FASTENER INSPECTION

1. Purpose

A. To detect broken or severely cracked bolts using ultrasonic inspection.

NOTE: This procedure cannot be used to inspect certain bolt types. For typical bolts which may be inspected, see Figure 1.

2. Equipment

A. Instrument/Transducer -- Any pulse-echo ultrasonic instrument and transducer combination operating in the 5 to 10 MHz range, satisfying the calibration requirements of Paragraph 4., is suitable for this procedure. The following equipment was used in developing this procedure:

(1) Instrument -- USL 38, Krautkramer Branson

(2) Transducer -- 0.25-inch diameter, 10 MHz, gamma, P/N 2911645-1, K. B. Aerotech

B. Reference Standard -- Calibration Bolt and Calibration Block.

(1) Calibration Bolt -- Use bolt of similar material, type, and length as bolt to be examined.

NOTE: Get bolt properties from engineering drawings.

(2) Calibration Block -- one inch thick block of similar material as bolt to be examined.

C. Couplant -- Light grease or equivalent, compatible with airplane structure.

3. Preparation for Inspection

A. Locate inspection bolt and ensure end of bolt contacting transducer is clean and free of sealant.

4. Instrument Calibration

A. Apply couplant to calibration block and ends of calibration bolt.

B. Perform preliminary instrument adjustments per owner's operating manual

NOTE: Reject or signal suppression is not to be used in calibration or inspection.

C. Place transducer on calibration block. Adjust screen range to equal one major division on the screen graticule per 1-inch of calibration block length.

D. Adjust instrument gain using calibration bolt for inspection conducted from:

NOTE: Transducer used for inspection should not allow more than 10 percent full screen height of spurious signals between the initial pulse and the back surface reflection at the calibration gain setting.

(1) Bolt head (annulus).

(a) Place transducer firmly on flat surface of calibration bolt head (annulus).

(b) Adjust gain to obtain a back surface reflection amplitude of 40 percent of full screen height (Figure 2).

(2) Bolt threaded end.

(a) Place transducer firmly on flat surface of calibration bolt threaded end.

(b) Adjust gain to obtain a back surface reflection amplitude of 60 percent of full screen height (Figure 3).

5. Inspection Procedure

A. Determine the bolt properties and the end of bolt to be inspected.

B. Calibrate instrument per Paragraph 4.

C. Apply couplant to bolt end.

D. Place transducer firmly on flat of bolt end and scan. Screen presentation should appear as noted during calibration.

NOTE: Bolt length can be verified by comparing the length indicated by the position of the back surface reflection to the known length of the calibration bolt or block (Paragraph 4.C.). If bolt appears to be 0.25 inch shorter or 0.50 inch longer than calibration bolt, verify length in reference drawings.

6. Inspection Results

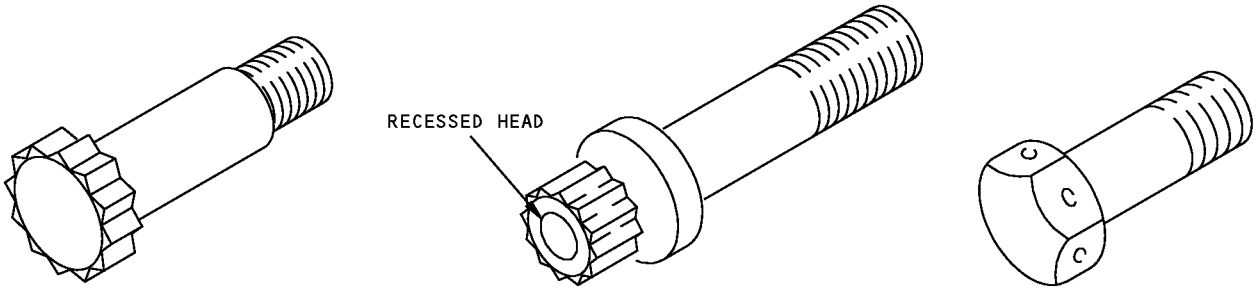
NOTE: Ensure that transducer is placed firmly on bolt when obtaining inspection results.

A. A fracture along the shank will be noted by an indication from the fracture face with the absence of the expected back surface reflection (Figure 4 and Figure 5).

