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## NONDESTRUCTIVE TEST MANUAL

### PART 2 - X-RAY

#### HORIZONTAL STABILIZER - PIVOT FITTING - SPLICE PLATE INSPECTION

##### 1. Purpose

- A. Use this procedure to examine the pivot fitting splice plates for possible cracks. The pivot fitting splice plate locations are at the pivot fittings of the horizontal stabilizer. See Figure 1 for the inspection areas.
- B. MPD Appendix B DTR Check Form Reference:
  - (1) ITEM 55-10-I13B
  - (2) ITEM 55-10-I13C

##### 2. Equipment

- A. X-ray Generator - Use an end anode emission generator which can go through 1.0 inch (25.4 mm) of aluminum and can do this procedure. An Andrex 100 CP constant potential generator was used to help prepare this procedure.

NOTE: The maximum recommended generator tube diameter that can be used is 4.0 inches (102 mm) or less because of the limited source-to-film distance. A larger diameter generator tube can be used if you can get a radiographic sensitivity of 2-2T.

- B. Film - Use a low speed, very high contrast, very low grain film. This procedure was prepared with Kodak M film. Cut the film to fit the inspection area. See Figure 4.

NOTE: The film specifications are from the American Society For Testing Materials (ASTM) document E1815-96.

- C. Processor - Manual or automatic.
- D. Image Quality Indicators (IQI's) - The aluminum material in the inspection area is approximately 1.0 inch (25 mm) thick. Use a 0.020 inch (0.5 mm) thick aluminum plaque-type penetrometer to make sure of a 2-2T radiographic sensitivity. More data about IQI's can be found in Part 1, 51-02-00.

NOTE: Plaque type IQI's are recommended because of the dimensions and configuration of the inspection area. The correct exposure sensitivity is not always easy to know when wire IQI's are used. There is a distance of approximately 0.5 inch (12.7 mm) from the top surface of the fitting to the wire IQI's if the IQI's are put on top of the fastener heads.

- E. Lead sheet - Use a lead sheet with dimensions 2.8 inches (71.1 mm) x 0.125 inches (3.1 mm). The purpose of the lead sheet is to decrease radiation scatter.

##### 3. Preparation for Inspection

- A. Get access to the horizontal stabilizer torque box through access tail door 312AR.

**WARNING:** MAKE SURE TO FOLLOW ALL SAFETY PROCEDURES WHEN YOU ISOLATE THE HORIZONTAL STABILIZER ACTUATOR.

- B. Make sure the horizontal stabilizer is locked in the mid position.
- C. Remove access panels 313CLX and 314CRX.

NOTE: Removal of the access panels is necessary to position the X-ray generator.

- D. Remove sealant around the fasteners as necessary to position the film and IQI parallel with the inspection surface of the pivot fitting.

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- A. Identify the inspection areas. A total of eight exposures are necessary to examine the splice plates. Four exposures are necessary at each pivot fitting; two exposures are necessary at the top of each pivot fitting (one exposure at the inboard end and one at the outboard end) and two exposures are necessary at the bottom of each pivot fitting (one exposure at the inboard end and one at the outboard end).
- (1) The inspection area and IQI position is shown in Figure 2 for the inspection of the splice plate that is at the lower outboard end of the pivot fitting on the right side of the airplane. All inspection areas and IQI positions for the inboard and outboard sides of each pivot fitting will be almost the same.
- (2) The X-ray generator and film position is shown in Figure 3 for the inspection of the splice plate that is at the lower inboard end of the pivot fitting on the right side of the airplane. All X-ray generator and film positions for the inboard and outboard sides of each pivot fitting will be almost the same.

**NOTE:** It is permitted to put the X-ray generator external to the airplane if the X-ray beam is aligned correctly and if the density of the X-ray film and the radiographic sensitivity are as specified in this procedure. The X-ray parameters must be adjusted for the change in the material thickness and the source-to-film distance.

