEL STAMP THE REFERENCE STANDARD NUMBER NDT3065

2 BACR15CE5D4 OR BACR15GF5D4 (5 LOCATIONS).

3 ETCH OR SCRIBE THE LETTER ON THE SURFACE OF THE TOP PIECE TO IDENTIFY THE LOCATION OF THE EDM NOTCH AND THE PROBE POSITION FOR THE INSTRUMENT CALIBRATION.

4 45 DEGREE DOUBLE BEVEL WITH THE END OF THE BEVEL AT THE CENTER OF THE THICKNESS OF THE PIECE.

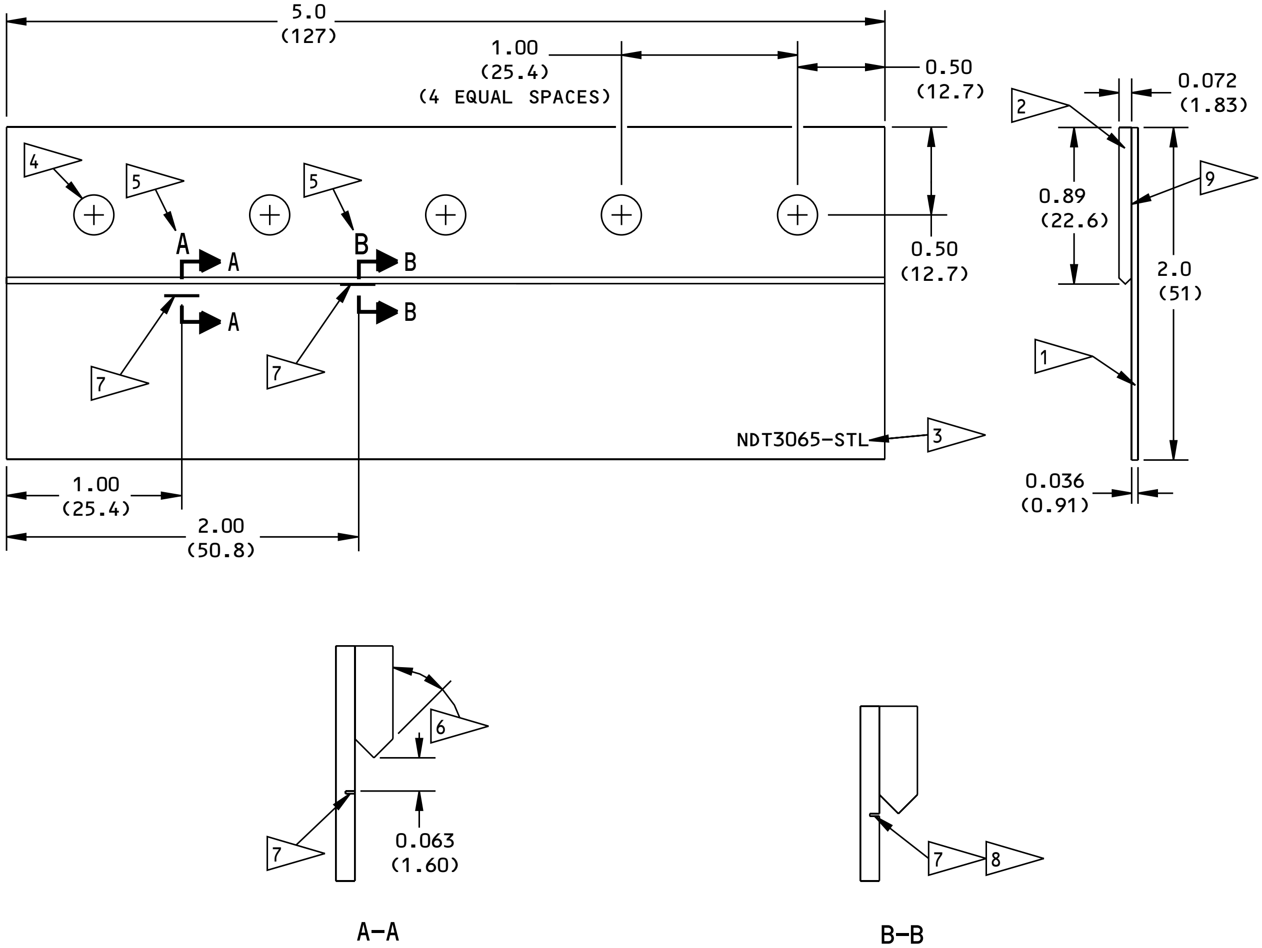
5 EDM NOTCH:
LENGTH: 0.200 (5.08) ±0.010 (0.25)
DEPTH: 0.018 (0.46) ±0.002 (0.05)
WIDTH: 0.005 (0.13) ±0.002 (0.05)

6 PUT THE EDM NOTCH FLUSH (±0.005 (0.13)) WITH THE END OF THE BEVEL AS SHOWN IN SECTION B-B AND FLUSH (±0.005 (0.13)) WITH THE END OF THE SQUARE EDGE AS SHOWN IN SECTION C-C.

