



767

NONDESTRUCTIVE TEST MANUAL

PART 4 - ULTRASONIC

JT9D ENGINE THRUST LINK AND EVENER BAR LUGS

1. Purpose

- A. Use this procedure to do an ultrasonic inspection to find cracks in the JT9D engine thrust links and evener bars. This procedure examines the hole areas of the thrust links and evener bars for the possible cracks.
- B. Service Bulletin reference: 767-71A0087

2. Equipment

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

- A. All ultrasonic equipment that can be calibrated as specified in this procedure can be used.
 - (1) Instrument - Use an ultrasonic instrument that can operate at 5 MHz. The ultrasonic instruments specified below were used to prepare this procedure.
 - (a) Sonic-136 - Staveley Instruments, Inc.
 - (b) USN 50 - Krautkramer Branson
 - (2) Transducer - This procedure uses two 5 MHz angle beam transducers with two 0.187 inch (4.74 mm) diameter crystals in each transducer case. The crystals are angled 7° in opposite directions. The transducers specified below were used to prepare this procedure.
 - (a) Part number: SUS631. Manufacturer: Search Unit Systems (Division of NDT Products Engineering).
 - 1) The transducer crystals are set at an angle to give a 29 degree refracted shear angle in steel. Case dimensions: 0.50 inch (12.7 mm) long, 0.42 inch (10.6 mm) wide, 0.37 inch (9.5 mm) high, and a 1.32 inch (33.5 mm) radius inspection surface.
 - (b) Part number: SUS632. Manufacturer: Search Unit Systems (Division of NDT Products Engineering).
 - 1) The transducer crystals are set at an angle to give a 35 degree refracted shear angle in steel. Case dimensions: 0.56 inch (14.2 mm) long, 0.75 inch (19.0 mm) wide, 0.375 inch (9.52 mm) high, and a 1.60 inch (40.6 mm) radius inspection surface.
 - (3) Reference Standard - Make reference standards NDT631 and NDT632 as specified in Figure 2 and Figure 3.
 - (4) Couplant - All ultrasonic couplant that will not damage the airplane structure can be used. Commercial grease or oil can be used if the equipment can be calibrated with it as specified in Paragraph 4.

3. Preparation for Inspection

- A. Get access to the engine thrust link and evener bar. See Figure 1.
 - (1) Open the engine fan cowl, core cowl, and thrust reverser.
 - (2) Remove or reposition the fuel control feedback cable on the right side of the engine to examine the evener bar.
 - (3) Remove or reposition a wire harness on the left side of the engine to examine the forward lug of the thrust link.

NOTE: The removals and/or repositions of hardware specified in Paragraph 3.A.(2) and Paragraph 3.A.(3) are necessary for the transducer to fully access the inspection areas.

EFFECTIVITY
ALL; 767 WITH JT9D ENGINES

PART 4 71-20-01

D634T301

Page 1
May 15/2006



767

NONDESTRUCTIVE TEST MANUAL

- (4) Remove all dirt and grease from the inspection surfaces on the thrust links and evener bars. See Figure 1 and Figure 6 for the inspection areas.

4. Instrument Calibration

- A. Calibration for the inspection of the aft clevis lugs of the thrust links on JT9D engines for cracks at the hole diameters. Use reference standard NDT631 and transducer SUS631.

- (1) Set the instrument frequency at 5 MHz.
- (2) Set the reject control to its minimum value.

NOTE: The reject control is kept at a minimum to better monitor the screen baseline and thus be sure that sound goes into the part.

- (3) Connect the transducer to the instrument.
- (4) Put couplant on the radius of the reference standard.
- (5) Put the transducer on the reference standard at transducer position 1 so that the sound beam points at corner notch 1. See Figure 4, Flagnotes 1 and 6. Make sure that the edge of the transducer is aligned with the edge of the reference standard.
- (6) Set the initial pulse signal of the transducer at 0% full screen width on the instrument screen.
- (7) Move the transducer to and away from corner notch 1 and look at the instrument screen display for the maximum signal from the notch. See Figure 4, Flagnote 2.
- (8) Put the maximum received signal at 80 percent of full screen width and adjust the instrument gain to put the signal at 80 percent of full screen height. See Figure 4, Flagnote 3.
- (9) Move the transducer between transducer positions 1 and 2 so that the sound beam points to an area without a notch and monitor the instrument screen display. No signal will occur on the instrument screen display. This will be the usual screen display during the inspection unless there is a crack.
- (10) Move the transducer on the reference standard to transducer position 2 so that the sound beam points at corner notch 2. See Figure 4, Flagnotes 4 and 7. Make sure that the edge of the transducer is aligned with the edge of the reference standard.
- (11) Move the transducer to and away from corner notch 2 and look at the instrument screen display for the maximum signal from the notch. See Figure 4, Flagnote 5.
 - (a) The maximum signal from corner notch 2 must be 70 percent of full screen height or more and between 75 and 95 percent of full screen width.
 - (b) If the maximum signal from corner notch 2 is not 70 percent of full screen height or more, increase the gain until you get a signal that is a minimum of 70 percent of full screen height.

- B. Calibration for the inspection of the forward lugs of the thrust links and the lugs of the evener bars on JT9D engines for cracks at the hole diameters. Use reference standard NDT632 and transducer SUS632.

- (1) Do Paragraph 4.A.(1) thru Paragraph 4.A.(11) but, when referred to Figure 4, refer to Figure 5. See Figure 5.

NOTE: Make sure that the ultrasonic beam points in the correct direction. The ultrasonic beam for this transducer points at the transducer connector.

5. Inspection Procedure

- A. Examine the aft clevis lugs of the thrust links on JT9D engines for cracks at the hole diameters as follows:
 - (1) Prepare for the inspection as specified in Paragraph 3.
 - (2) Do the calibration as specified in Paragraph 4.A.