- B. Put the IQI on the low side of the right pivot fitting to examine the splice plate at the outboard end of the pivot fitting as shown in Figure 2. Make sure the IQI is adjacent to the inspection area but not between the inspection fasteners (Figure 2, Flagnotes 1 and 5). Make sure the IQI is always on the X-ray generator side of the pivot fitting.
- C. Put the film and lead sheet on top of the inspection fasteners. Make sure that the film is between the fastener and the lead sheet. See Figure 2, Flagnote 3.
- D. Install a support to hold the lead sheet and film in position. See Figure 2, Flagnote 4.
- E. Position the X-ray generator as follows:
- (1) Make sure the anode emission port of the X-ray generator is positioned directly below the inspection fasteners.
- (2) Make sure the source-to-film distance (SFD) is as specified in Figure 4.
- (3) Make sure the X-ray beam will be 90 degrees to the inspection surface and centered between the forward and aft rows of inspection fasteners.
- (4) Make sure the X-ray generator is safely positioned below the inspection area.
- F. Set the X-ray generator control as specified in Exposure 1 of Figure 4 to examine approximately 1.0 inch (25.4 mm) of aluminum.

**WARNING:** X-RAY RADIATION IS A POTENTIAL HEALTH HAZARD. DO THE STANDARD RADIATION SAFETY PROCEDURES.

- G. Operate the X-ray generator to take Exposure 1. See Figure 4 for the necessary sensitivity and film density.
- H. Do Paragraph 4.B. thru Paragraph 4.G. again for Exposure 2 to examine the splice plate at the lower inboard end of the pivot fitting on the right side of the airplane. See Figure 4 and Figure 2 and Figure 3.
- I. Do Paragraph 4.B. thru Paragraph 4.H. again for splice plate Exposures 3 and 4 at the lower outboard and inboard ends of the pivot fitting on the left side of the airplane. See Figure 4 and Figure 2 and Figure 3.



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J. Do Paragraph 4.B. thru Paragraph 4.I. again for splice plate Exposures 5 thru 8 at the top (inboard and outboard) ends of the pivot fittings on the left and right sides of the airplane. See Figure 4 and Figure 2 and Figure 3. To examine the top ends of the pivot fitting, make sure:

- (1) The IQI is on the upper side of the pivot fitting.
- (2) The film and lead sheet are below the inspection fasteners.
- (3) The X-ray generator is above the inspection fasteners.

### 5. Inspection Results

A. Examine the radiographs for cracks in the inspection area. Make sure the density and sensitivity are within the limits shown in Figure 4 and the X-ray beam was centered between the inspection fasteners.

NOTE: If a crack does not extend from fastener hole to fastener hole, it is possible that it will not show on the X-ray.

B. All areas that have possible crack indications must be more carefully examined with the fastener removed.

- (1) Do an eddy-current open bolt hole inspection as specified in Part 6, 55-10-02.