7 EDM NOTCH:
LENGTH: 0.200 (5.08) ±0.010 (0.25)
DEPTH: 0.010 (0.25) ±0.002 (0.05)
WIDTH: 0.005 (0.13) ±0.002 (0.05)

8 APPLY FAY SURFACE SEALANT, BMS 5-95, CLASS B BETWEEN THE TOP AND BOTTOM PIECES AS SPECIFIED IN BAC 5000. MAKE SURE THE SEALANT DOES NOT EXTEND BEYOND THE FAYING SURFACE.

Reference Standard NDT3065
Figure 2



NOTES:

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

INCHES	MILLIMETERS
X.XXX = ±0.005	X.XX = ±0.1
X.XX = ±0.025	X.X = ±0.5
X.X = ±0.050	X = ±1

- SURFACE ROUGHNESS: 63 Ra OR BETTER

1 ALUMINUM (CLAD OR BARE)

2 301 (1/2 HARD) CRES

3 ETCH OR STEEL STAMP THE REFERENCE STANDARD NUMBER NDT3065-STL

4 BACR15CE5D4 (5 LOCATIONS)

5 ETCH OR SCRIBE THE LETTER ON THE SURFACE OF THE TOP PIECE TO IDENTIFY THE LOCATION OF THE EDM NOTCH AND THE PROBE POSITION FOR THE INSTRUMENT CALIBRATION.

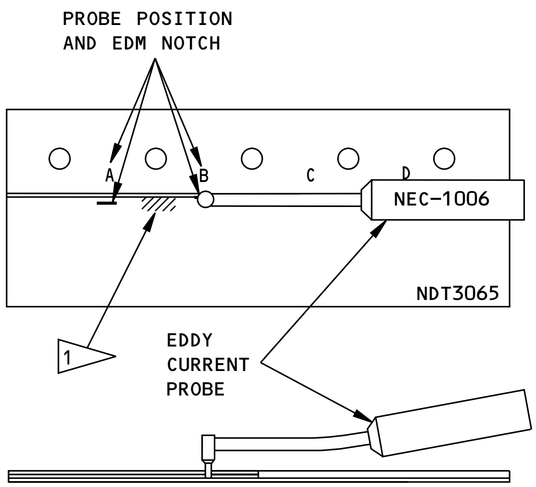
6 45 DEGREE DOUBLE BEVEL ALONG THE FULL LENGTH

7 EDM NOTCH:
LENGTH: 0.200 (5.08) ±0.010 (0.25)
DEPTH: 0.018 (0.46) ±0.002 (0.05)
WIDTH: 0.005 (0.13) ±0.002 (0.05)

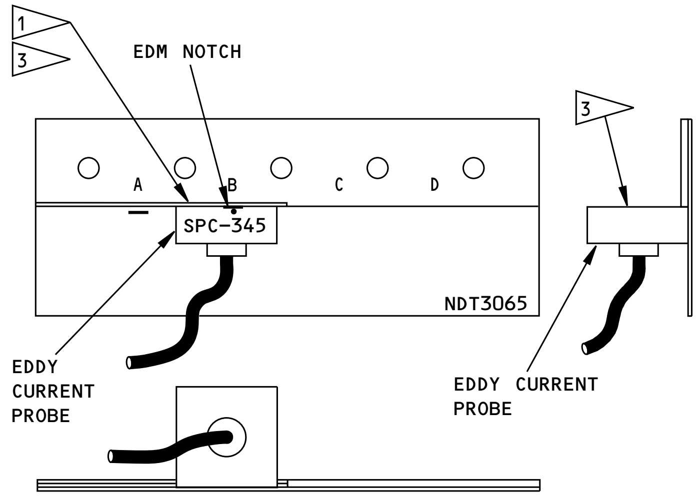
8 PUT THE EDM NOTCH FLUSH WITH THE END OF THE BEVEL AS SHOWN IN SECTION B-B TO 0.003 (0.076) BEYOND THE EDGE OF THE BEVEL.

9 APPLY FAY SURFACE SEALANT, BMS 5-95, CLASS B BETWEEN THE TOP AND BOTTOM PIECES AS SPECIFIED IN BAC 5000. MAKE SURE THE SEALANT DOES NOT EXTEND BEYOND THE FAYING SURFACE.

