PART 4 - ULTRASONIC

CHROME PLATE CHECK OF THE RUDDER, ELEVATOR AND AILERON PCU MANIFOLD BORES

1. Purpose

A. This procedure can be used to identify if the manifold bore of the rudder, elevator and aileron PCU assemblies are chrome plated. The rudder PCU assemblies 64-44861-( ) and 65C37052-( ) and the elevator/aileron PCU assemblies 65-44761-( ) can be examined while they are on the airplane. See Figure 1 for the location of the rudder PCUs, Figure 2 for the location of elevator PCUs and Figure 3 for the location of the aileron PCUs.

B. This inspection puts a 15 or 20 MHz longitudinal wave transducer on the outer surface of the PCU assembly manifold to examine the bore of the manifold cylinder. Figure 1 shows the transducer inspection surface for the rudder main PCU. Figure 4 shows the transducer inspection surfaces for the elevator and aileron PCU's.

NOTE: The rudder main PCU has a forward and an aft manifold that are necessary to examine.

NOTE: There are five configurations of the elevator/aileron PCU manifolds. Figure 4 shows the configurations for the different part numbers.

C. Service Letter References: 737-SL-27-30, 737-SL-27-120

2. Equipment

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

A. All ultrasonic equipment that can do the calibration instructions of this procedure can be used.

(1) Instrument - It is necessary to use an ultrasonic instrument that can operate at frequencies of 15 or 20 MHz. Instruments with a wideband selection can be used if they can do the calibration instructions of this procedure. It must be possible to get an RF waveform on the instrument's screen display. The instruments specified below were used to help prepare this procedure.

(a) Sonic 1200; Staveley

(b) Masterscan 330; Sonatest Inc.

(c) USD 10, USD 15; Krautkramer Branson

(d) USN52R; Krautkramer Branson

(2) Transducer - It is necessary to use a zero degree, longitudinal wave, 15 or 20 MHz delay line transducer. The case or delay tip diameter must not be more than 0.30 inch (7.6 mm). The transducers specified below were used to help prepare this procedure.

(a) 15 MHz, 0.25 inch (6 mm) diameter, alpha series, delay line; made by KB Aerotech, Krautkramer part number 113-127-660.

(b) 20 MHz, 0.25 inch (6 mm) diameter, alpha series, delay line; made by KB Aerotech, Krautkramer part number 291-629-600.

(3) Reference Standard - Make reference standards NDT3014-A and B as specified in Figure 5 or you can get them from the Service Engineering NDT Group at Boeing's Customer Services.

(4) Couplant - All ultrasonic couplants that will not damage the airplane structure can be used. A light commercial grease works good.

3. Prepare for the Inspection

A. To get access to the rudder PCU assembly, remove the access panels on the right and left sides of the vertical tail as shown in Figure 1.

B. To get access to the two aileron PCU assemblies, go into the main landing gear (MLG) wheel well on the left side of the airplane as shown in Figure 3.

C. To get access to the two elevator PCU assemblies, do one of the two alternatives that follow:

(1) Remove the access panel on the right side of the tail cone. Access to the PCU inspection surface will be very difficult through this access panel opening because there is only a small area in which to work and there is linkage in the way. Complete access through the tail cone access panel is necessary to reach the PCU on the left side of the airplane. If the tail cone is not removed, it will be necessary to move the PCU assembly away from the BS 1156 bulkhead to get access to the inspection surface.

(2) Remove the tail cone from the airplane if access to the inspection surface of the PCU through the access panel is not possible.

D. Clean the inspection surface (refer to SOPM 20-30-03 for general cleaning procedures).

4. Instrument Calibration

A. Calibrate your equipment to examine the rudder PCU assembly as follows:

(1) Set the instrument frequency to 15 or 20 MHz.

(2) Set the screen display to the RF waveform.

(3) Set the damping control to the highest value (minimum damping).

(4) Put a sufficient amount of couplant on the step 1 inspection surface of reference standards NDT3014-A and B. See Details I and II in Figure 6 for the transducer positions.

(5) Put the transducer on the step 1 inspection surface of reference standard NDT3014-A. See Detail I in Figure 6 for the transducer position.

(6) Adjust the instrument delay, range and gain controls to get the first signal from the back surface of the reference standard to show on the screen display.

(7) Set the screen range to between 0.10 to 0.20 inches (2.5 to 5 mm).

(8) Adjust the delay control to position the first back surface signal at approximately the center of the screen display. See Detail III in Figure 6.

(9) Adjust the instrument gain to get the highest and lowest points of the back surface signal (peak-to-peak) between 80 and 100% of full screen height. See Detail III in Figure 6. Make sure the first peak of the signal shows a positive (upward) indication as shown in Detail III in Figure 6.

NOTE: Do not use reject.

(10) Put the transducer on the step 1 inspection surface of reference standard NDT3014-B. See Detail II in Figure 6 for the transducer position.

(11) Adjust the instrument gain, if necessary, to get the highest and lowest points of the back surface signal (peak-to-peak) so it is between 80 and 100% of full screen height. See Detail IV in Figure 6. Make sure the first peak of the signal shows a negative (downward) indication as shown in Detail IV in Figure 6.

B. Calibrate your equipment to examine the elevator/aileron PCU assemblies as follows:

(1) For part numbers 65-44761-7 thru -10, -12, and -14 thru -18, put a sufficient amount of couplant on the step 1 inspection surface of reference standards NDT3014-A and B. See Details I and II in Figure 6 for the transducer positions.

(2) For part numbers 65-44761-19 thru -21, put a sufficient amount of couplant on the step 2 inspection surface of reference standards NDT3014-A and B. See Details I and II in Figure 6 for the transducer positions.

(3) Set the instrument frequency to 15 or 20 MHz.

(4) Set the screen display to the RF waveform.

(5) Set the damping control to the highest value (minimum damping).

(6) Put the transducer on the applicable step 1 or 2 inspection surfaces (as specified in Paragraph 4.B.(1) or Paragraph 4.B.(2)) of reference standard NDT3014-A. See Detail I in Figure 6 for the transducer positions.

(7) Adjust the instrument delay, range and gain controls to get the first signal from the back surface of the reference standard to show on the screen display.

(8) Set the screen range to between 0.10 to 0.20 inches (2.5 to 5 mm).

(9) Adjust the delay control to position the first back surface signal at approximately the center of the screen display. See Detail III in Figure 6.

(10) Adjust the instrument gain to get the highest and lowest points of the back surface signal (peak-to-peak) so it is between 80 and 100% of full screen height. See Detail III in Figure 6.

NOTE: Do not use reject.