EFFECTIVITY
ALL; 767 WITH JT9D ENGINES

D634T301

PART 4 71-20-01

Page 2
May 15/2006



767

NONDESTRUCTIVE TEST MANUAL

- (3) Put couplant on the inspection surface for the top lug of the thrust link. See Figure 6, Inspection Area "A".
 - (4) Put the SUS631 transducer on the inspection surface of the top lug to examine the forward area of the lug hole. See Figure 6, Flagnote 1.
 - (a) Slowly move the transducer in the inspection area. As you do the scan, monitor the ultrasonic screen display. See Figure 6, Flagnote 2.

NOTE: The SUS631 transducer examines each end of the lug hole at the same time.
 - (b) Make a record of areas that cause ultrasonic signals to occur that are 40 percent of full screen height (or more) and are at approximately 80 percent of full screen width.
 - (5) Turn the transducer in the opposite direction and examine the aft area of the lug hole. See Figure 6, Flagnote 3.
 - (6) Do Paragraph 5.A.(3) thru Paragraph 5.A.(5) for the bottom lug of the thrust link.
 - (7) Do Paragraph 5.A.(3) thru Paragraph 5.A.(6) for the thrust link on the opposite side of the same engine.
 - (8) Do Paragraph 5.A.(3) thru Paragraph 5.A.(7) for the two aft clevis lugs on the thrust links of the opposite engine. See Figure 6, Flagnotes 1, 2 and 3.
- B. Examine the forward lug of the thrust links on JT9D engines for cracks at the hole diameters as follows:
- (1) Prepare for the inspection as specified in Paragraph 3.
 - (2) Do the calibration as specified in Paragraph 4.B.
 - (3) Put couplant on the inspection surface for the forward lug of the thrust link. See Figure 6, Inspection Area "B".
 - (4) Put the SUS632 transducer on the inspection surface of the forward lug to examine the aft area of the hole in the forward lug. Start the scan with the transducer put outboard as far as possible on the lug inspection surface. See Figure 6, Flagnote 4.
 - (a) Make sure that the ultrasonic beam is pointed aft and inboard. For this transducer, the ultrasonic beam exits the transducer in the same direction as the cable connector.
 - (b) Slowly move the transducer in the inspection area to the aft flat area of the thrust link. As you do the scan, monitor the ultrasonic screen display. See Figure 6, Flagnote 5.

NOTE: The SUS632 transducer examines each end of the lug hole at the same time.
 - (c) Make a record of areas that cause ultrasonic signals to occur that are 40 percent of full screen height (or more) and are at approximately 80 percent of full screen width.
 - (5) Put the transducer on the inspection surface of the forward lug to examine the forward area of the forward lug. See Figure 6, Flagnote 6.
 - (a) Make sure that the ultrasonic beam is pointed forward and inboard. For this transducer, the ultrasonic beam exits the transducer in the same direction as the cable connector.
 - (b) Slowly move the transducer to the forward flat area of the thrust link in the inspection area. As you do the scan, monitor the ultrasonic screen display. See Figure 6, Flagnote 7.
 - (6) Do Paragraph 5.B.(3) thru Paragraph 5.B.(5) for the forward lug of the thrust link on the opposite side of the same engine. See Figure 6, Flagnotes 4, 5, 6 and 7.
 - (7) Do Paragraph 5.A.(3) thru Paragraph 5.B.(6) for the forward lugs of the thrust links on the opposite engine.
- C. Examine the lug of the evener bar on JT9D engines for cracks at the hole diameters as follows:
- (1) Prepare for the inspection as specified in Paragraph 3.

EFFECTIVITY
ALL; 767 WITH JT9D ENGINES

D634T301

PART 4 71-20-01

Page 3
May 15/2006



767

NONDESTRUCTIVE TEST MANUAL

- (2) Do the calibration as specified in Paragraph 4.B.
- (3) Put couplant on the inspection surface of the evener bar. See Figure 6, Inspection Area "C".
- (4) Put the SUS632 transducer on the aft inspection surface of the evener bar, adjacent to the thrust link. See Figure 6, Flagnote 8.
- (5) Slowly move the transducer aft and inboard on the inspection surface of the evener bar. As you do the scan, monitor the ultrasonic screen display. See Figure 6, Flagnote 9.

NOTE: The SUS632 transducer examines each end of the lug hole at the same time.

- (a) Make a record of areas that cause ultrasonic signals to occur that are 40 percent of full screen height (or more) and are approximately 80 percent of full screen width.
- (6) Do Paragraph 5.C.(1) thru Paragraph 5.C.(5) on the opposite side of the engine.
- (7) Do Paragraph 5.C.(1) thru Paragraph 5.C.(6) on the opposite engine.

6. Inspection Results

- A. Compare all of the ultrasonic signals you get during the inspections of the engine thrust links and evener bars with the signals you got during calibration on the reference standard.
- B. Thrust links and evener bars that do not cause crack indications to occur during the inspection are acceptable.
- C. An ultrasonic indication that is 40 percent of full screen height and is at approximately 80 percent of full screen width is a possible crack. The areas that cause these types of signals to occur must be examined more carefully with the bushing removed as follows:
 - (1) Do a visual inspection of the lug hole bore at the location of the ultrasonic indication.
 - (2) Do a surface eddy current inspection as specified in Part 6, 51-00-02 or a magnetic particle inspection as specified in SOPM 20-20-01.