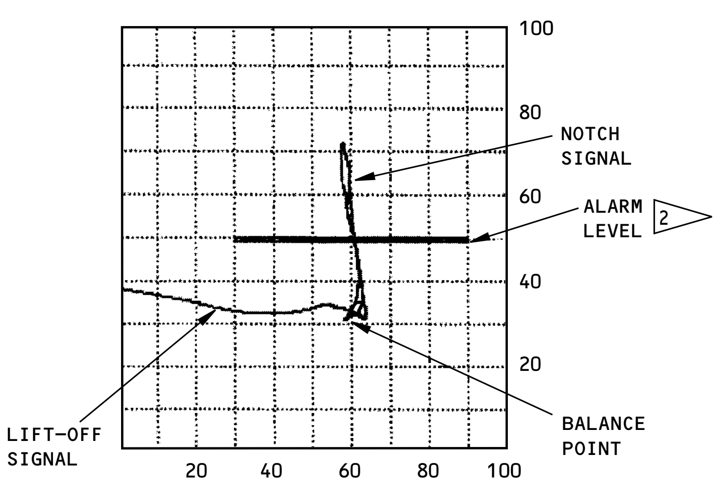
Reference Standard NDT3065-STL
Figure 3



NEC-1006 PROBE POSITION ON THE REFERENCE STANDARD
DETAIL I

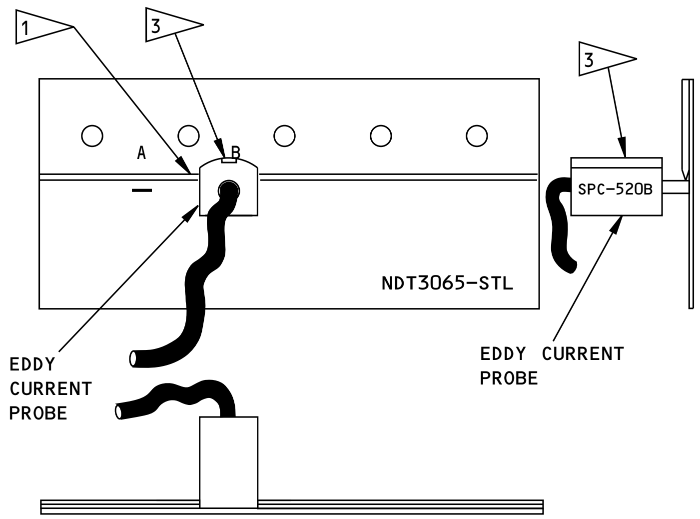


SPC-345 PROBE POSITION ON THE REFERENCE STANDARD
DETAIL III

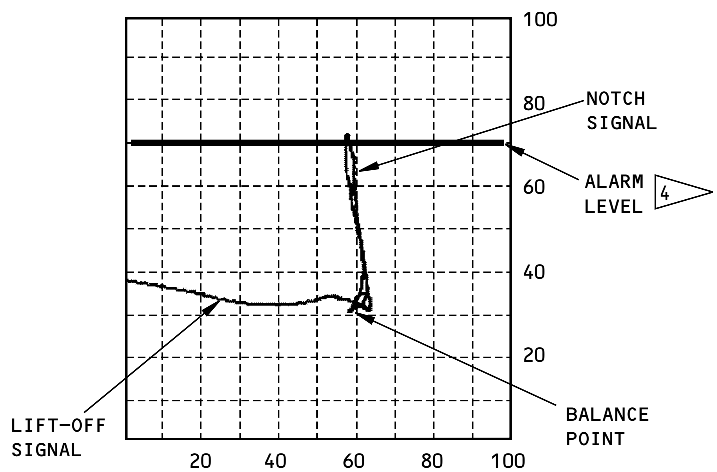


SCREEN DISPLAY
DETAIL II

Instrument Calibration
Figure 4 (Sheet 1)



SPC-520B PROBE POSITION ON THE REFERENCE STANDARD
DETAIL IV



SCREEN DISPLAY
DETAIL V

NOTES:

- THE SCREEN DISPLAY SHOWN IN DETAILS II AND V ARE EXAMPLES. DIFFERENT INSTRUMENTS AND PROBES CAN CAUSE DIFFERENT DISPLAYS.

1 PROBE POSITION TO SET LIFT-OFF AND BALANCE THE INSTRUMENT

2 THE ALARM LEVEL SHOWN IN DETAIL II IS SET TO 50% OF FULL SCREEN HEIGHT (FSH) (20% OF FSH HIGHER THAN THE BALANCE POINT).

3 THE LINE ON THE SIDE OF THE EDDY CURRENT PROBE IDENTIFIES THE LOCATION OF THE COIL. BALANCE THE INSTRUMENT WITH THE LINE AT THIS LOCATION.

4 THE ALARM LEVEL SHOWN IN DETAIL V IS SET TO 70% OF FULL SCREEN HEIGHT (FSH) (40% OF FSH HIGHER THAN THE BALANCE POINT).

Instrument Calibration
Figure 4 (Sheet 2)

PART 6 - EDDY CURRENT
INSPECTION FOR CRACKS THAT ARE ON THE BACK SIDE AND NOT FULLY THROUGH THE THICKNESS OF AN ALUMINUM PART

1. Purpose

   A. This subsurface eddy current inspection can be used to examine aluminum parts for cracks that occur on the back side and do not go through the full thickness. The part can be a skin, doubler, web or equivalent type of part.

   B. This inspection is done with a subsurface eddy current probe and an impedance plane display instrument. Scans must be done perpendicular to a subsurface edge to find cracks that are along the subsurface edge.

   C. The thickness of the part to be examined must be known before this inspection can be done.

2. Equipment

   A. Instruments

      (1) All eddy current instruments that have an impedance plane display are permitted for use if they:

         (a) Can operate between 2 and 40 KHz. The frequency must be adjustable in 1 KHz increments.