(11) Put the transducer on the applicable step 1 or 2 inspection surfaces (as specified in Paragraph 4.B.(1) or Paragraph 4.B.(2)) of reference standard NDT3014-B. See Detail II in Figure 6 for the transducer position.

(12) Adjust the instrument gain, if necessary, to get the highest and lowest points of the back surface signal (peak-to-peak) so it is between 80 and 100% of full screen height. See Detail IV in Figure 6. Make sure the first peak of the signal shows a negative (downward) indication as shown in Detail IV in Figure 6.

5. Inspection Procedure

A. Examine the rudder PCU assembly as follows:

(1) Identify the inspection surfaces of the forward and aft manifolds. See Figure 1.

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

(3) Put a sufficient amount of couplant on the inspection surfaces of the forward and aft manifolds.

(4) Put the transducer on the forward or aft inspection surface and make sure that a back surface signal occurs on the screen display. Make sure the transducer fully touches the inspection surface so that you get a stable signal from the bore surface.

NOTE: If necessary, adjust the instrument delay and gain controls to get the back surface signal to show on the screen display. The thickness of the PCU manifolds can be different because of manufacturing tolerances.

(5) Adjust the instrument delay to set the signal to the left of the screen display. This is done to make sure that, if the PCU has a sleeve installed, the signal from the sleeve can be seen.

(6) Adjust the gain control to get the highest and lowest points of the first back surface signal (peak-to-peak) at the same signal height set during calibration.

(7) Make a slow scan along the inspection surface and monitor the first peak of the signal to identify if it is positive or negative.

(8) Do Paragraph 5.A.(4) thru Paragraph 5.A.(7) again for the other (forward or aft) inspection surface.

B. Examine the elevator/aileron PCU assemblies as follows:

(1) Identify the part numbers of the PCU assemblies to be examined.

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

(3) Put a sufficient amount of couplant on the inspection surface.

(4) Put the transducer on the inspection surface identified in Figure 4 for the applicable PCU assembly and make sure that a back surface signal occurs on the screen display. Make sure the transducer fully touches the inspection surface so that you get a stable signal from the bore surface.

NOTE: If necessary, adjust the instrument delay and gain controls to get the back surface signal to show on the screen display. The thickness of the PCU manifolds can be different because of manufacturing tolerances.

(5) Adjust the instrument delay to set the signal to the left of the screen display. This is done to make sure that the signal from the sleeve can be seen if the PCU has a sleeve installed.

(6) Adjust the instrument gain control to get the highest and lowest points of the first back surface signal (peak-to-peak) at the same signal height set during calibration.

(7) Make a slow scan along the inspection surface and monitor the signal to identify if the first peak of the signal is positive or negative.

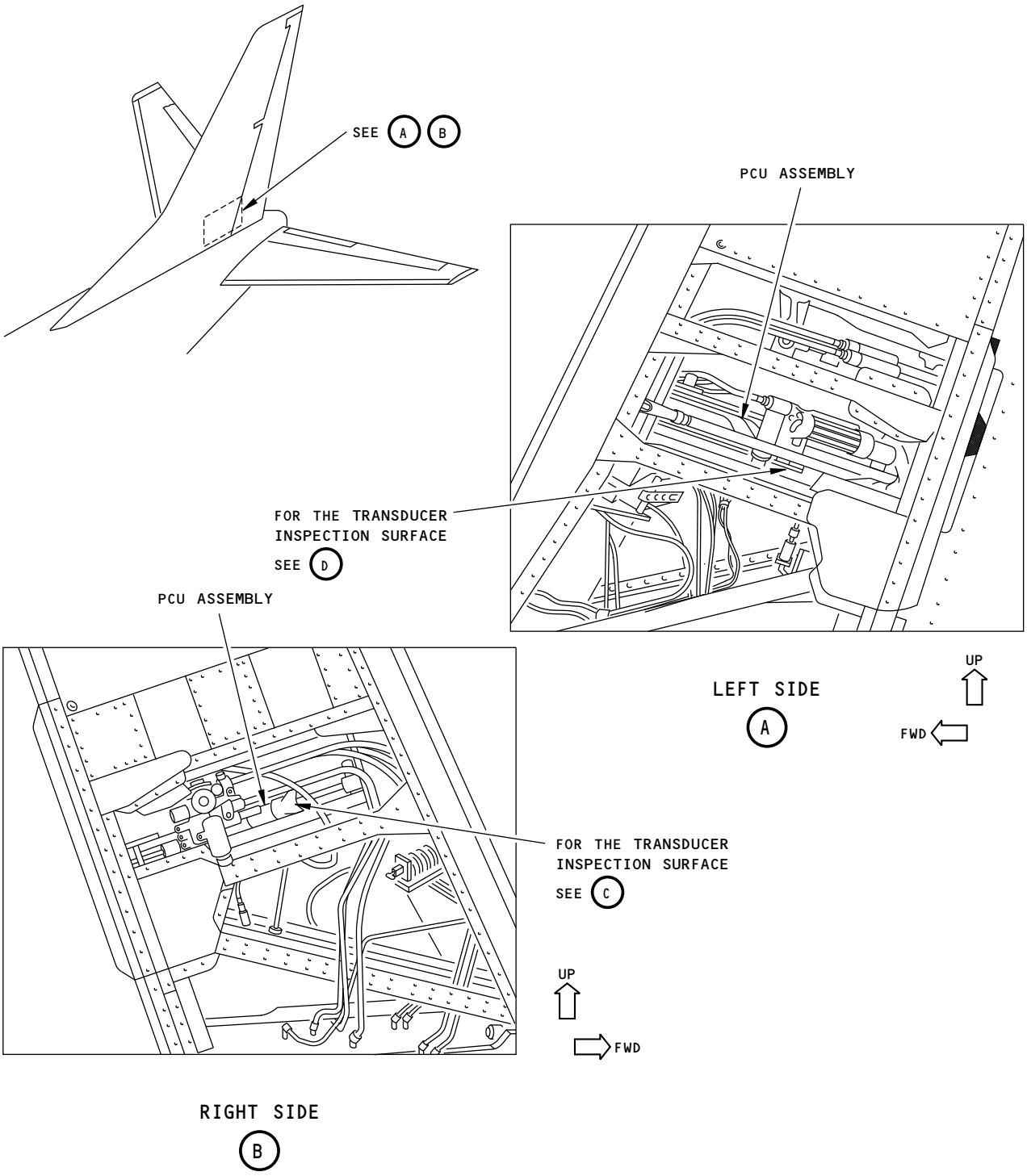
6. Inspection Results

A. An ultrasonic signal that looks the same as that shown in Detail III in Figure 6 is an aluminum surface. The first peak of the signal is in the positive (up) direction if the bore surface is aluminum.