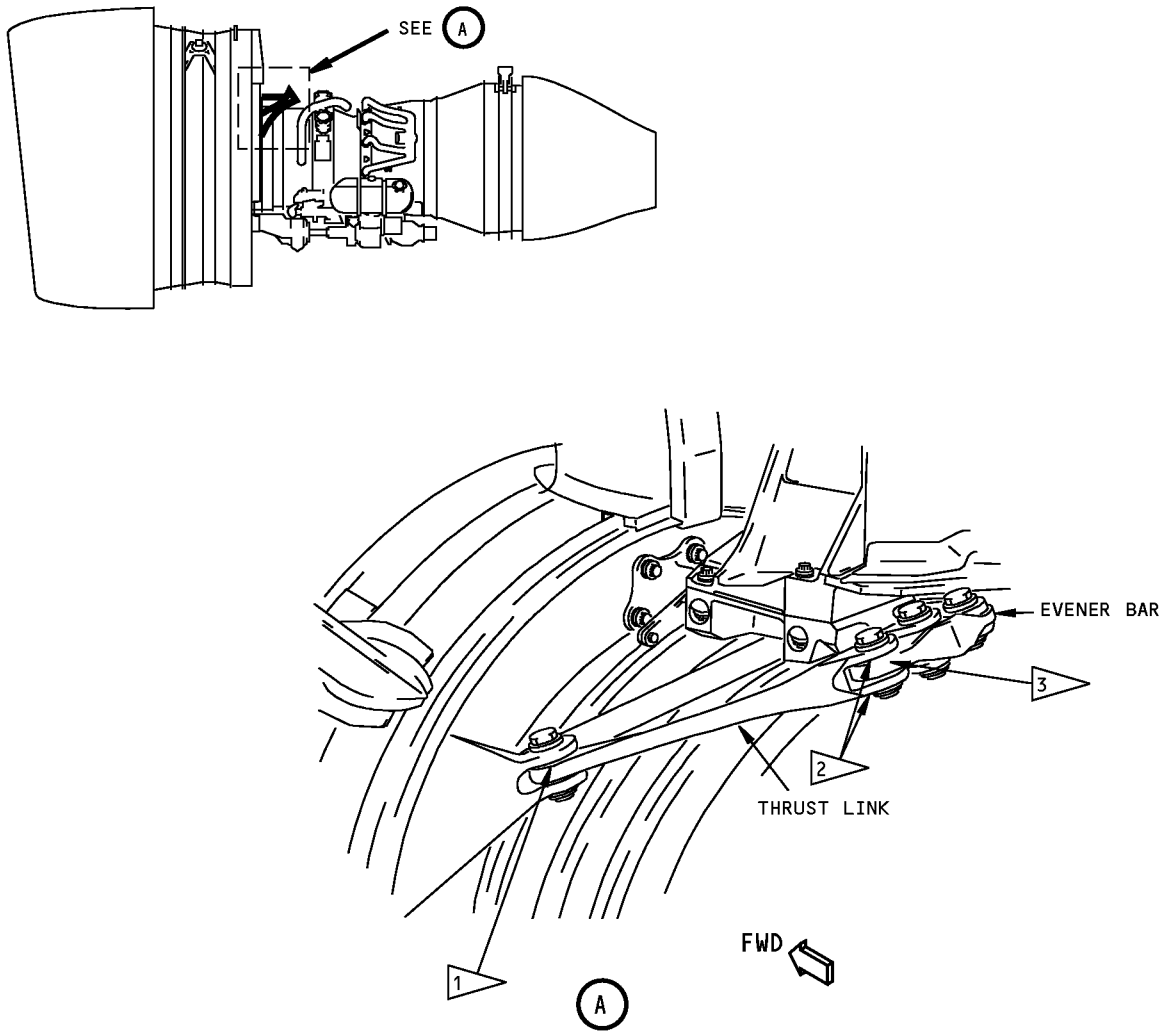
EFFECTIVITY
ALL; 767 WITH JT9D ENGINES

D634T301

PART 4 71-20-01

Page 4
May 15/2006

**767
NONDESTRUCTIVE TEST MANUAL**



NOTES

- THE LEFT SIDE OF THE ENGINE IS SHOWN; THE RIGHT SIDE IS ALMOST THE SAME
- FLAG NOTES 1 THRU 3 IDENTIFY THE INSPECTION AREAS