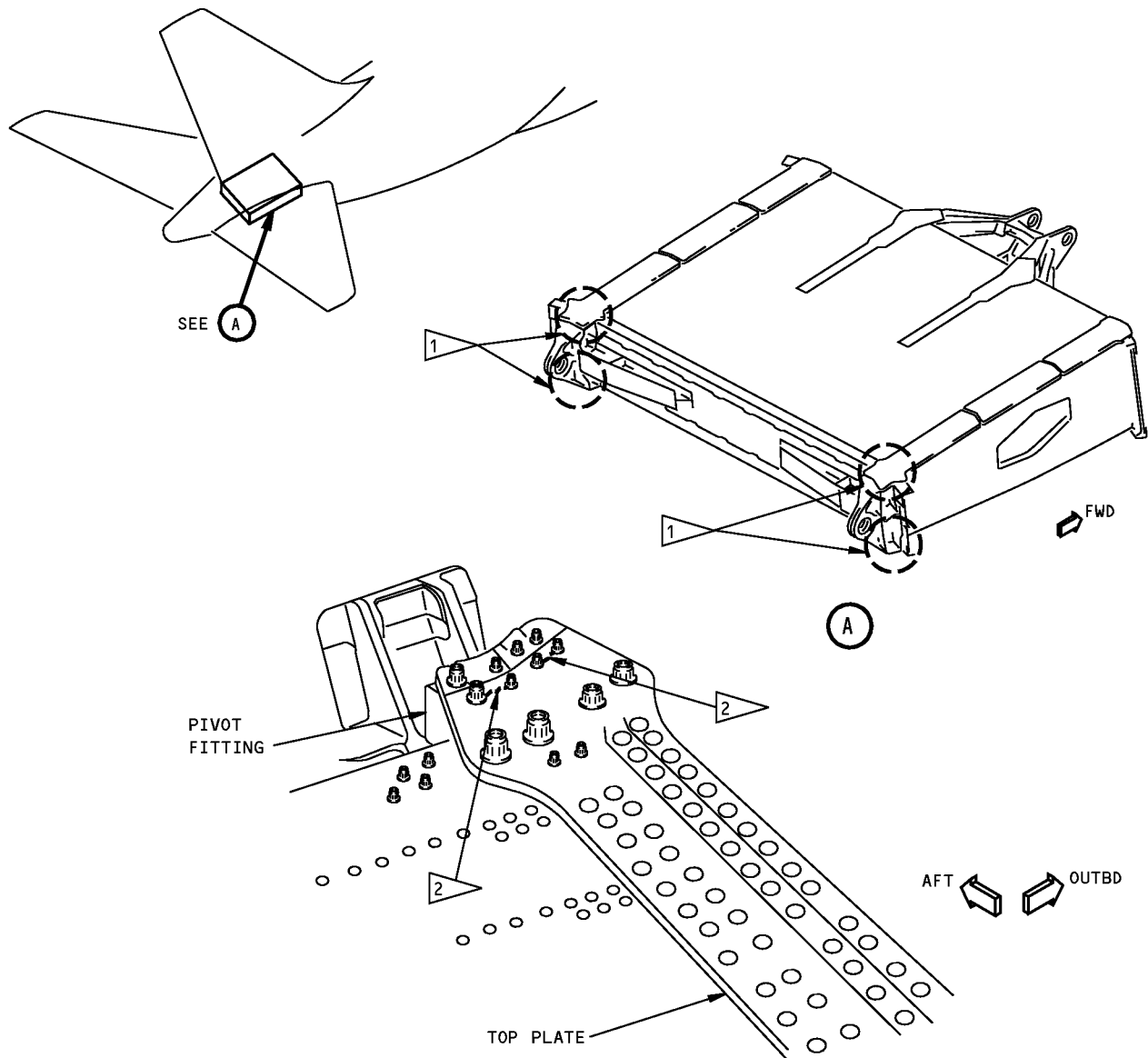
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## NOTES:

THE TOP OF THE LEFT SIDE IS SHOWN; THE TOP OF THE RIGHT SIDE AND THE BOTTOM LEFT AND RIGHT SIDES ARE ALMOST THE SAME.

- 1 INSPECTION AREAS. SEE FIGURE 2.
- 2 POSSIBLE CRACK LOCATION BETWEEN THE FASTENER HOLES IN THE SPLICE PLATE. THE SPLICE PLATE IS BETWEEN THE TOP PLATE AND THE PIVOT FITTING.