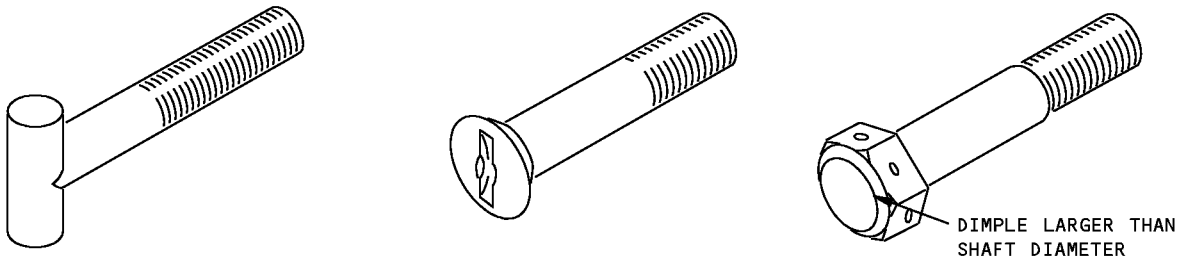
B. A large crack without shank separation may be noted by an indication of 20 percent full screen height or greater, with the expected back surface reflection still visible (Figure 6 and Figure 7).

C. If fracture face of bolt is irregular, the reflected ultrasound may be deflected away from the transducer. A decrease in back surface reflection amplitude indicates a potential cracked or fractured bolt.

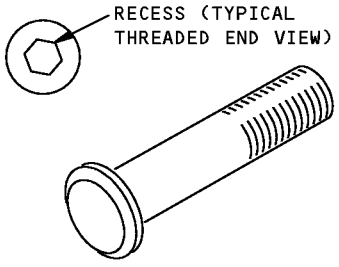
D. Compare all results to those obtained from calibration bolt (Paragraph 4.D.).