         (b) Can find the reference notch in the reference standard as specified in the calibration instructions of this procedure.

      (2) The instruments that follow were used to help prepare this procedure:

         (a) NDT 19e; Nortec / Staveley

         (b) Phasec 2200; Hocking / Krautkramer

   B. Probes

      (1) It is necessary to use a spot probe to do this inspection. The spot probe must operate between 2 and 40 KHz. The spot probe diameter must not be more than 0.50 inch (12.7 mm). When this procedure is used internally at lap joint locations, use a 90 degree angle probe.

      (2) The spot probes that follow operated satisfactorily when this procedure was made. Other probes can be used if they can find the notch in the reference standard as specified in the calibration instructions of this procedure.

         (a) SPO-5328; Nortec/Staveley (Reflection probe)

         (b) SPO-5327; Nortec/Staveley (Reflection probe)

(c) SNG 0.375/31/25K; NDT Engineering (this probe has a spring loaded collar)

(d) NEC1005; NDT Engineering (Reflection probe, 90 degree angle)

(e) SPO-5329; Nortec/Staveley (Reflection probe)

(f) NEC1084; NDT Engineering (Reflection probe, 90 degree angle)

(g) NEC1095; NDT Engineering (Reflection probe, 90 degree angle)

(h) SPC-4TF-105-2R; EC/NDT (Reflection probe, 90 degree angle)

(i) NEC1089; NDT Engineering (Reflection probe, 90 degree angle)

NOTE: For smaller diameter probes, a collar attached around the probe will make the probe scan more stable. If a collar is used, it must be adjusted so that the probe satisfactorily touches the part.

C. Reference Standard

(1) Make reference standard(s) NDT1085-XXX. The reference standard drawing shown in Fig. 2 shows 10 reference standards with different upper layer thicknesses. Make the reference standard(s) that will be nearest the thickness of the part to be examined (within +/- 0.007 inch (0.18 mm)).

NOTE: If you have reference standard NDT396, then you do not have to make reference standard NDT1085-036. Reference standard NDT396 can be used to examine parts that are 0.033 to 0.040 inch (0.84 to 1.0 mm) thick.

3. Prepare for the Inspection

A. Make sure that the instrument, probe, reference standard and the inspection area are at the same temperature.

B. Get access to the inspection area on the side of the part where the scans will be done.

C. Make sure the part is clean and has no rough paint in the inspection area.

D. Teflon tape on the end of the probe that is not more than 0.004 inch (0.10 mm) thick will make it easier to do the scans, but it is not necessary. The probe can possibly scratch the part if the scans are done without Teflon tape on the probe. If you make a decision to use the Teflon tape on the probe, make sure it is put on the probe before calibration.

NOTE: Some airplanes have sound dampening aluminum foil installed in some areas on the internal side of the airplane. Do not do this inspection through the aluminum foil. Move the aluminum foil from the inspection area before you do the inspection from the internal side of the skin. Do not scratch, scribe or damage the airplane when you move the aluminum foil. Also, remove the adhesive from the skin. Make sure you install the aluminum foil after the inspection.

4. Calibration

NOTES: (1) Refer to the equipment instruction manual as necessary for equipment operation instructions.

(2) If the part to be examined is painted, put approximately 0.006 inch (0.15 mm) of transparent, nonconductive tape on the reference standard before calibration.

(3) If the part has a nonconductive finish that is 0.003 inch (0.076 mm) thick or less, such as primer, it is not necessary to put nonconductive tape on the reference standard before calibration.

A. Identify the thickness of the part that will be examined.

B. Go to Table 1 in Fig. 3 to identify the correct reference standard to use and the instrument frequency for the calibration and inspection. Use the reference standard that is in the range of thicknesses specified in Table 1.

(1) Set the instrument to the applicable frequency specified in Table 1.

NOTE: During calibration, the calibration frequency can be adjusted higher or lower than the frequency specified in Table 1 (see Fig. 3).

(2) Set the high pass (HP) filter to off (0 Hz).

(3) Set the low pass (LP) filter to the minimum value that does not decrease the amplitude of the signals at normal scan speeds. If the low pass filter is too low, and the scan speed is increased during the inspection, it is possible to not see a crack indication.

C. Put the probe at position 1 (double layer) on the reference standard that you identified in para. 4.B. See Fig. 3, Detail A.

D. Balance the instrument.

E. Adjust the balance point signal so that it is 30 percent of full screen height.

NOTE: The vertical gain must be approximately 14 to 20 db higher than the horizontal gain.

F. Set lift-off so that the signal moves in a horizontal direction to the left. See Fig 3, Detail B.

G. Do a probe scan away from the reference notch so that the probe goes across the edge of the second layer. Monitor the signals on the screen display and stop the probe when it is on the single layer. See Fig. 3, Detail A, probe position 1 and 2 and Detail B.

(1) If the end point of the single layer signal is higher than the balance point of the double layer signal, (as shown in Fig. 3, Detail E) increase the frequency and adjust the phase to get the signals to look equivalent to Fig 3, Detail B.