**Horizontal Stabilizer Pivot Fitting - Splice Plate Inspection Areas**  
**Figure 1**

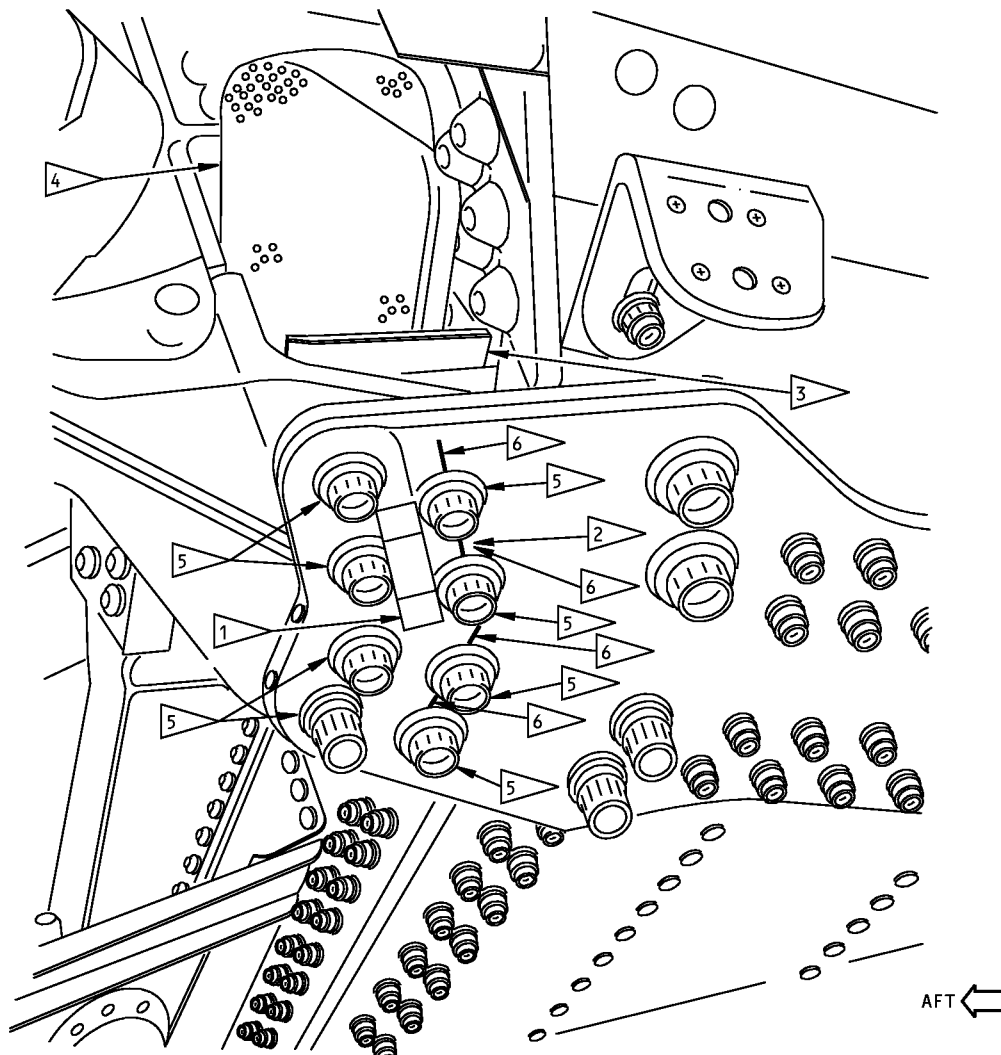
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IQI AND FILM POSITION FOR THE INSPECTION OF THE SPLICE PLATE THAT IS AT THE LOWER OUTBOARD END OF THE PIVOT FITTING ON THE RIGHT SIDE OF THE AIRPLANE.

## NOTES:

VIEW AS YOU LOOK FROM OUTSIDE THE AIRPLANE  
THE LOW RIGHT SIDE OF THE PIVOT FITTING IS  
SHOWN; THE LOW SIDE OF THE LEFT PIVOT FITTING  
IS OPPOSITE. THE TOP SIDES OF THE RIGHT AND  
LEFT PIVOT FITTING ARE ALMOST THE SAME.