TYPICAL BOLTS WHICH MAY BE INSPECTED FROM EITHER END

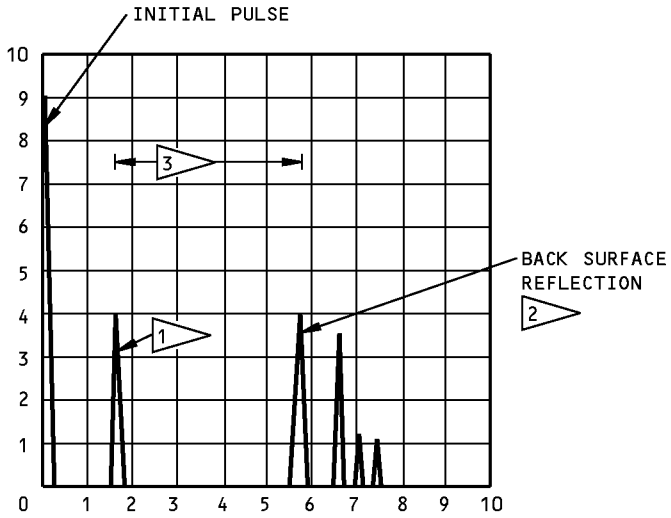


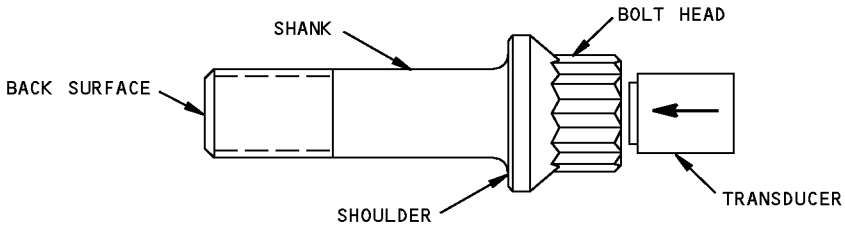
TYPICAL BOLTS WHICH MAY ONLY BE INSPECTED FROM THREADED END



TYPICAL BOLTS WHICH MAY ONLY BE INSPECTED FROM BOLT HEAD END

Typical Bolt Types
Figure 1





NOTES

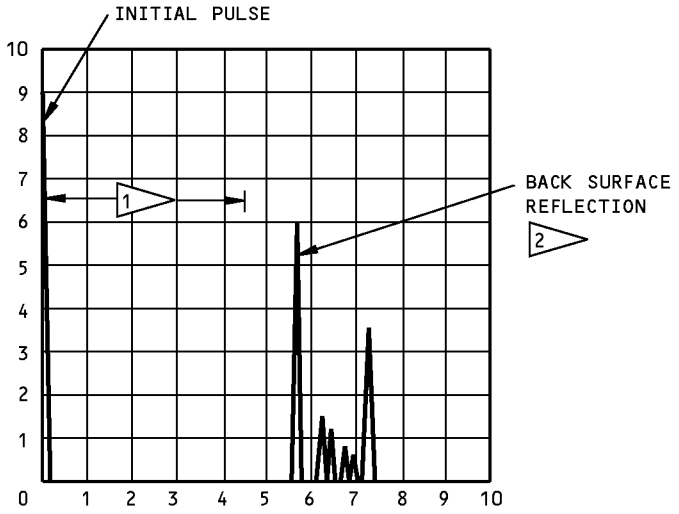
- TYPICAL SCREEN RESPONSE FOR INSPECTION CONDUCTED FROM BOLT HEAD (ANNULUS) OF A 5.5 INCH BOLT

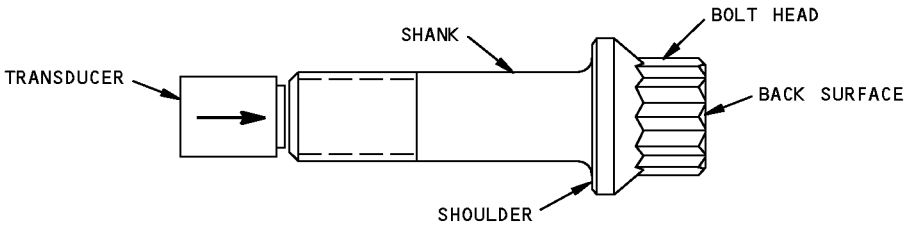
1 SIGNAL FROM BOLT SHOULDER WHEN TRANSDUCER POSITION OVERLAPS BOTH BOLT SHOULDER AND SHANK

2 BACK SURFACE REFLECTION IS FIRST SIGNAL OF RECEIVED BACK SURFACE REFLECTIONS AND IS AMPLITUDE SENSITIVE ACCORDING TO BOLT DIAMETER. SET SIGNAL AMPLITUDE TO 40% OF FULL SCREEN HEIGHT

3 TYPICAL FRACTURE OR CRACK INDICATIONS WILL APPEAR BETWEEN BOLT SHOULDER SIGNAL AND BACK SURFACE REFLECTION

Bolt Head Response
Figure 2





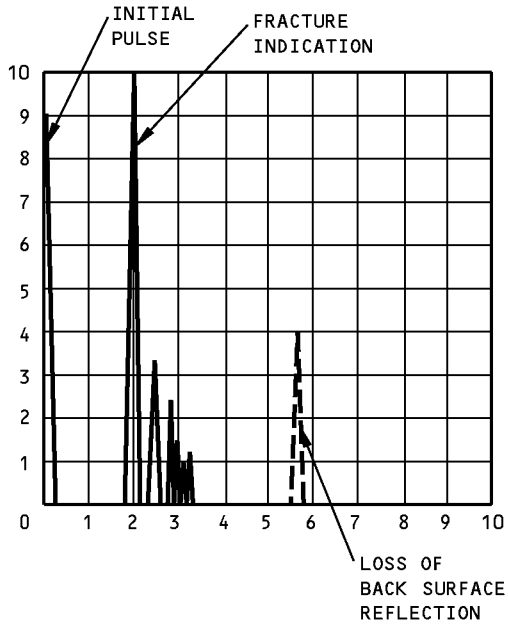
NOTES

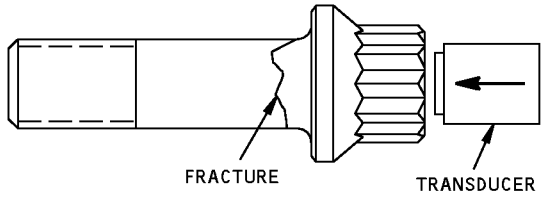
- TYPICAL SCREEN RESPONSE FOR INSPECTION CONDUCTED FROM THREADED END OF A 5.5 INCH BOLT