B. An ultrasonic signal that looks the same as that shown in Detail IV in Figure 6 is a chrome plated surface. The first peak of the signal is in the negative (down) direction if the bore surface is chrome plated.

C. Ultrasonic signals that look the same as those shown in Detail II in Figure 7 are signals from the aluminum surface and the steel sleeve.

NOTE: The signal from a PCU assembly with a sleeve will look as shown in Details I or II in Figure 7. Detail I shows only one signal from the aluminum surface. This will occur when there is no sound transfer into the sleeve. Detail II shows two signals. The first is an interface signal of the aluminum surface to the front of the steel sleeve. The second signal is to the right and is from the back surface of the steel sleeve. This second signal occurs when sound transfers into the steel sleeve. The second signal from a steel sleeve can occur intermittently. An intermittent signal from a steel sleeve is permitted. The bores of PCU manifolds that have steel sleeves are not chrome plated.



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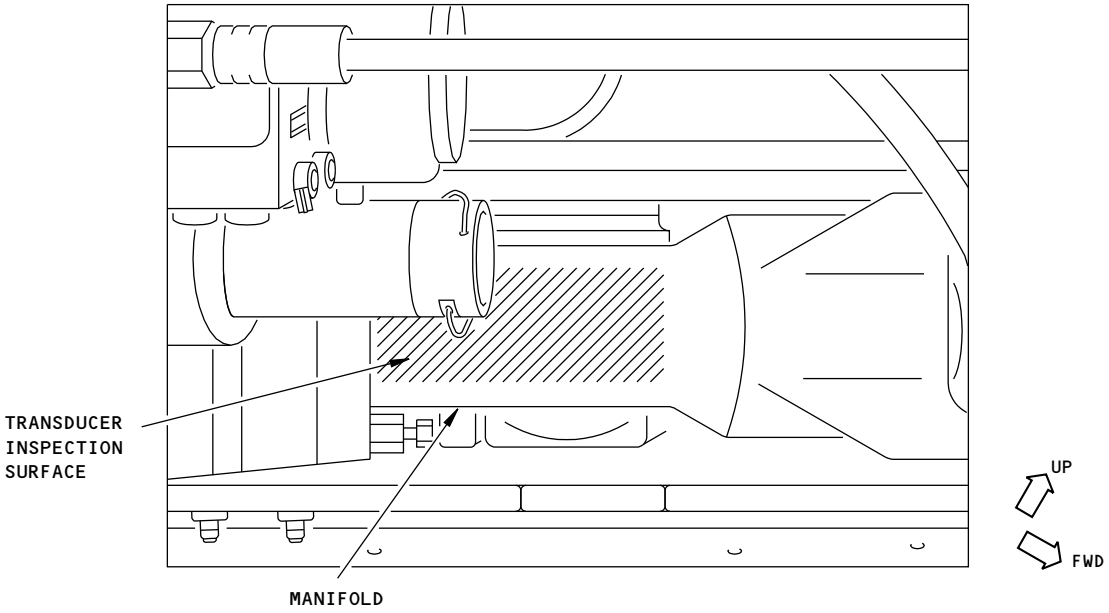
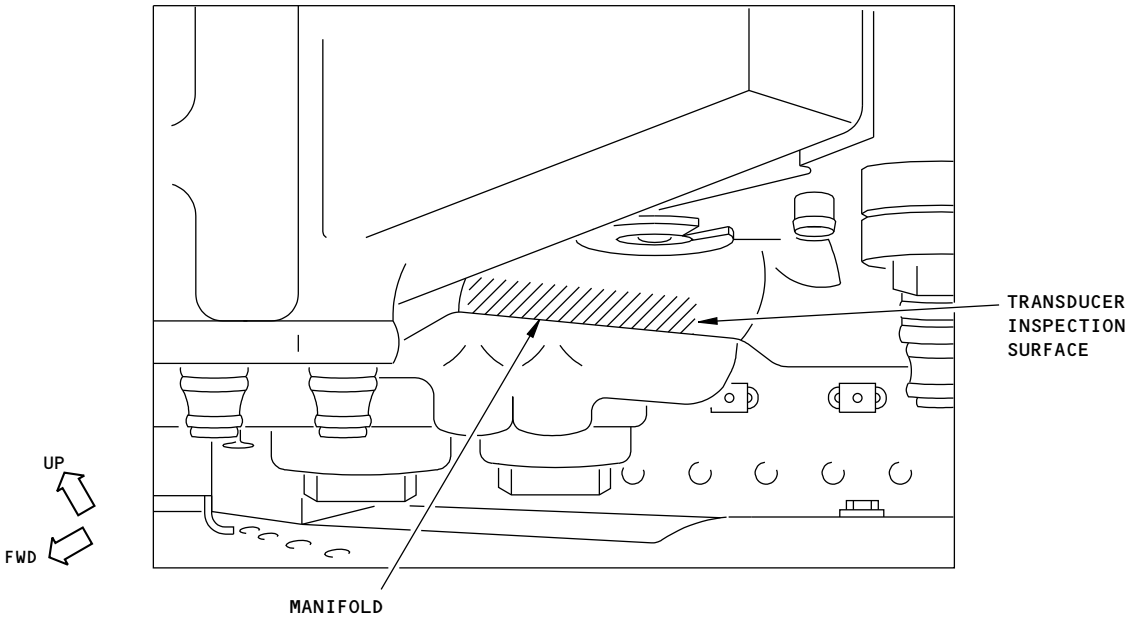
Rudder PCU Assembly Location and Inspection Surfaces
Figure 1 (Sheet 1 of 2)



FORWARD MANIFOLD ASSEMBLY
RIGHT SIDE

C



AFT MANIFOLD ASSEMBLY
LEFT SIDE

D

NOTE:

TRANSDUCER INSPECTION SURFACE

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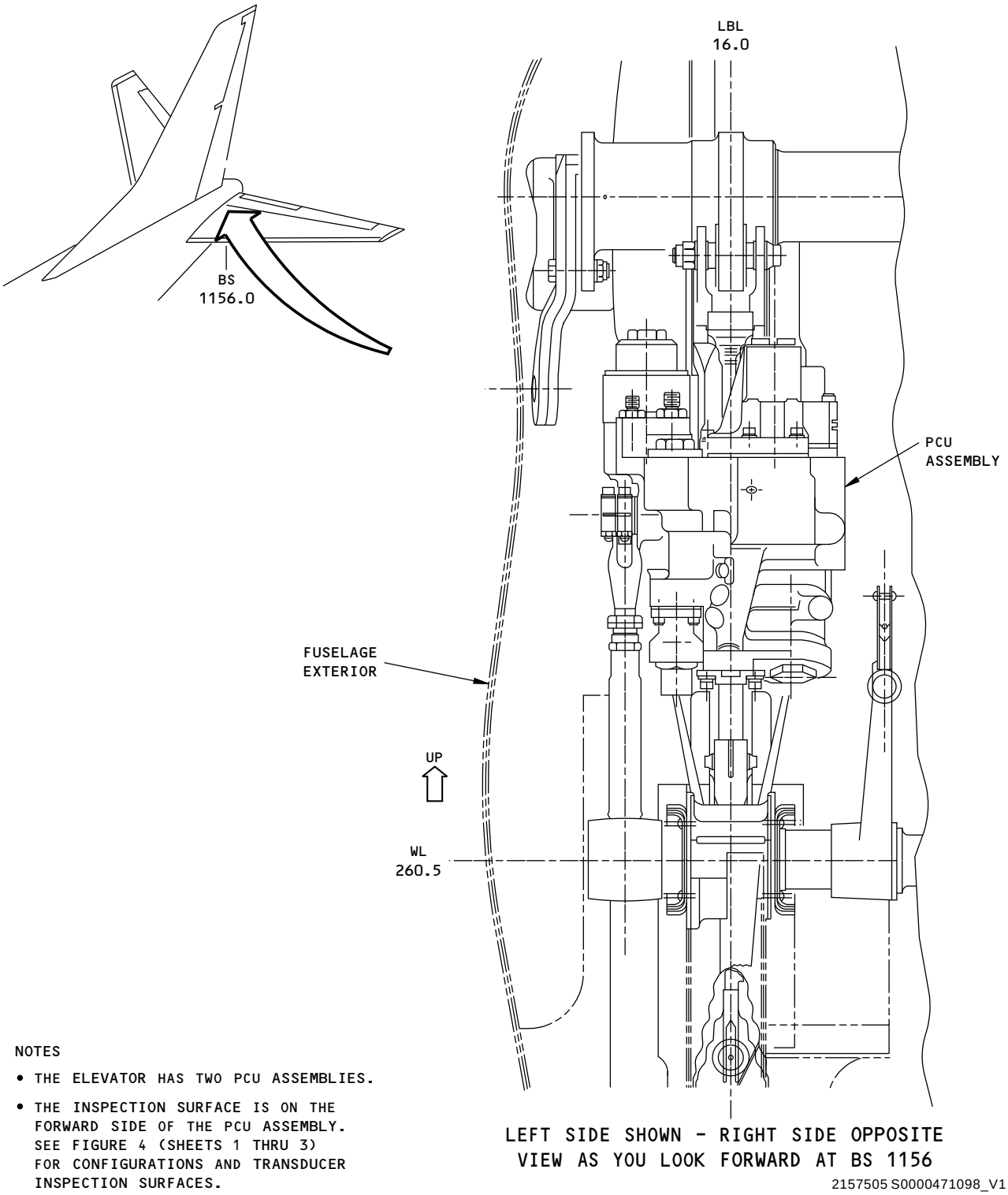
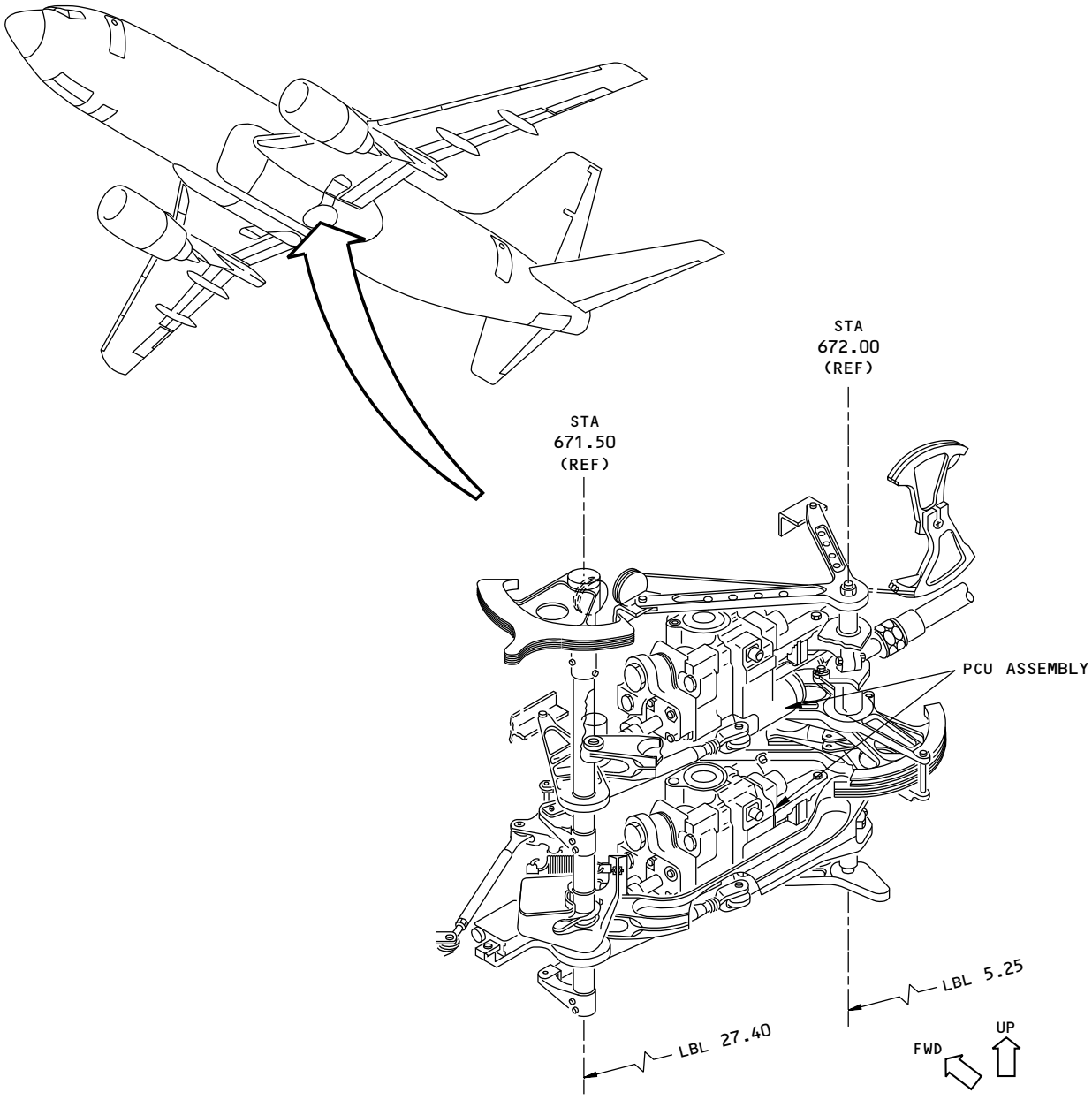
Rudder PCU Assembly Location and Inspection Surfaces
Figure 1 (Sheet 2 of 2)



NOTES

- THE ELEVATOR HAS TWO PCU ASSEMBLIES.
- THE INSPECTION SURFACE IS ON THE FORWARD SIDE OF THE PCU ASSEMBLY. SEE FIGURE 4 (SHEETS 1 THRU 3) FOR CONFIGURATIONS AND TRANSDUCER INSPECTION SURFACES.