(2) If the end point of the single layer signal is lower than the balance point of the double layer signal (as shown in Fig. 3, Detail D), decrease the frequency and adjust the lift-off to get the signals to look equivalent to Fig 3, Detail B.

H. Do a probe scan as specified in par. 4.G. and monitor the signal on the display. Make sure there is less than a 5 percent of full screen height difference between the balance point of the double layer signal and the end point of the single layer signal.

I. If necessary, continue to adjust the frequency and lift-off angle so that the balance point of the double layer signal and the end point of the single layer signal are almost equivalent to the signals shown in Fig. 3, Detail B.

J. Put the probe at position 3 and do a minimum of three probe scans across the reference notch (probe position 3 to 4 and back) and monitor the notch signal. See Fig 3, Details A and C.

K. Adjust the gain so that the signal from the reference standard notch is 30 percent of full screen height above the balance point as shown in Fig. 3, Detail C.

L. Make sure the lift-off is horizontal and to the left.

M. Do a scan across the notch and make small increases in the scan speed to see if the notch signal decreases. If the notch signal decreases, increase the value for the low pass filter a small quantity.

5. <u>Inspection Procedure</u>

A. Calibrate the instrument as specified in par. 4.

B. Put the probe on the part in the inspection area.

C. Balance the instrument and make sure the lift-off goes horizontally to the left as shown in Fig. 3, Detail B.

D. Do the probe scans in the inspection area so that the probe scans are at 90 degrees to the direction of possible cracks. During the probe scans:

NOTE: It is important to know the direction that the subsurface cracks can occur before you do the probe scans.

(1) If necessary, make small adjustments to the frequency and lift-off to get the single layer signal and the double layer signal at the same screen heights, or almost the same screen heights, as the signal shown in Fig. 3, Detail B. Do not adjust the gain.

(2) It is not necessary to calibrate on the reference standard again after you adjust the frequency for the airplane if the skin thickness is within the range of Table 1 specified in Fig. 3.

(3) Monitor the instrument for crack signals. Make sure you can identify subsurface edge signals as compared to crack signals. See Fig. 3 for these different signals.

NOTE: It is possible that the inspection area that you examine does not have a second layer edge to scan across. This would prevent the adjustments in para. 5.D.(1). This will be permitted, however, it is important to make sure the lift-off goes horizontally to the left while you do the scans.

CAUTION: DO NOT CHANGE THE GAIN ADJUSTMENT THAT WAS SET DURING THE CALIBRATION. IF THE GAIN IS CHANGED DURING THE INSPECTION, THE INSPECTION WILL BE UNSATISFACTORY.

(4) Make sure the probe scans are one probe diameter or less from each other during the inspection.

NOTE: If a collar is used on a probe, make sure each probe scan is the diameter of the probe and not the diameter of the collar.

6. Inspection Results

A. All signals that are almost the same as the notch signal from the reference standard are crack indications. Also, signals that are 15 percent of full screen height (or more) above the balance point are crack indications. See Fig. 3, Detail C for the reject level.

B. Some signals can go up on the screen display and stay there during the scan. These types of signals can occur if material has been removed from the back of the part because of corrosion or grinding.

C. If signals equivalent to those specified in par. 6.A. are found, do the steps that follow:

(1) Get access to the back side of the part where the indication was found. It can be necessary to remove structure to get access to the back side of the part.

(2) Do a surface eddy current scan on the back side of the part that caused the crack indication to occur. Refer to Part 6, 51-00-00, Fig. 23 for the surface inspection.

(a) Make sure the probe scans are done in the same direction that caused the indication to occur with the subsurface probe.

D. If signals equivalent to those specified in par. 6.B. are found, do the steps that follow:

(1) Get access to the far side of the part where the indication was found. It can be necessary to remove structure to get access to the back side of the part.

