

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



ERA24LA016

MATERIALS LABORATORY

Factual Report 24-040

July 5, 2024

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A. ACCIDENT INFORMATION

Location: Richmond, Virginia
Date: October 21, 2023
Vehicle: Cessna 172I, N7716G
Investigator: Eric Alleyne, ASI-ERA

B. COMPONENTS EXAMINED

Precision Airmotive Corp. carburetor; Model: MA-4-5; Part number: 10-5193; Serial number: 75055902 - Removed from a Lycoming O-360-A4M aircraft engine; Engine total time: 1557.2 h as of 9/6/23.

C. EXAMINATION PARTICIPANTS

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

D. DETAILS OF THE EXAMINATION

A partially disassembled carburetor, manufactured by Precision Airmotive Corp., was submitted to the NTSB Materials Laboratory for examination (figures 1 and 2). The float bracket had fractured into two pieces (figure 1b). By design, the float bracket was attached to the throttle body and bowl cover assembly by two screws. The float was attached to the bracket by a float lever shaft (figure 1b). A float valve (figures 2a and 2b) was coupled to the float by a clip that was also mounted on the float lever shaft. Rotation of the float about the shaft resulted in axial motion of the float valve inside the float valve seat (figure 3). When the valve was sealed against the seat, the flow of fuel into the bowl was restricted.

One of the float bracket arms had fractured as a result of cyclic fatigue and had separated from the rest of the bracket. The separated piece showed a light rub mark from contact with the float hinge (figure 4a). The fracture surfaces were flat and contained radiating lines and curved crack growth features that were consistent with the fracture originating along the interior edge where the arm intersected the base of the bracket (figure 4b). The origin was approximately 0.08 inch long and started about 0.015 inch from the side of the bracket closest to the float valve seat. The bracket was removed from the throttle body and bowl cover assembly, cleaned in acetone, and examined using a scanning electron microscope (SEM). The fracture surface exhibited either smearing features from fracture face recontact or fine feathery features consistent with high-cycle low amplitude fatigue (figures 5a - 5c). There were no apparent anomalies along the inner edge where the fracture originated.

The float valve seat was worn. The seat was removed using a screw extractor (which created deformation marks at the opening to the seat) (figure 6a). The inner cylindrical valve guide surfaces contained longitudinal wear marks at three locations spaced 120° apart from one another (figures 6b and 6c). The spacing was the same as the three-lobed design of the float valve (figure 2b). Between the longitudinal wear marks, there was a circumferential wear mark close to the seat (figure 6c). The float valve surfaces were rubbed but did not appear worn.

Submitted by:

Donald Kramer, Ph.D.
Senior Materials Engineer

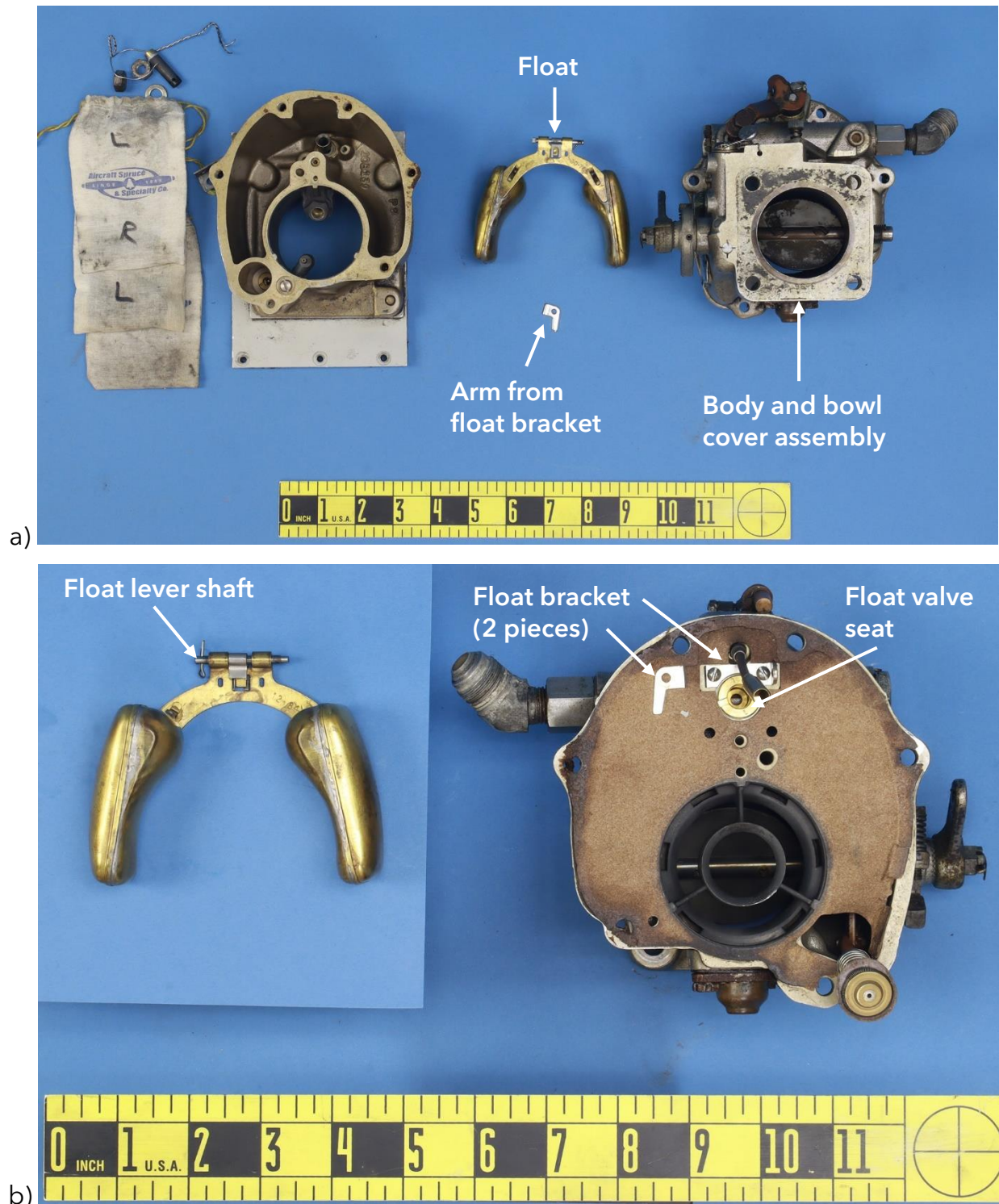


Figure 1. a) Partially disassembled carburetor as received and b) float and throttle body and bowl cover assembly with labels indicating the float bracket pieces and the float valve seat.



Figure 2. Images of the float valve: a) side view and b) isometric view.

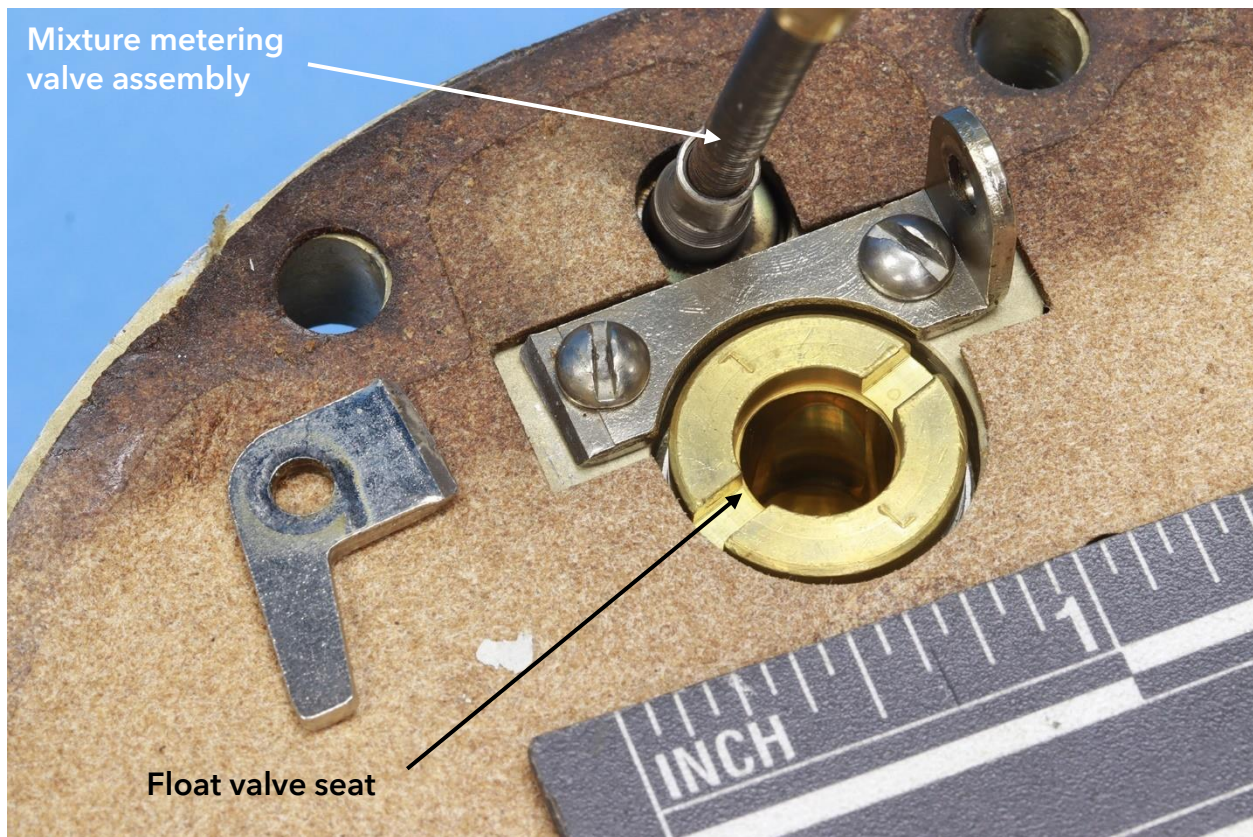


Figure 3. Image of fractured float bracket and valve seat.