Elevator PCU Assembly Location
Figure 2



NOTES

- VIEW AS YOU LOOK FORWARD
- THERE ARE TWO AILERON PCU ASSEMBLIES TO EXAMINE
- THE INSPECTION SURFACE IS ON THE AFT SIDE OF THE PCU ASSEMBLY. SEE FIGURE 4 (SHEETS 1 THRU 3) FOR CONFIGURATIONS AND INSPECTION SURFACES

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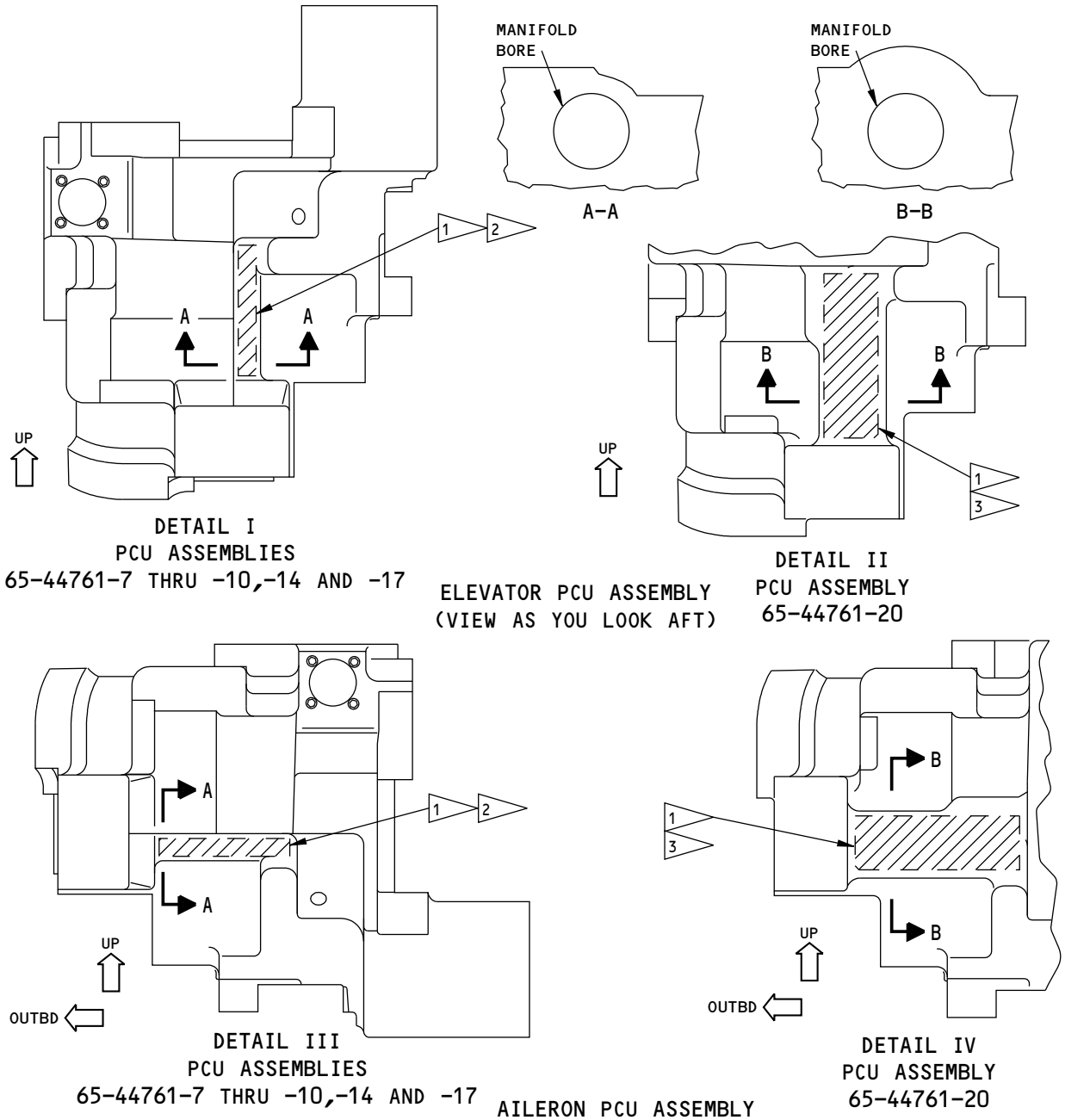
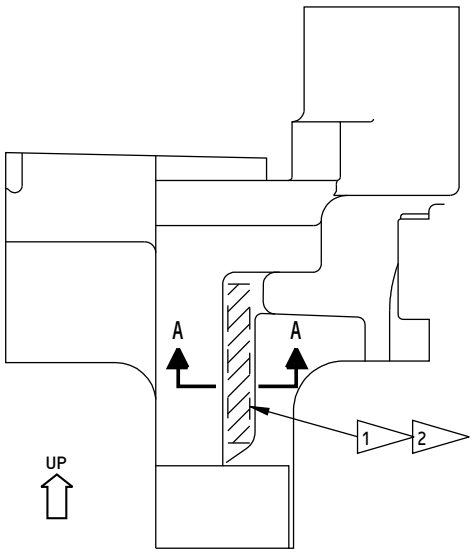
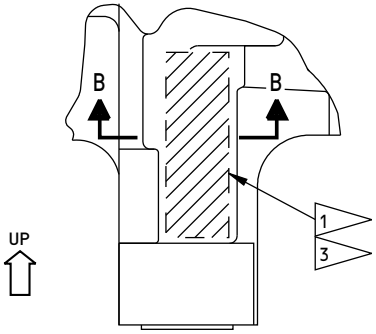
Aileron PCU Assembly Locations
Figure 3