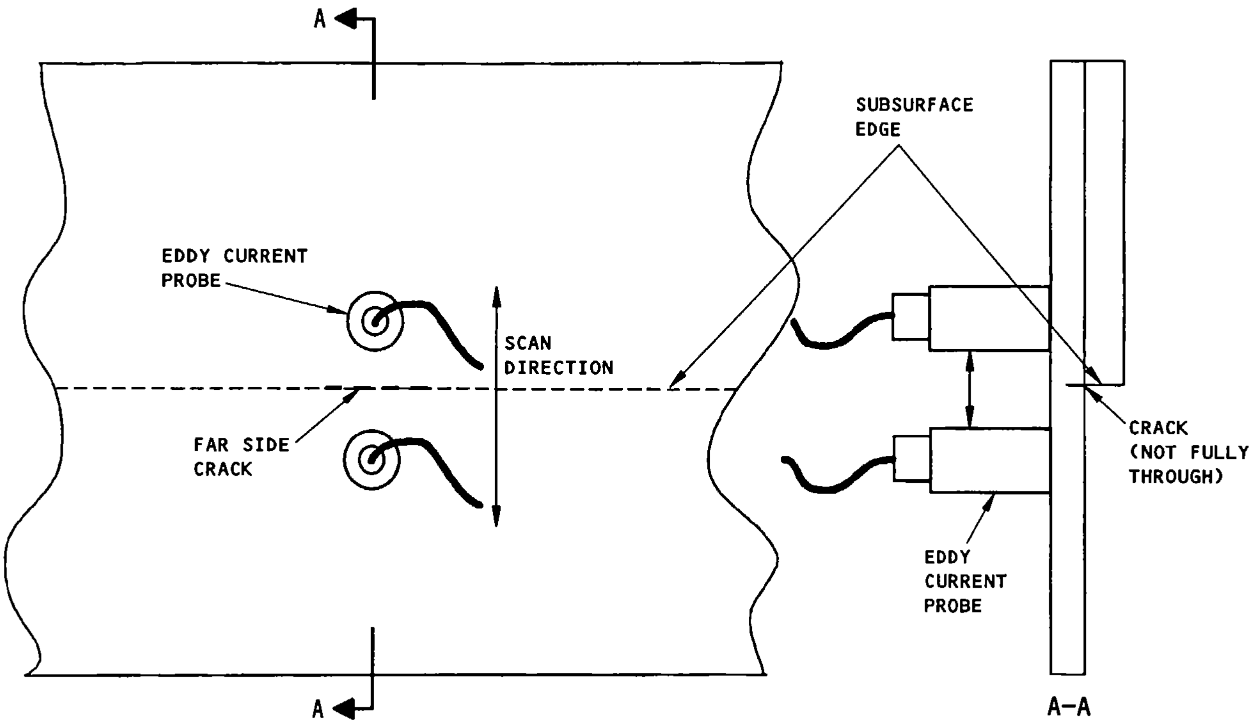
(2) Use one or more of the instruments that follow to find the thickness of the part that caused the crack indication to occur:

(a) a micrometer (if possible)

(b) a Magna-Mike made by Panametrics

(c) an Ultrasonic Thickness gauge

(3) Tell engineering if a thickness is found to be less than the drawing thickness.