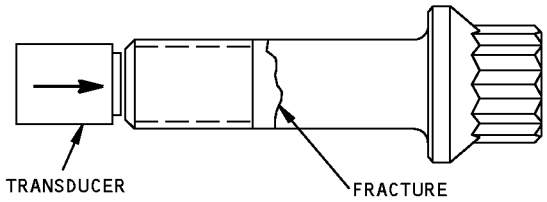
1 TYPICAL FRACTURE OR CRACK INDICATIONS WILL APPEAR BETWEEN INITIAL PULSE AND CALCULATED SCREEN DISTANCE OF SHANK LENGTH

2 BACK SURFACE REFLECTION IS FIRST SIGNAL OF RECEIVED BACK SURFACE REFLECTIONS AND IS AMPLITUDE SENSITIVE ACCORDING TO BOLT DIAMETER. SET SIGNAL AMPLITUDE TO 60% OF FULL SCREEN HEIGHT

Threaded End Response
Figure 3



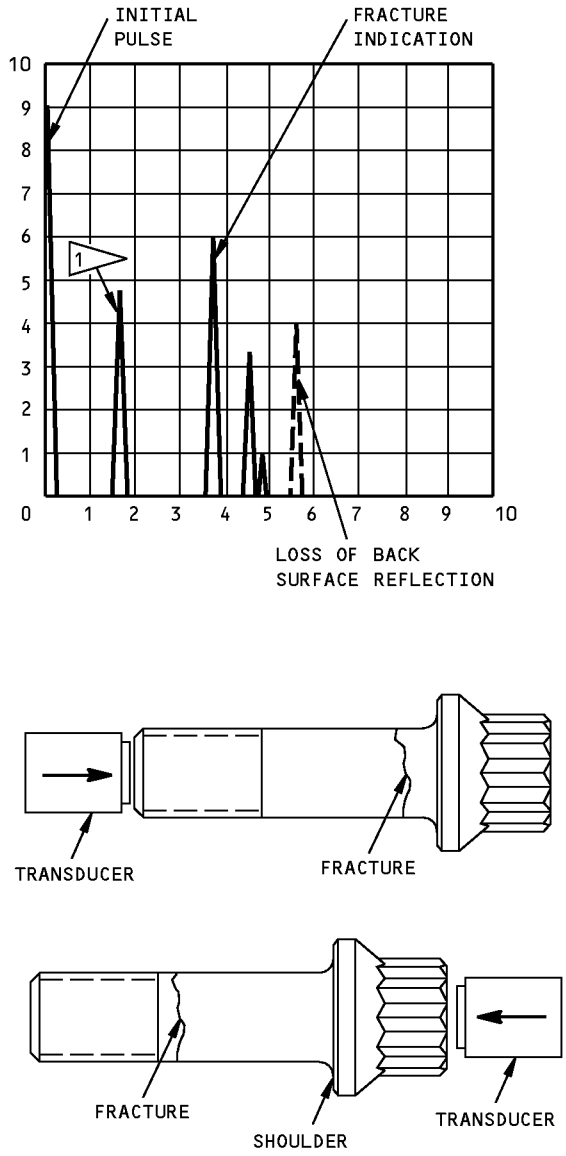




NOTE

- TYPICAL SCREEN RESPONSE OF A FRACTURE ALONG BOLT SHANK CLOSE TO SOUND ENTRY POINT

Fracture Close to Sound Entry Point
Figure 4

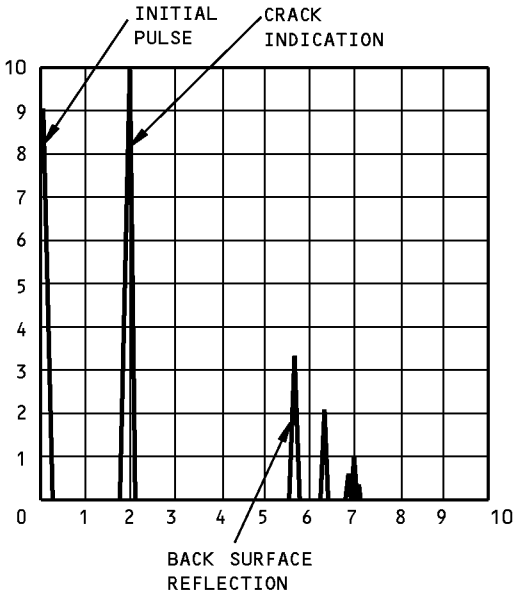


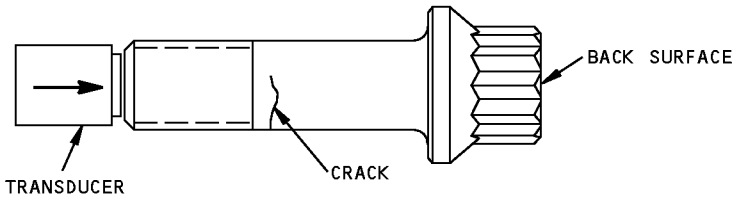