Elevator and Aileron PCU Assemblies
Figure 4 (Sheet 1 of 3)

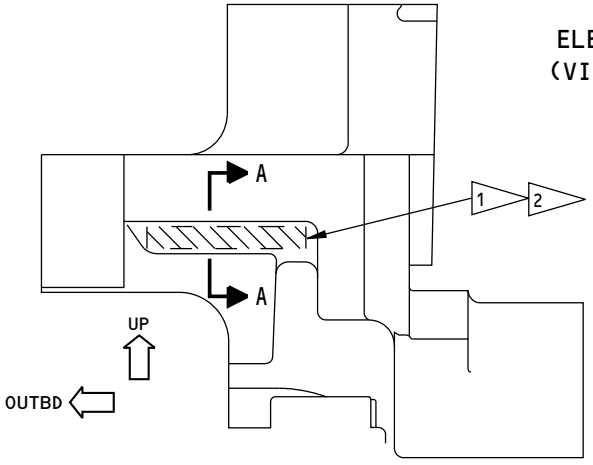


DETAIL V
PCU ASSEMBLIES
65-44761-12,-15,-16 AND -18

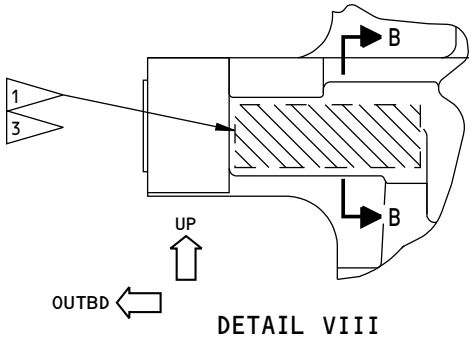


DETAIL VI
PCU ASSEMBLIES
65-44761-19 AND -21 4

ELEVATOR PCU ASSEMBLY
(VIEW AS YOU LOOK AFT)



DETAIL VII
PCU ASSEMBLIES
65-44761-12,-15,-16 AND -18



DETAIL VIII
PCU ASSEMBLIES
65-44761-19 AND -21 4

AILERON PCU ASSEMBLY
(VIEW AS YOU LOOK FORWARD)

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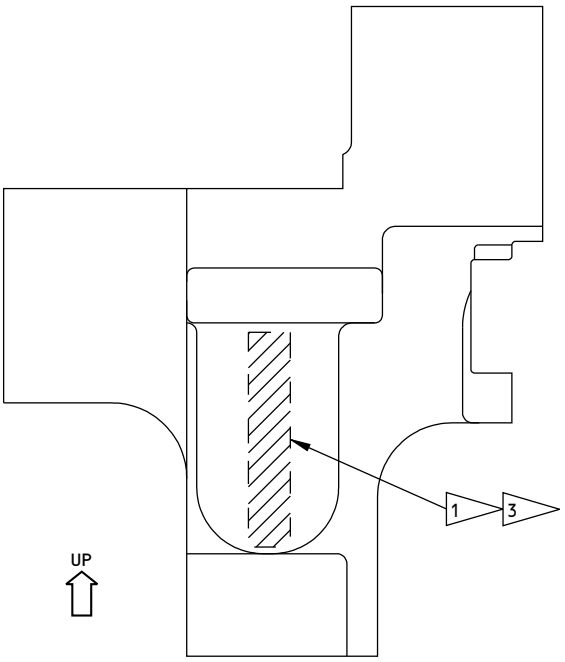
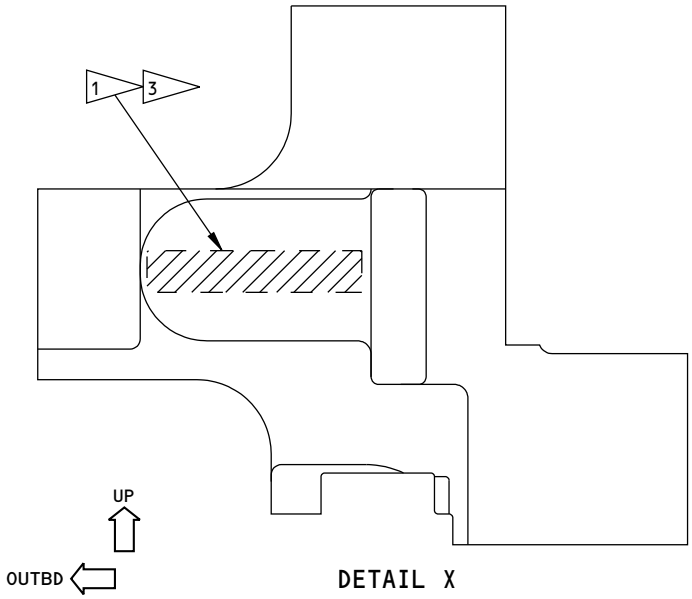
Elevator and Aileron PCU Assemblies
Figure 4 (Sheet 2 of 3)



DETAIL IX
ELEVATOR PCU ASSEMBLY 65-44761-21 (WITH MANIFOLD ASSEMBLY
65C34636-1 OR -3) (VIEW AS YOU LOOK AFT)



DETAIL X
AILERON PCU ASSEMBLY 65-44761-21 (WITH MANIFOLD ASSEMBLY
65C34636-1 OR -3) (VIEW AS YOU LOOK FORWARD)