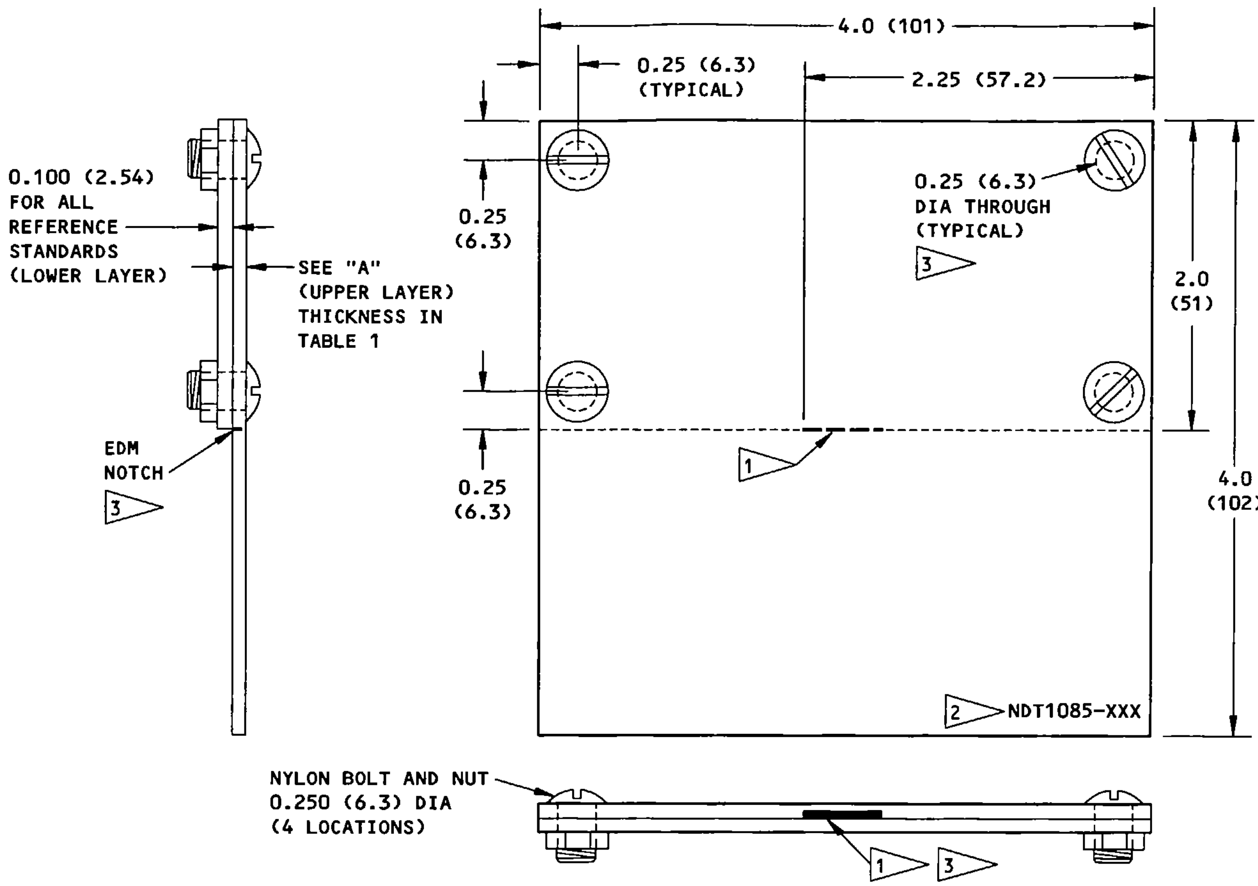


EXAMPLES OF A PART WITH A SUBSURFACE EDGE THAT IS EXAMINED WITH A SUBSURFACE EDDY CURRENT PROBE. THE PART THAT YOU EXAMINE COULD BE DIFFERENT.

NOTES:

- DO THE PROBE SCANS AT 90 DEGREES ACROSS THE SUBSURFACE EDGE OF THE PART WHERE THE CRACKS CAN OCCUR.

Typical Probe Scans on an Aluminum Part
Figure 1



NOTES:

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

INCHES	MILLIMETERS
X.XXX = ±0.005	X.XX = ±0.1
X.XX = ±0.025	X.X = ±0.5
X.X = ±0.050	X = 1

- MATERIAL: 2024-T3 CLAD (TWO SKINS)

[1] EDM NOTCH DIMENSIONS IN ALL REFERENCE STANDARDS:
LENGTH: 0.50 (12.7)
DEPTH: 50% THROUGH THE "A" THICKNESS
WIDTH: 0.007 (0.18) MAXIMUM WIDTH

[2] STAMP OR ETCH THE APPLICABLE REFERENCE STANDARD NUMBER. REPLACE XXX WITH THE APPLICABLE "A" THICKNESS AS SPECIFIED IN TABLE 1.

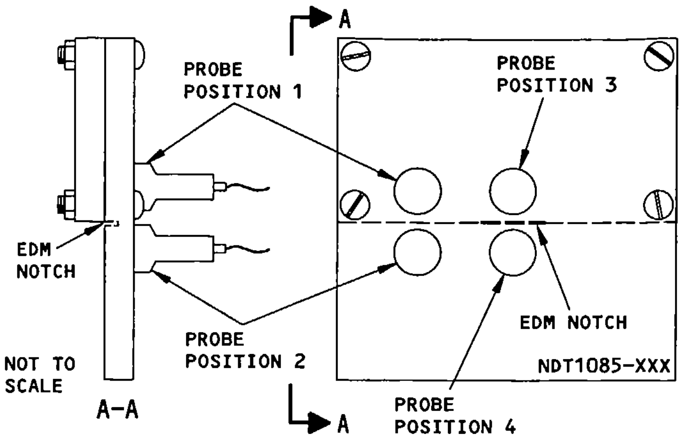
[3] MAKE SURE THE 2ND LAYER EDGE IS IMMEDIATELY ABOVE THE EDM NOTCH BEFORE THE 4 BOLT HOLES ARE DRILLED. THE EDGE OF THE SKIN TO THE NOTCH CENTERLINE TOLERANCE IS 0.010 (0.25).

REFERENCE STANDARD NUMBER	"A" (UPPER LAYER) THICKNESS
NDT1085-032	0.032 (0.81)
NDT1085-036 [4]	0.036 (0.91)
NDT1085-050	0.050 (1.3)
NDT1085-063	0.063 (1.6)
NDT1085-071	0.071 (1.8)
NDT1085-080	0.080 (2.0)
NDT1085-090	0.090 (2.3)
NDT1085-100	0.100 (2.5)
NDT1085-112	0.112 (2.8)
NDT1085-125	0.125 (3.2)

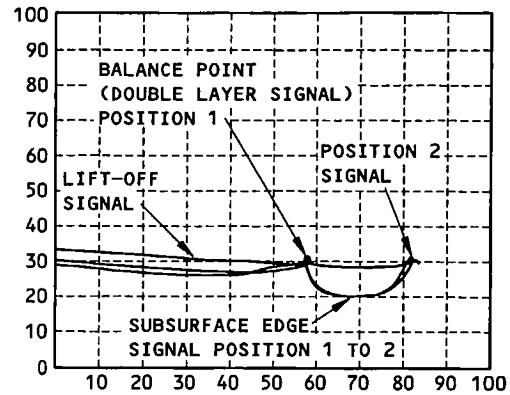
TABLE 1

[4] IF YOU HAVE REFERENCE STANDARD NDT396, THEN YOU DO NOT HAVE TO MAKE REFERENCE STANDARD NDT1085-036.