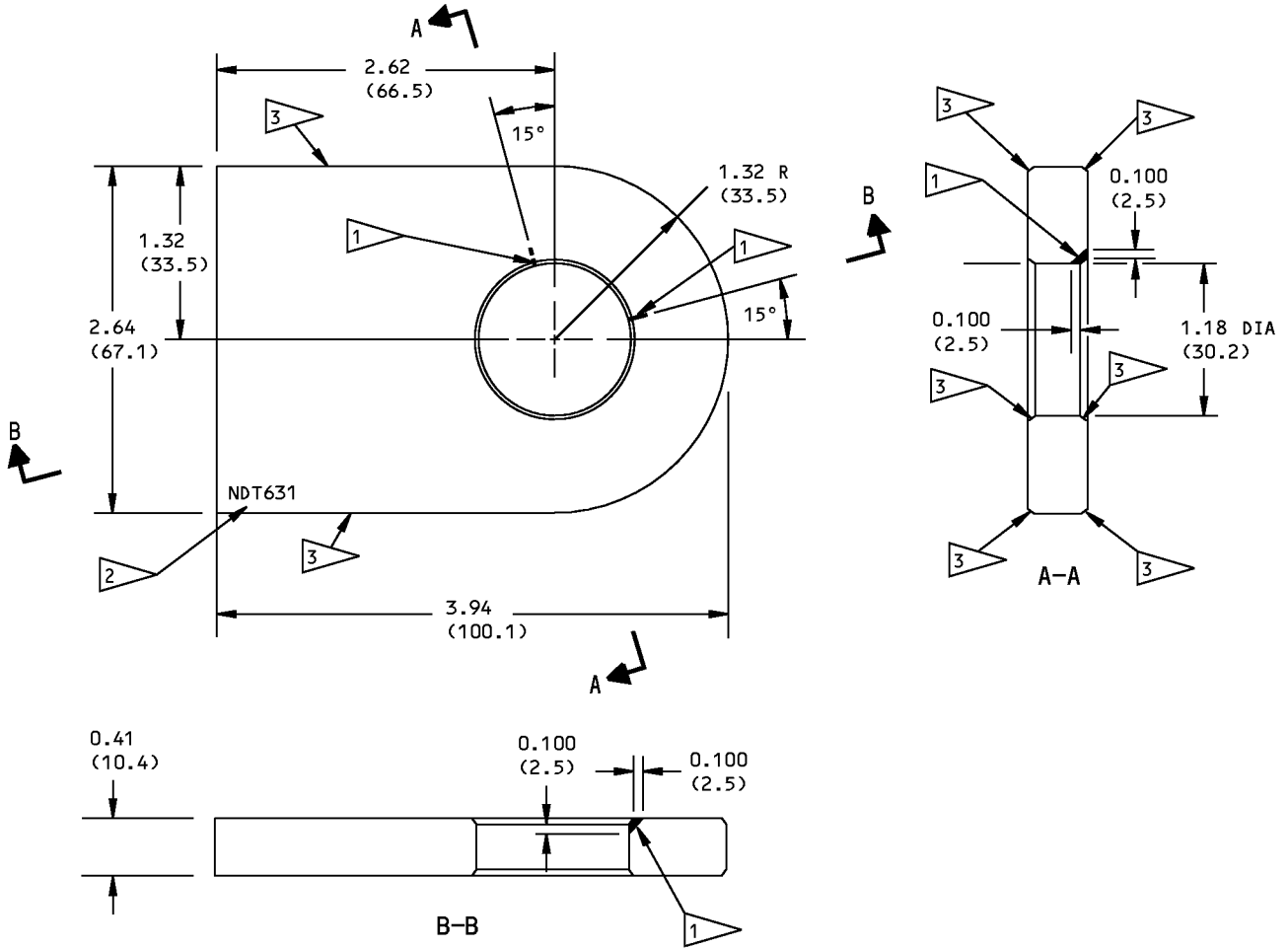
- 1 THE FORWARD LUG OF THE THRUST LINKS ARE EXAMINED FOR CRACKS AT THE HOLE DIAMETERS.
- 2 THE AFT CLEVIS LUGS OF THE THRUST LINKS ARE EXAMINED FOR CRACKS AT THE HOLE DIAMETERS.
- 3 THE EVENER BARS ARE EXAMINED FOR CRACKS AT THE HOLE DIAMETERS.

**Engine Thrust Link and Evener Bar Inspection Areas
Figure 1**

EFFECTIVITY
ALL; 767 WITH JT9D ENGINES

PART 4 71-20-01

NONDESTRUCTIVE TEST MANUAL



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
- MATERIAL: 15-5 PH CRES.
OPTIONAL MATERIAL: 4130,4140,4340
- SURFACE ROUGHNESS: 63 RA OR BETTER

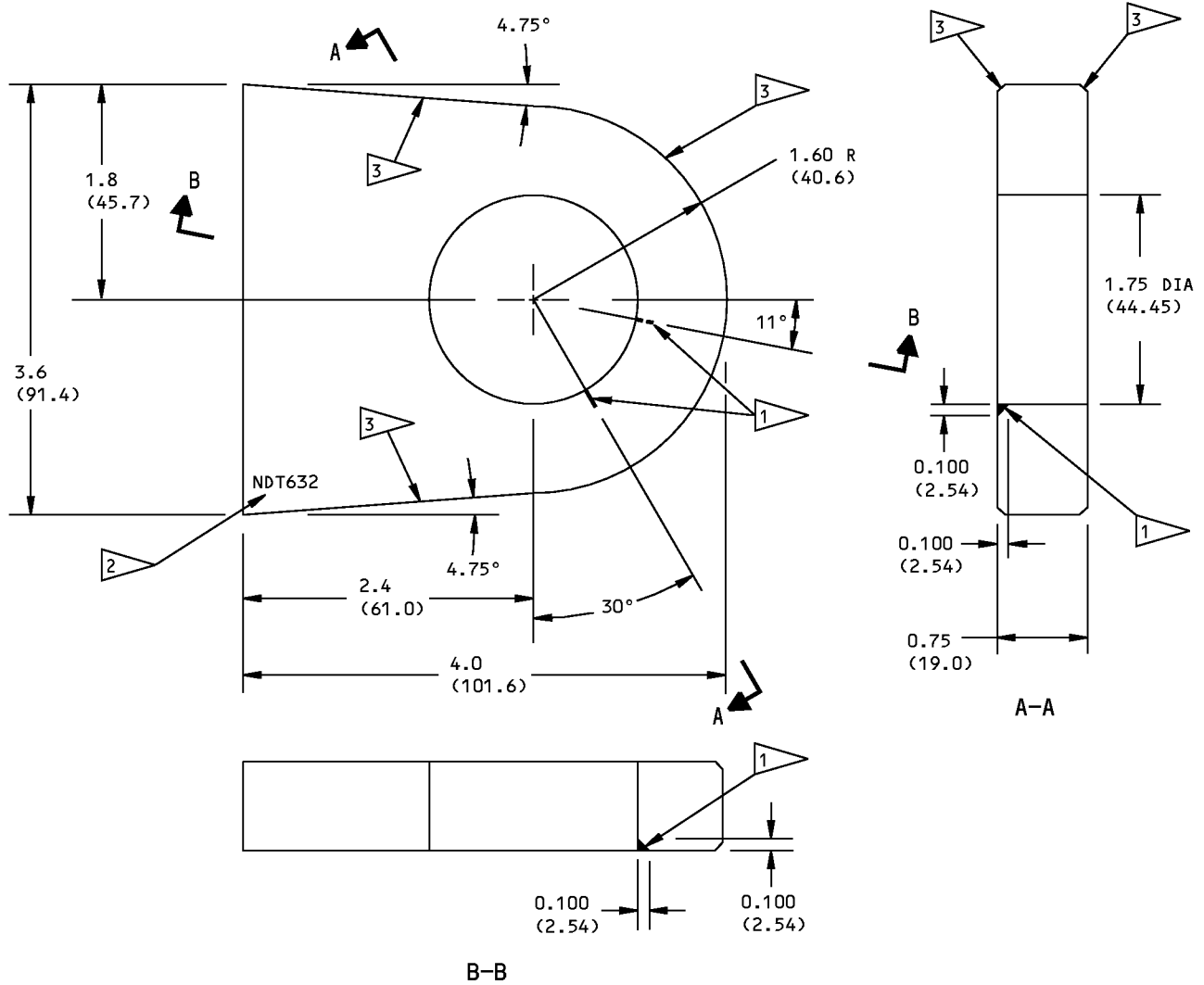
- 1 EDM NOTCH: 0.015 (0.38) MAXIMUM WIDTH
- 2 ETCH OR STEEL STAMP THE REFERENCE STANDARD NUMBER NDT631 IN THIS LOCATION
- 3 CHAMFER - 0.030 (0.76) BY 45 DEGREES

