

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



CEN22LA141

MATERIALS LABORATORY

Factual Report 23-012

February 24, 2023

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A. ACCIDENT INFORMATION

Location: Brodhead, Wisconsin
Date: March 13, 2022
Vehicle: Cessna 150M, N63246
Investigator: Michael Folkerts, ASI-CEN

B. COMPONENTS EXAMINED

Continental Motors O-200-A - Number 1 cylinder assembly with fractured rocker arm bosses; P/N: Not determined; Time Since Installed: 1659.1 h (approx.).

C. EXAMINATION PARTICIPANTS

Specialist Donald Kramer, Ph.D.
National Transportation Safety Board
Washington, DC

D. DETAILS OF THE EXAMINATION

The number 1 cylinder assembly from a Continental Motors O-200-A was submitted to the NTSB Materials Laboratory for examination as shown in figures 1a and 1b. As indicated in figure 1b, the bosses supporting the exhaust and intake rocker shafts had fractured. The fracture surfaces were examined with the aid of a stereomicroscope and are shown in greater detail in figures 2 - 4.

Features consistent with fatigue crack initiation and progression were observed on the bosses supporting the exhaust rocker shaft. The upper and lower fractures on the outer boss are shown in figures 2a and 2b, respectively. The fracture surfaces were tinted and had a flat feathery appearance across most of the fractures with radial lines progressing away from the outer edges of the rocker shaft bore hole. The origin areas did not exhibit any notable features. The features were consistent with fatigue crack initiation at and progression from the bore hole. On the lower fracture surface, a secondary fatigue crack was observed initiating at the lower inner corner of the boss, which progressed toward the primary crack, the two cracks meeting along a final overstress parting line. The percentage of fatigue crack progression on the upper and lower fractures, measured on calibrated digital images, was 93% and 94%, respectively.

The middle boss supported both the exhaust and intake rocker shafts. The upper and lower fracture surfaces, shown in figures 3a and 3b, respectively, exhibited flat feathery features on the side supporting the exhaust rocker shaft with radial lines progressing away from the rocker shaft bore hole. The origin areas were damaged. The features were consistent with crack initiation at and progression away from the rocker shaft bore hole. The percentage of fatigue crack propagation on the upper

and lower fractures was 24% and 56%, respectively. The remainder of each fracture surface exhibited rough granular features, consistent with overstress.

The fractures surfaces on the outer intake rocker shaft boss are shown in figures 4a and 4b. The upper and lower fractures exhibited rough granular features, consistent with overstress fractures.

The thickness of the center boss was measured at several locations with a caliper. The bore hole exhibited wear in some locations and the as-reamed thickness could not be determined in those regions. The lowest measured thickness was 0.194 inch in the region between the exhaust and intake rocker arm bushings, indicated in figure 3a. The diameter of the bore hole, measured with a caliper in a region with no wear was approximately 0.700 inch.

E. ATTACHMENTS

Continental Service Bulletin M73-13 - Reaming and Bushing Rocker Shaft Bosses, Teledyne Continental Motors, Mobile, AL, 1977.

FAA Airworthiness Directive 94-05-05-R1, January 29, 1996.

Submitted by:

Donald Kramer, Ph.D.
Sr. Materials Engineer

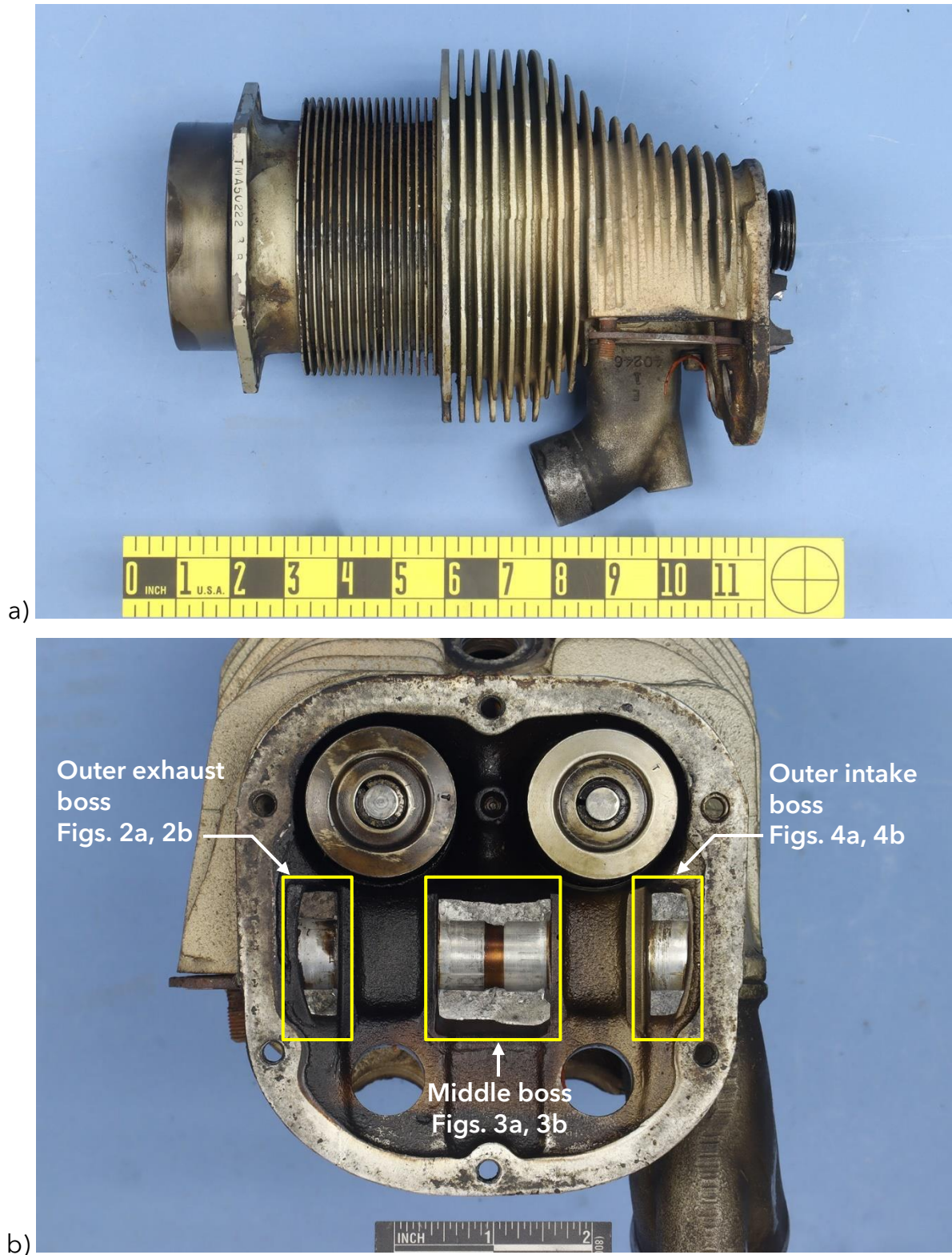


Figure 1. Number 1 cylinder assembly as received: a) view of cylinder side and b) view of rocker box with fractured rocker shaft bosses, as indicated.