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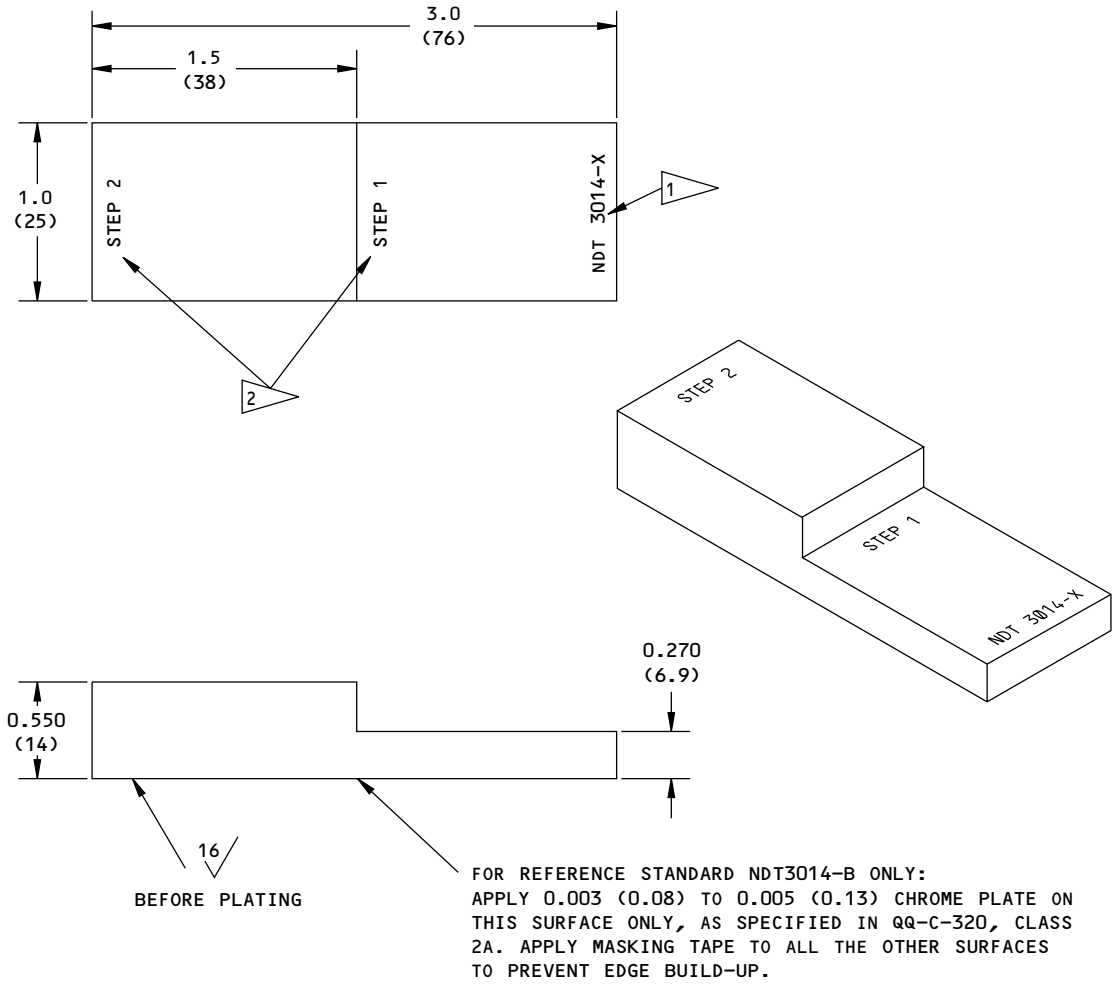
Elevator and Aileron PCU Assemblies
Figure 4 (Sheet 3 of 3)



NOTES

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

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: 7075-T6 OR T73 BARE ALUMINUM
- SURFACE ROUGHNESS: 63 Ra OR BETTER UNLESS SPECIFIED DIFFERENTLY
- MAKE TWO REFERENCE STANDARDS, ONE THAT IS CHROME PLATED AND ONE THAT IS NOT PLATED.
- REFERENCE STANDARDS NDT3014-A AND -B ARE AVAILABLE FROM THE SERVICE ENGINEERING NDT GROUP AT BOEING'S CUSTOMER SERVICES.

1 ETCH OR SCRIBE THE REFERENCE STANDARD NUMBER. IDENTIFY THE REFERENCE STANDARD THAT IS NOT PLATED AS NDT3014-A AND THE PLATED REFERENCE STANDARD AS NDT3014-B

2 ETCH OR SCRIBE THE STEP NUMBER

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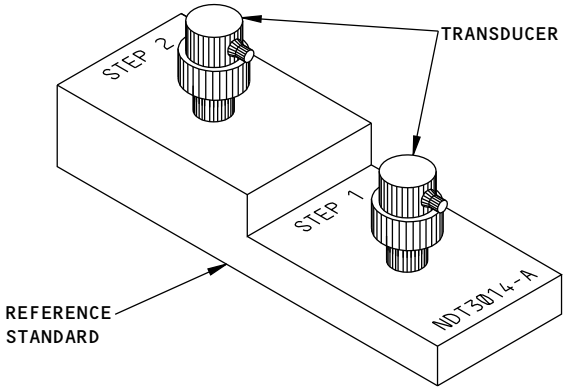
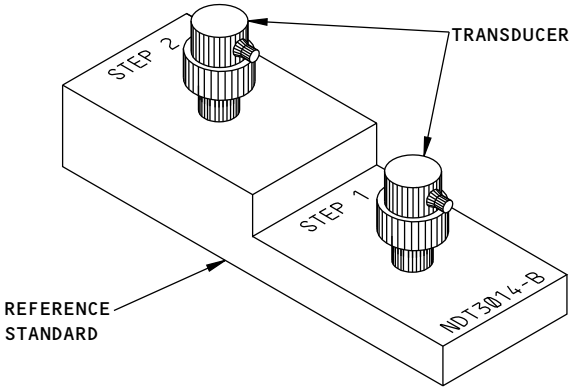
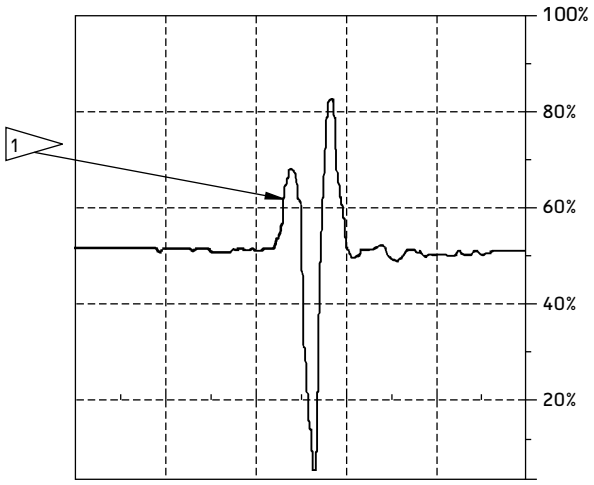
Reference Standards NDT3014-A and -B
Figure 5



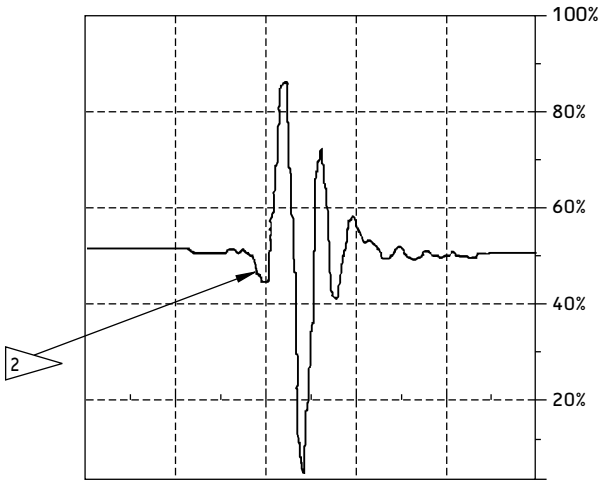
DETAIL I
TYPICAL TRANSDUCER POSITION ON
REFERENCE STANDARD NDT3014-A



DETAIL II
TYPICAL TRANSDUCER POSITION ON
REFERENCE STANDARD NDT3014-B



DETAIL III
FIRST BACK SURFACE SIGNAL FROM
REFERENCE STANDARD NDT3014-A
(ALUMINUM SURFACE)