Reference Standard NDT631
Figure 2

EFFECTIVITY
ALL; 767 WITH JT9D ENGINES

PART 4 71-20-01

**767
NONDESTRUCTIVE TEST MANUAL**



NOTES

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- TOLERANCE (UNLESS SPECIFIED DIFFERENTLY):

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X.X = ± 0.050	X = ± 1
- MATERIAL: 15-5 PH CRES.
OPTIONAL MATERIAL: 4130,4140,4340
- SURFACE ROUGHNESS = 63 RA OR BETTER

- EDM NOTCH: 0.015 (0.38) MAXIMUM WIDTH
- ETCH OR STEEL STAMP THE REFERENCE STANDARD NUMBER NDT632 IN THIS LOCATION
- CHAMFER - 0.030 (0.76) BY 45 DEGREES

**Reference Standard NDT632
Figure 3**

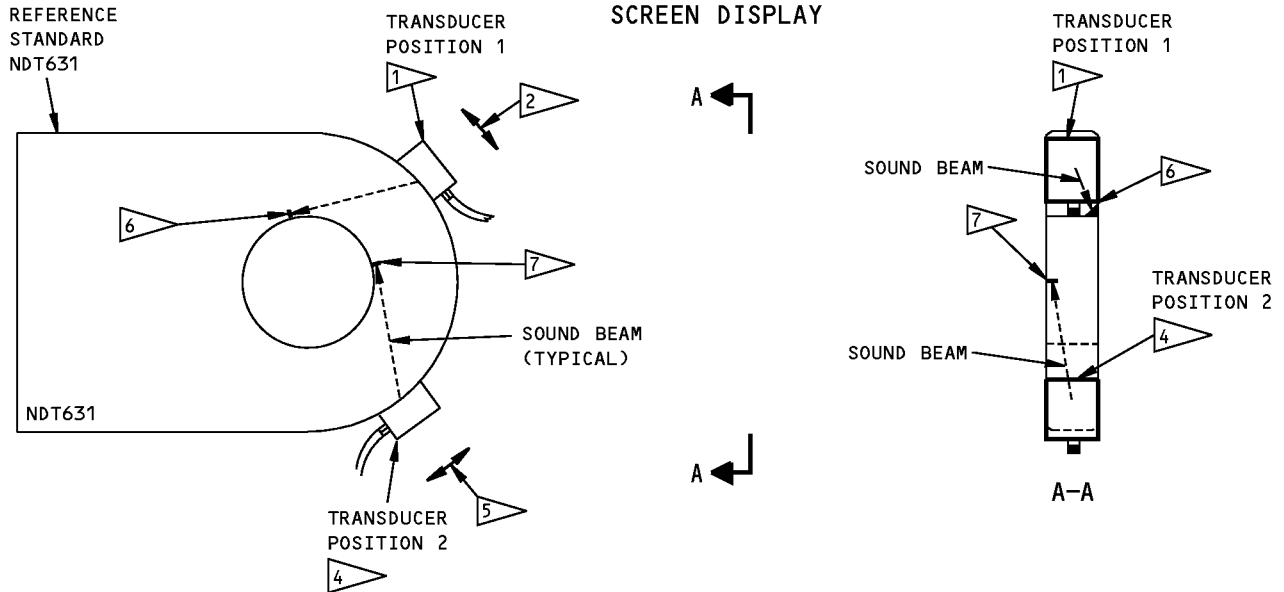
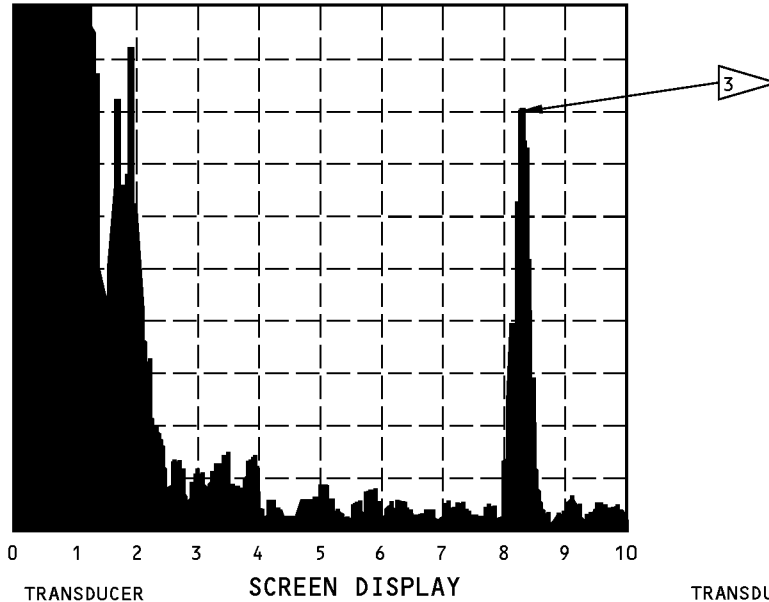
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PART 4 71-20-01