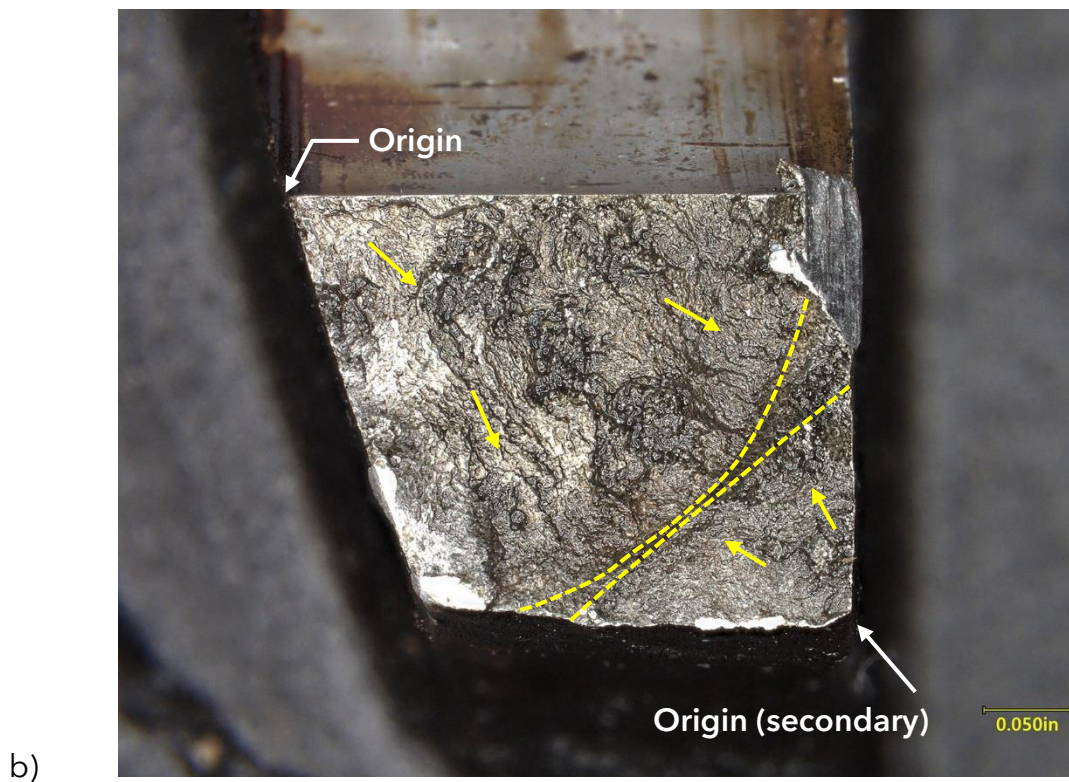
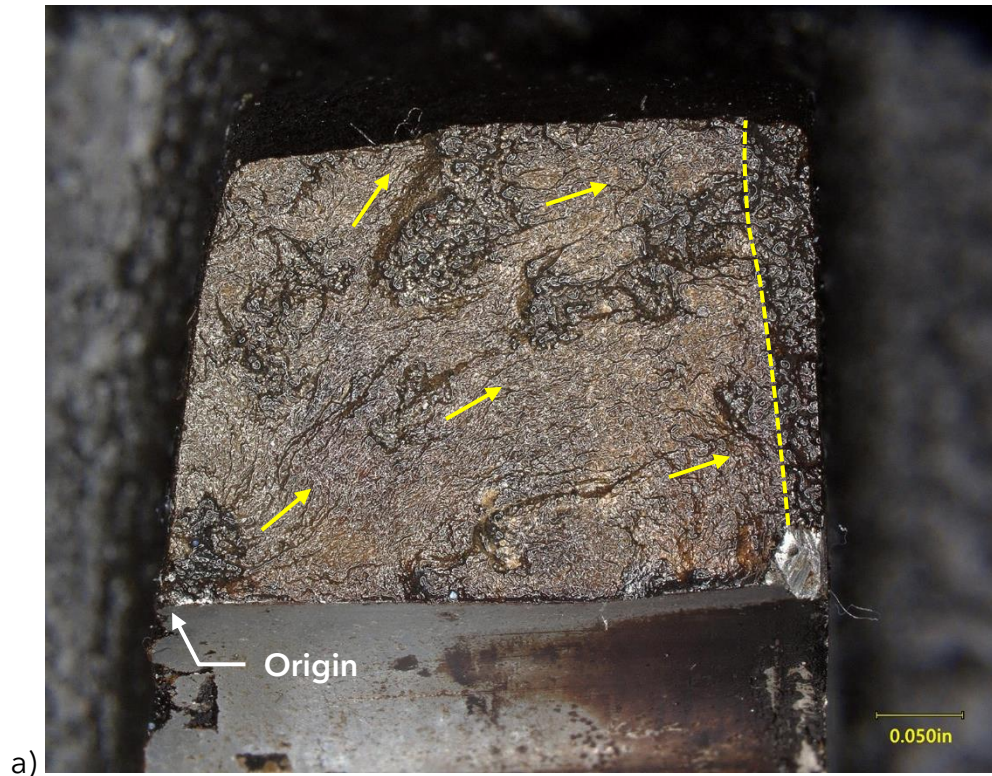


Figure 2. Outer exhaust rocker shaft boss fractures: a) upper fracture and b) lower fracture. Yellow arrows indicate the local direction of crack propagation. The yellow dashed lines indicate approximate transition from fatigue to overstress.