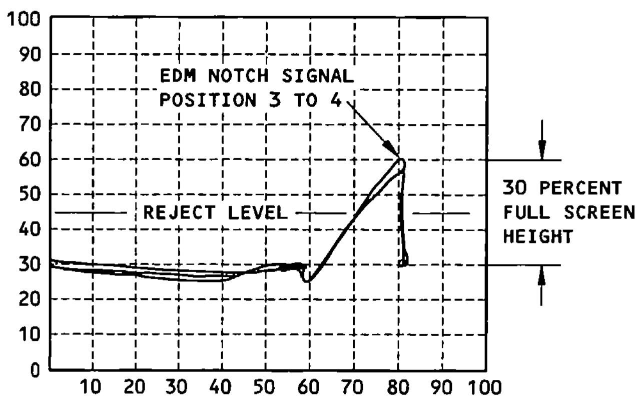
Reference Standards NDT1085-XXX
Figure 2



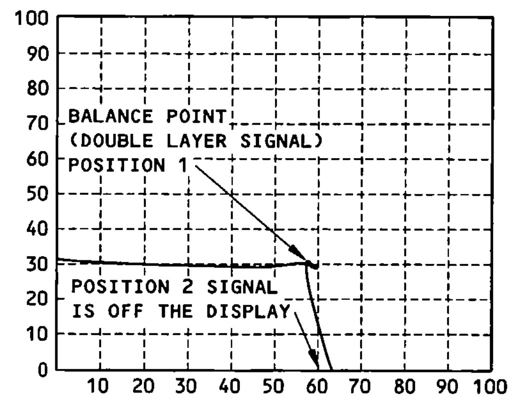
CALIBRATION PROBE POSITIONS FOR THE INSPECTION OF SUBSURFACE CRACKS
DETAIL A



DETAIL B

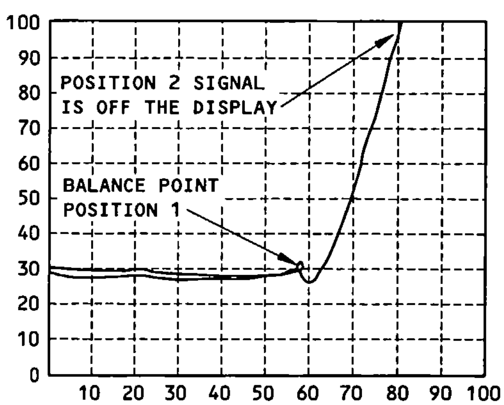


DETAIL C



DETAIL D

HERE THE FREQUENCY IS TOO HIGH. DECREASE THE FREQUENCY UNTIL THE POSITION 1 AND 2 SIGNALS LOOK EQUIVALENT TO THE SIGNALS SHOWN IN DETAIL B



DETAIL E

HERE THE FREQUENCY IS TOO LOW. INCREASE THE FREQUENCY UNTIL THE POSITION 1 AND 2 SIGNALS LOOK EQUIVALENT TO THE SIGNALS SHOWN IN DETAIL B

NOTES:

- SET THE VERTICAL GAIN SO IT IS 14 TO 20 dB HIGHER THAN THE HORIZONTAL GAIN.
- SET THE FREQUENCY AS SPECIFIED IN TABLE 1 SO THAT THE DIFFERENCE BETWEEN THE DOUBLE LAYER SIGNAL (POSITION 1) AND THE SINGLE LAYER SIGNAL (POSITION 2) IS LESS THAN 5 PERCENT OF FULL SCREEN HEIGHT. SEE DETAILS A AND B.
- SEE DETAILS A, B, D AND E TO SEE HOW TO ADJUST THE FREQUENCY AND PHASE TO DO THE CALIBRATION.
- ADJUST THE GAIN SO THAT THE NOTCH SIGNAL GOES TO 30 PERCENT OF FULL SCREEN HEIGHT ABOVE THE BALANCE POINT. SEE DETAILS A AND C.

Calibration Positions with Impedance Plane Signals
Figure 3 (Sheet 1)

UPPER LAYER THICKNESS INCH (mm)	REFERENCE STANDARD NUMBER	FREQUENCY AT THE START OF THE CALIBRATION
0.025 TO 0.032 (0.64 TO 0.81)	NDT1085-032	40 KHz
0.033 TO 0.040 (0.84 TO 1.00)	NDT1085-036	34 KHz
0.041 TO 0.050 (1.04 TO 1.27)	NDT1085-050	18 KHz
0.051 TO 0.063 (1.29 TO 1.60)	NDT1085-063	12 KHz
0.064 TO 0.071 (1.62 TO 1.80)	NDT1085-071	10 KHz
0.072 TO 0.080 (1.82 TO 2.03)	NDT1085-080	7 KHz
0.081 TO 0.090 (2.05 TO 2.28)	NDT1085-090	6 KHz
0.091 TO 0.100 (2.31 TO 2.54)	NDT1085-100	4 KHz
0.101 TO 0.112 (2.56 TO 2.84)	NDT1085-112	3 KHz
0.113 TO 0.125 (2.87 TO 3.17)	NDT1085-125	2 KHz

INSTRUMENT FREQUENCIES FOR THE REFERENCE STANDARDS
TABLE 1

NOTE: The instrument frequencies shown above are used at the start of the calibration. It can be necessary to adjust the frequency higher or lower during the calibration to get the signals shown in Details B and C. The best frequency for each reference standard can be different with different probes.

Calibration Positions with Impedance Plane Signals
Figure 3 (Sheet 2)