Page 7
May 15/2006

D634T301

NONDESTRUCTIVE TEST MANUAL



- 1 PUT THE TRANSDUCER ON THE REFERENCE STANDARD AT TRANSDUCER POSITION 1 SO THAT THE SOUND BEAM POINTS AT CORNER NOTCH 1.
- 2 MOVE THE TRANSDUCER TO AND AWAY FROM THE NOTCH. STOP THE TRANSDUCER MOVEMENT WHEN THE LARGEST SIGNAL IS RECEIVED FROM THE NOTCH.
- 3 PUT THE MAXIMUM RECEIVED SIGNAL AT 80 PERCENT OF FULL SCREEN WIDTH AND 80 PERCENT OF FULL SCREEN HEIGHT.
- 4 PUT THE TRANSDUCER ON THE REFERENCE STANDARD AT TRANSDUCER POSITION 2 SO THAT THE SOUND BEAM POINTS AT CORNER NOTCH 2.

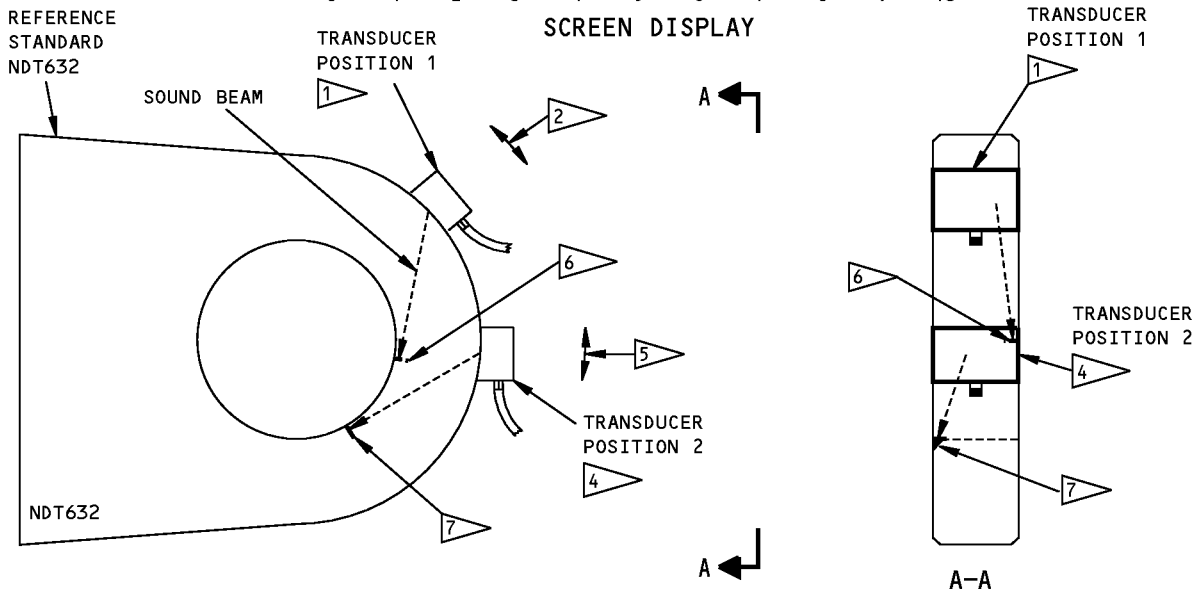
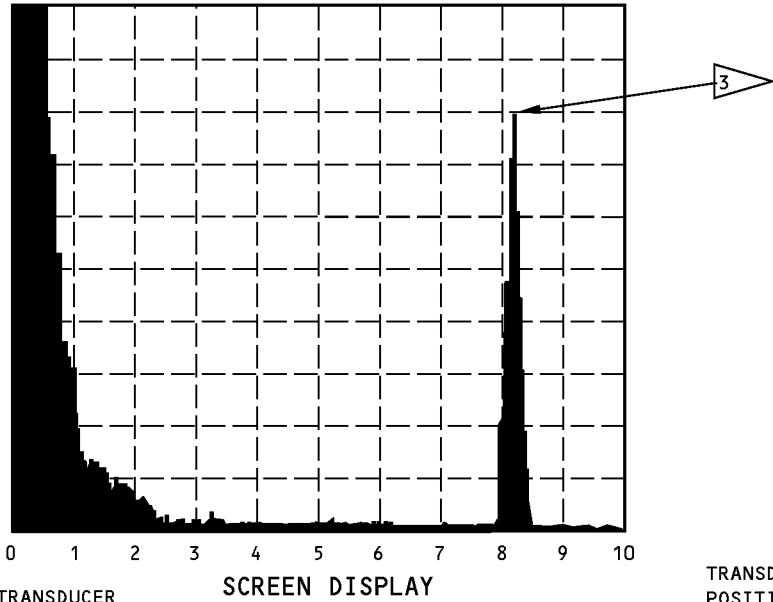
- 5 MOVE THE TRANSDUCER TO AND AWAY FROM CORNER NOTCH 2. STOP THE TRANSDUCER MOVEMENT WHEN THE LARGEST SIGNAL IS RECEIVED FROM THE NOTCH.
- 6 CORNER NOTCH 1; 0.10 X 0.10 INCH (2.5 X 2.5 MILLIMETERS)
- 7 CORNER NOTCH 2; 0.10 X 0.10 INCH (2.5 X 2.5 MILLIMETERS)