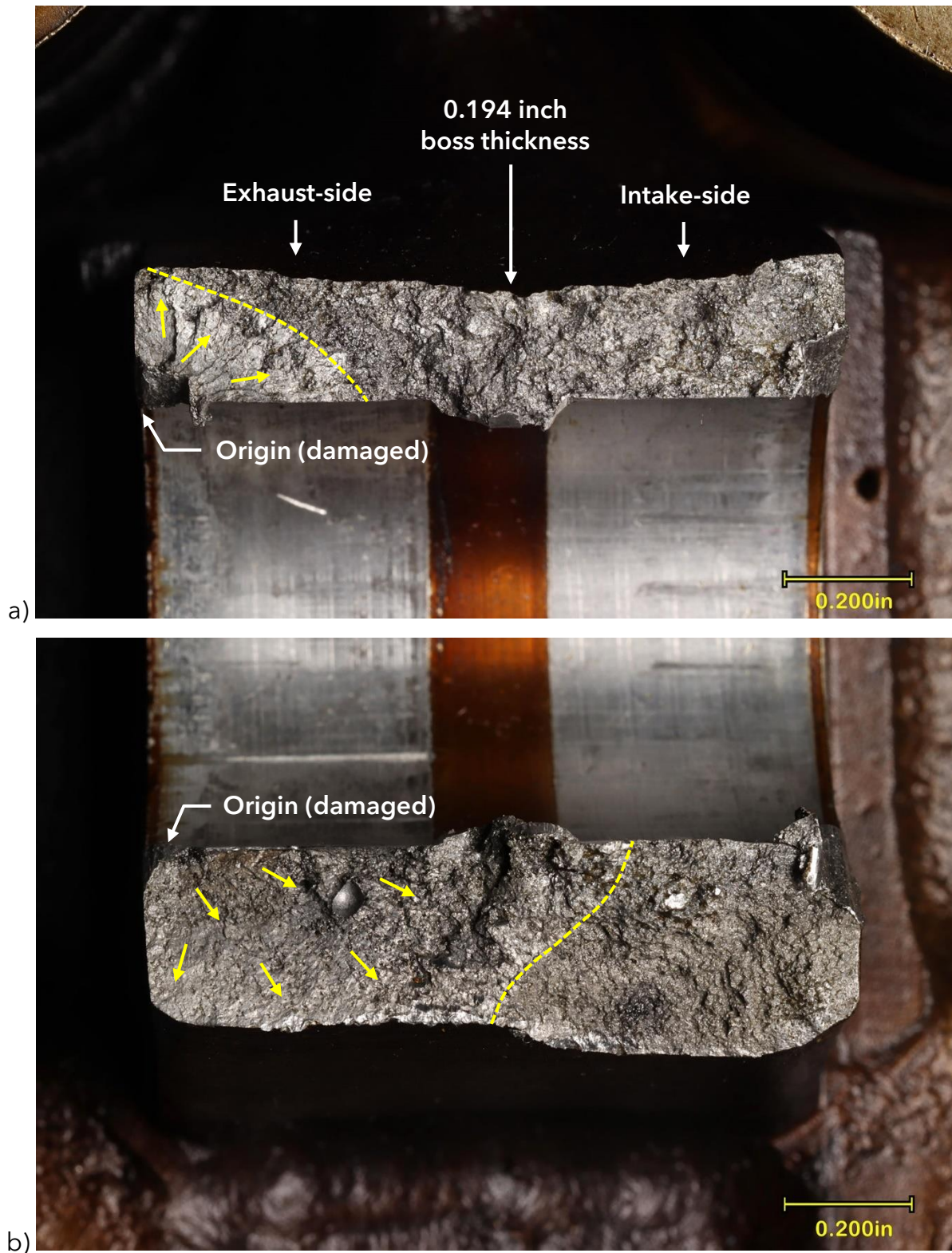


Figure 3. Middle rocker shaft boss fractures: a) upper fracture and b) lower fracture. Yellow arrows indicate the local direction of crack propagation. The yellow dashed lines indicate approximate transition from fatigue to overstress.