DETAIL IV
FIRST BACK SURFACE SIGNAL FROM
REFERENCE STANDARD NDT3014-B
(CHROME PLATED SURFACE)

NOTES

- THE SCREEN DISPLAYS IN DETAILS III AND IV ARE EXAMPLES. THE SIGNALS CAN LOOK DIFFERENT WITH OTHER INSTRUMENTS AND TRANSDUCER COMBINATIONS.
- USE A SCREEN RANGE OF BETWEEN 0.10 INCH (2.5 MM) TO 0.20 INCH (5 MM). A SCREEN RANGE OF 0.125 INCH (3 MM) WAS USED IN THE DETAIL I AND II SCREEN DISPLAYS.

1 MAKE SURE THE FIRST PEAK OF THE SIGNAL SHOWS A POSITIVE (UPWARD) INDICATION.

2 MAKE SURE THE FIRST PEAK OF THE SIGNAL SHOWS A NEGATIVE (DOWNWARD) INDICATION.

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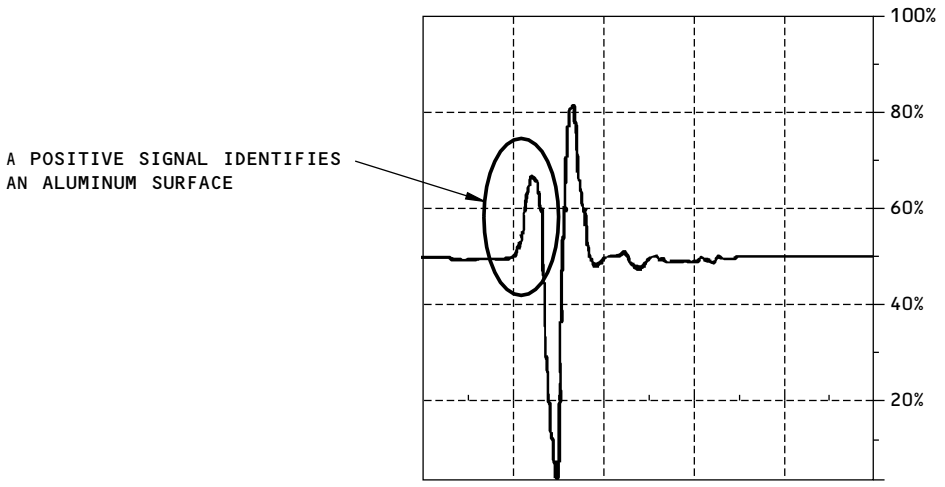
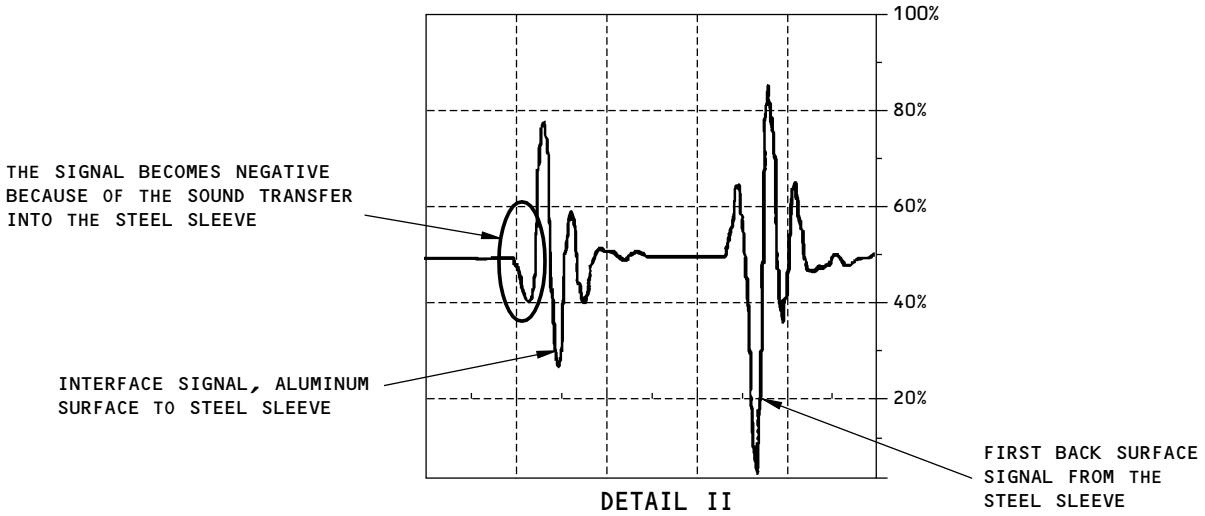
Instrument Calibration
Figure 6



DETAIL I
FIRST BACK SURFACE SIGNAL FROM THE ALUMINUM SURFACE OF THE MANIFOLD CYLINDER BORE
(NO SOUND TRANSFER INTO THE SLEEVE)



DETAIL II
INTERFACE SIGNAL FROM THE ALUMINUM SURFACE OF THE MANIFOLD CYLINDER BORE AND THE STEEL SLEEVE SIGNAL
(SOUND TRANSFER INTO THE SLEEVE)

NOTES

- THE SCREEN DISPLAYS IN DETAILS I AND II ARE SIGNALS FROM THE SAME PCU MANIFOLD, WITH A STEEL SLEEVE INSTALLED. DETAIL I SHOWS ONLY THE SIGNAL FROM THE ALUMINUM BORE SURFACE; SOUND HAS NOT TRANSFERRED INTO THE STEEL SLEEVE. DETAIL II SHOWS TWO SIGNALS; ONE FROM THE ALUMINUM SURFACE AND ONE FROM THE STEEL SLEEVE.
- A SCREEN RANGE OF 0.125 INCH (3 MM) WAS USED IN THE DISPLAYS IN DETAILS I AND II.
- THE SIGNAL FROM THE STEEL SLEEVE WILL BE IMMEDIATELY TO THE RIGHT OF THE ALUMINUM SURFACE SIGNAL.

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Signals From a PCU With a Steel Sleeve
Figure 7