1 PUT THE IQI ON THE LOWER SURFACE OF THE  
PIVOT FITTING BETWEEN FASTENER ROWS

2 GET A FILM DENSITY BETWEEN 2.0 AND 3.0  
BETWEEN THE INSPECTION FASTENERS

3 PUT THE FILM AND LEAD SHEET ON TOP OF THE  
FASTENER ENDS ON THE OPPOSITE SIDE OF THE  
FITTING FROM THE X-RAY GENERATOR

4 SUPPORT MATERIAL (FOAM) USED TO HOLD THE  
FILM IN THE CORRECT POSITION

5 INSPECTION FASTENERS

6 LOOK FOR CRACKS IN THESE DIRECTIONS AT  
EACH OF THE INSPECTION FASTENERS.

**Inspection Area and IQI Position  
Figure 2**

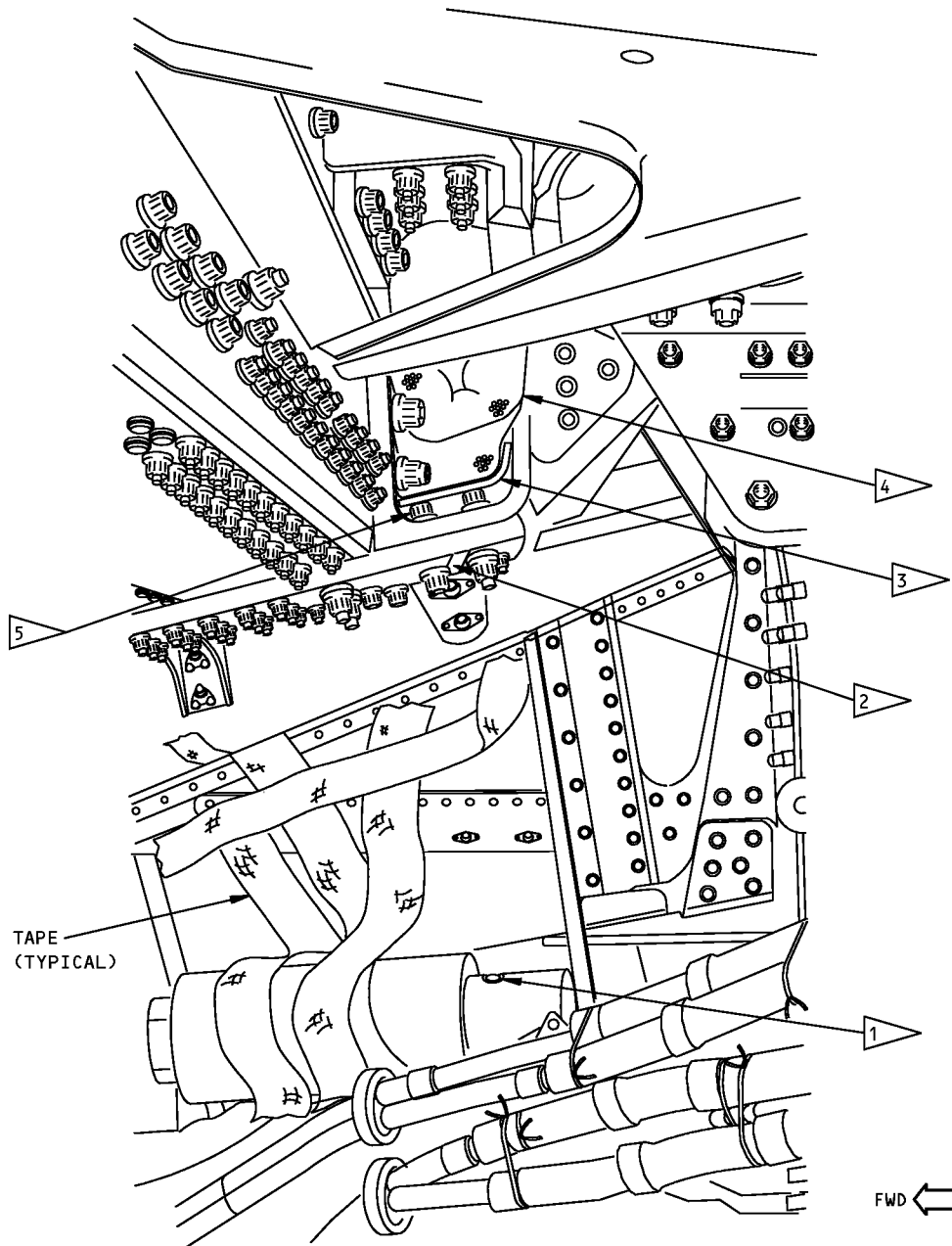
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X-RAY EQUIPMENT POSITIONS FOR THE INSPECTION OF THE SPLICE PLATE THAT IS AT THE LOWER INBOARD END OF THE PIVOT FITTING ON THE RIGHT SIDE OF THE AIRPLANE.