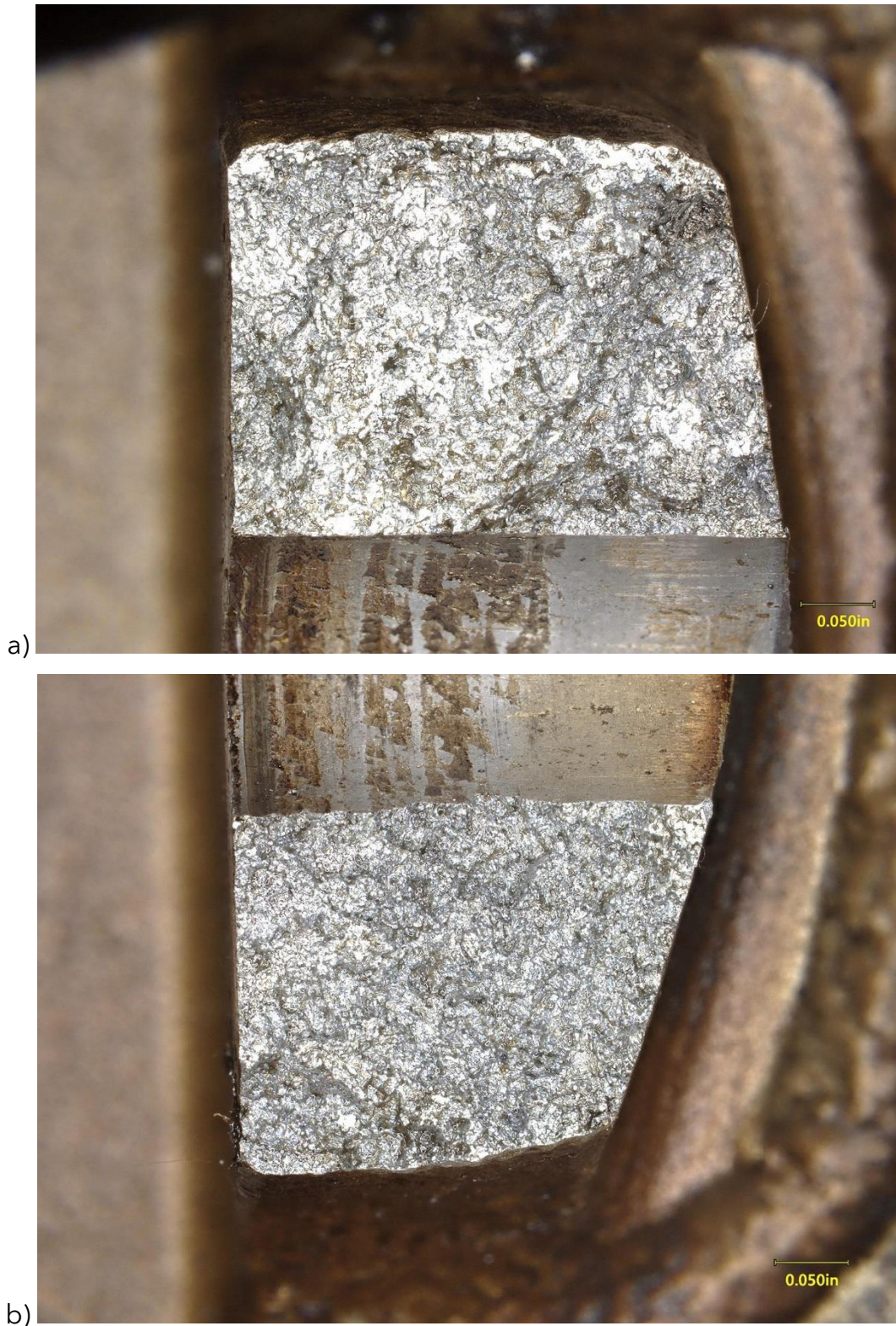


Figure 4. Outer intake rocker shaft boss fractures: a) upper fracture and b) lower fracture. The fractures exhibited a rough granular appearance, consistent with overstress.