NOTES

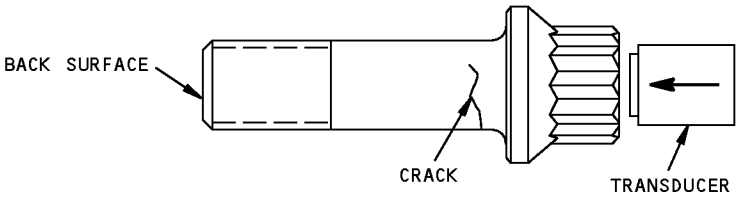
- TYPICAL SCREEN RESPONSE OF A FRACTURE ALONG BOLT SHANK AWAY FROM SOUND ENTRY POINT

1 SIGNAL FROM BOLT SHOULDER WHEN TRANSDUCER POSITION OVERLAPS BOTH BOLT SHOULDER AND SHANK

Fracture Away from Sound Entry Point
Figure 5



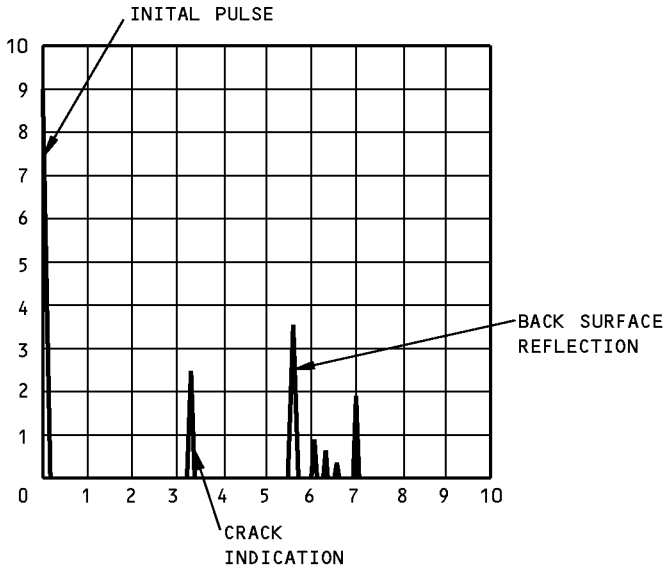


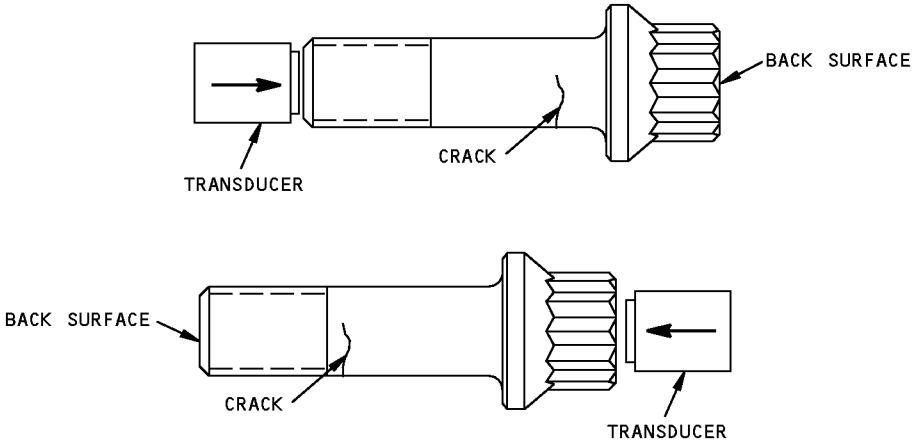


NOTE

- TYPICAL SCREEN RESPONSE OF A CRACK ALONG BOLT SHANK CLOSE TO SOUND ENTRY POINT

Crack Close to Sound Entry Point
Figure 6





NOTE

- TYPICAL SCREEN RESPONSE OF A CRACK ALONG BOLT SHANK AWAY FROM SOUND ENTRY POINT

Crack Away from Sound Entry Point
Figure 7