Instrument Calibration SUS631
Figure 4

EFFECTIVITY
ALL; 767 WITH JT9D ENGINES

PART 4 71-20-01

NONDESTRUCTIVE TEST MANUAL



- 1 PUT THE TRANSDUCER ON THE REFERENCE STANDARD AT TRANSDUCER POSITION 1 SO THAT THE SOUND BEAM POINTS AT CORNER NOTCH 1.
- 2 MOVE THE TRANSDUCER TO AND AWAY FROM THE NOTCH. STOP THE TRANSDUCER MOVEMENT WHEN THE LARGEST SIGNAL IS RECEIVED FROM THE NOTCH.
- 3 PUT THE MAXIMUM RECEIVED SIGNAL AT 80 PERCENT OF FULL SCREEN WIDTH AND 80 PERCENT OF FULL SCREEN HEIGHT.
- 4 PUT THE TRANSDUCER ON THE REFERENCE STANDARD AT TRANSDUCER POSITION 2 SO THAT THE SOUND BEAM POINTS AT CORNER NOTCH 2.

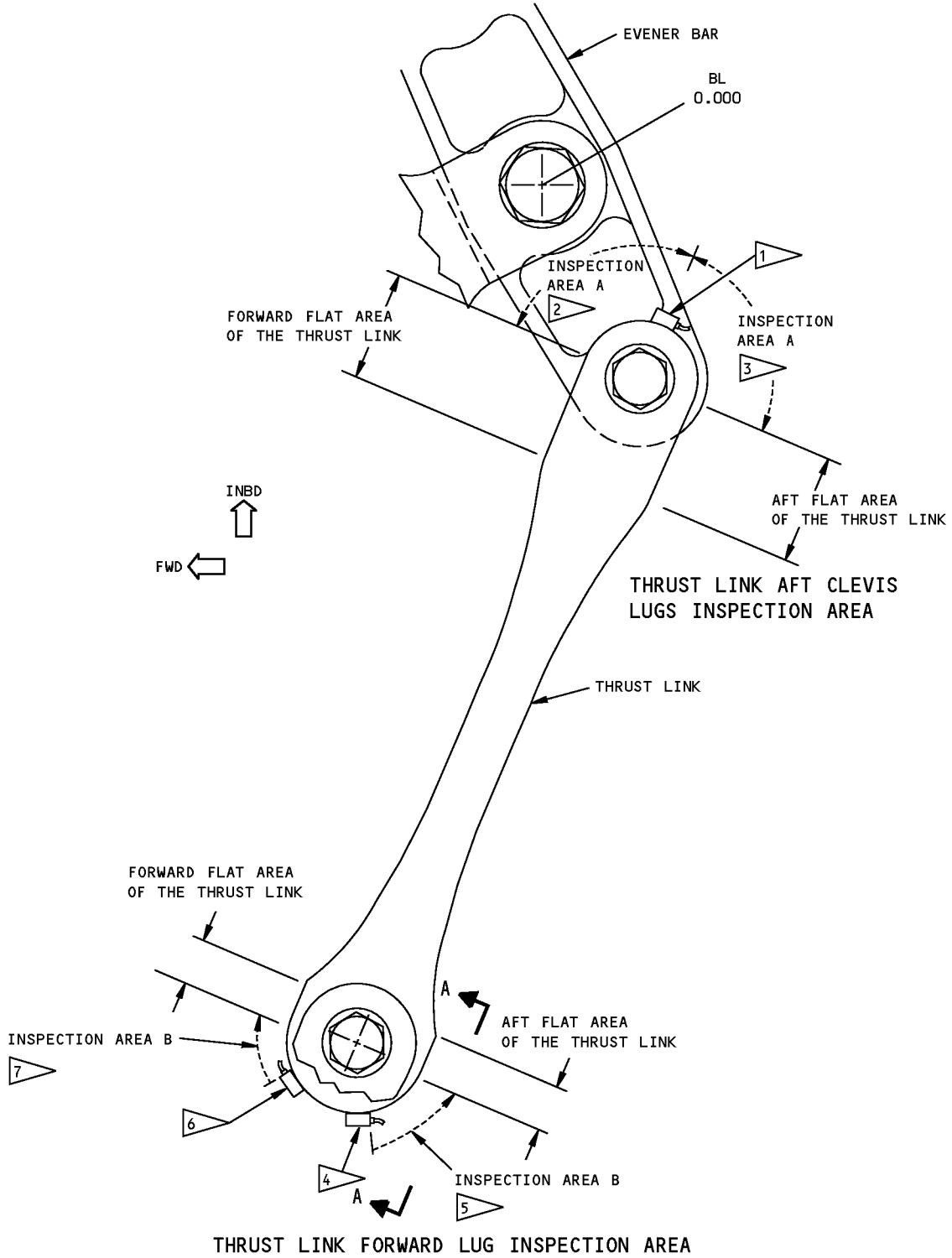
- 5 MOVE THE TRANSDUCER TO AND AWAY FROM CORNER NOTCH 2. STOP THE TRANSDUCER MOVEMENT WHEN THE LARGEST SIGNAL IS RECEIVED FROM THE NOTCH.
- 6 CORNER NOTCH 1; 0.10 X 0.10 INCH (2.5 X 2.5 MILLIMETERS)
- 7 CORNER NOTCH 2; 0.10 X 0.10 INCH (2.5 X 2.5 MILLIMETERS)