**X-Ray Generator and Film Position  
Figure 3 (Sheet 1 of 2)**

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### NOTES:

- VIEW AS YOU LOOK FROM INSIDE THE AIRPLANE THE LOW SIDE OF THE RIGHT PIVOT FITTING IS SHOWN; THE LOW SIDE OF THE LEFT PIVOT FITTING IS OPPOSITE. THE TOP SIDES OF THE RIGHT AND LEFT PIVOT FITTING ARE ALMOST THE SAME.

1. ALIGN THE ANODE EMISSION PORT OF THE X-RAY GENERATOR WITH THE INSPECTION FASTENERS. THE X-RAY BEAM MUST BE 90 DEGREES TO THE INSPECTION SURFACE AND CENTERED BETWEEN THE TWO INSPECTION FASTENERS.
2. PUT THE IQI ON THE GENERATOR SIDE OF THE PIVOT FITTING
3. PUT THE FILM AND THE LEAD SHEET ON THE TOP OF THE PIVOT FITTING INSPECTION FASTENERS ON THE OPPOSITE SIDE OF THE X-RAY GENERATOR
4. SUPPORT MATERIAL (FOAM) TO HOLD THE FILM IN THE CORRECT POSITION
5. INSPECTION FASTENERS

**X-Ray Generator and Film Position  
Figure 3 (Sheet 2 of 2)**

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EXPOSURE NUMBER	PIVOT FITTING LOCATION	SFD (MINIMUM)	GENERATOR SETTING	
			KV	MAS
1	LOWER RIGHT SIDE - OUTBOARD END	13 (330.2)	90	210
2	LOWER RIGHT SIDE - INBOARD END	13 (330.2)	90	210
3	LOWER LEFT SIDE - OUTBOARD END	13 (330.2)	90	210
4	LOWER LEFT SIDE - INBOARD END	13 (330.2)	90	210
5	TOP RIGHT SIDE - OUTBOARD END	22 (558.8)	90	390
6	TOP RIGHT SIDE - INBOARD END	22 (558.8)	90	390
7	TOP LEFT SIDE - OUTBOARD END	22 (558.8)	90	390
8	TOP LEFT SIDE - INBOARD END	22 (558.8)	90	390

**X-RAY PARAMETERS**  
**TABLE 1**

**NOTES:**

- ALL DIMENSIONS ARE IN INCHES (MILLIMETERS ARE IN PARENTHESES).
- THE GENERATOR SETTINGS ABOVE WERE GOTTEN WITH A CONSTANT POTENTIAL UNIT. IF YOU USE A SELF-RECTIFIED GENERATOR IT WILL BE NECESSARY TO INCREASE YOUR KV AND/OR MAS. USE THE MINIMUM NECESSARY KV IF POSSIBLE.
- USE ASTM FILM CLASS I FOR ALL EXPOSURES.
- GET A DENSITY OF BETWEEN 2.0 AND 3.0 IN THE AREA OF RADIOGRAPHIC INTEREST.
- GET A RADIOGRAPHIC SENSITIVITY OF 2 PERCENT OR BETTER IN THE AREA OF RADIOGRAPHIC INTEREST.
- ALL FILM IS 3.0 X 3.0 (76.2 X 76.2). CUT ONE CORNER OF THE FILM AT AN ANGLE THAT IS APPROXIMATELY 1.0 X 1.0 (25.4 X 25.4)
- SFD IS SOURCE-TO-FILM DISTANCE.

**X-Ray Parameters**  
**Figure 4**

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