Instrument Calibration SUS632
Figure 5

EFFECTIVITY
ALL; 767 WITH JT9D ENGINES

PART 4 71-20-01

NONDESTRUCTIVE TEST MANUAL



**Inspection of the Engine Thrust Links and Evener Bar
Figure 6 (Sheet 1 of 2)**

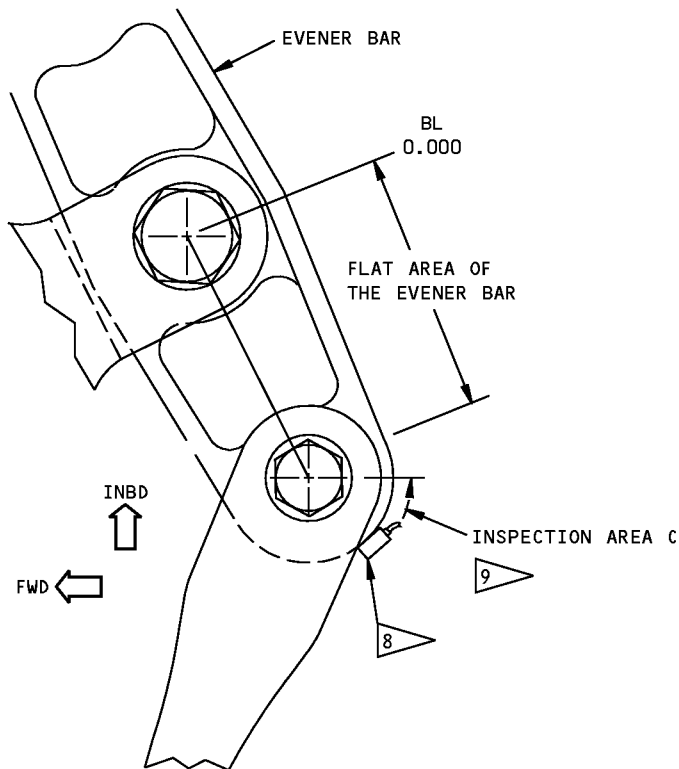
EFFECTIVITY
ALL; 767 WITH JT9D ENGINES

PART 4 71-20-01

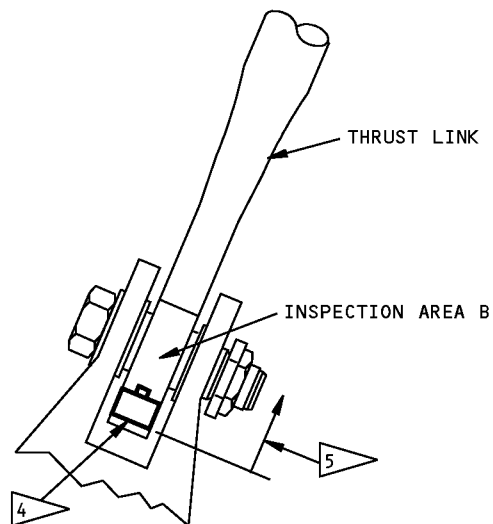
Page 10
May 15/2006

D634T301

NONDESTRUCTIVE TEST MANUAL



EVENER BAR INSPECTION AREA



THRUST LINK FORWARD LUG
A-A

NOTES

- THE LEFT SIDE OF THE ENGINE IS SHOWN, THE RIGHT SIDE IS ALMOST THE SAME. THE VIEWS OCCUR AS YOU LOOK DOWN.

- 1 ▽ PUT THE TRANSDUCER ON THE LUG SO THAT THE ULTRASONIC BEAM IS POINTED FORWARD.
- 2 ▽ MOVE THE TRANSDUCER AROUND THE LUG AND STOP WHEN THE EDGE OF THE TRANSDUCER TOUCHES THE FORWARD FLAT AREA OF THE THRUST LINK.
- 3 ▽ MOVE THE TRANSDUCER AFT AND OUTBOARD AND STOP WHEN THE TRANSDUCER EDGE TOUCHES THE AFT FLAT AREA OF THE THRUST LINK.
- 4 ▽ PUT THE TRANSDUCER ON THE LUG SO THAT THE ULTRASONIC BEAM IS POINTED AFT.
- 5 ▽ MOVE THE TRANSDUCER AROUND THE LUG AND STOP WHEN THE EDGE OF THE TRANSDUCER TOUCHES THE AFT FLAT AREA OF THE THRUST LINK.

- 6 ▽ PUT THE TRANSDUCER ON THE LUG SO THAT THE ULTRASONIC BEAM IS POINTED FORWARD AND INBOARD.
- 7 ▽ MOVE THE TRANSDUCER FORWARD AND INBOARD AND STOP WHEN THE TRANSDUCER EDGE TOUCHES THE FORWARD FLAT AREA OF THE LUG THRUST LINK.
- 8 ▽ PUT THE TRANSDUCER ON THE EVENER BAR SO THAT THE ULTRASONIC BEAM IS POINTED AFT AND INBOARD.
- 9 ▽ MOVE THE TRANSDUCER AROUND THE EVENER BAR AND STOP WHEN THE TRANSDUCER EDGE TOUCHES THE FLAT SURFACE OF THE EVENER BAR.

Inspection of the Engine Thrust Links and Evener Bar
Figure 6 (Sheet 2 of 2)

EFFECTIVITY
ALL; 767 WITH JT9D ENGINES

PART 4 71-20-01