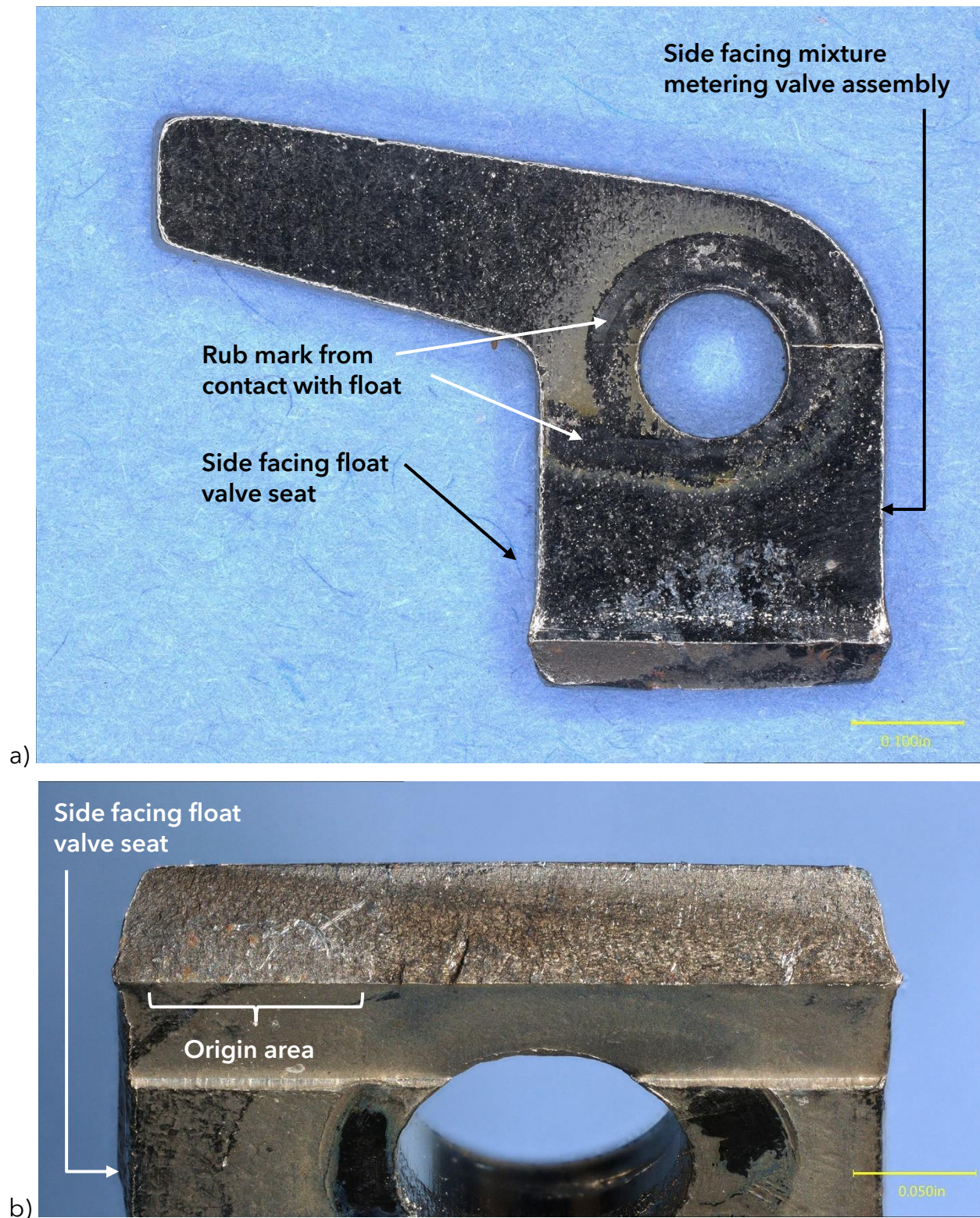


Figure 4. a) Separated arm of the float bracket with a rub mark from the float's hinge and b) mating fracture face on the bracket piece attached to the body and bowl cover assembly showing the fracture origin on the interior bend near the side of the bracket closest to the float valve seat.

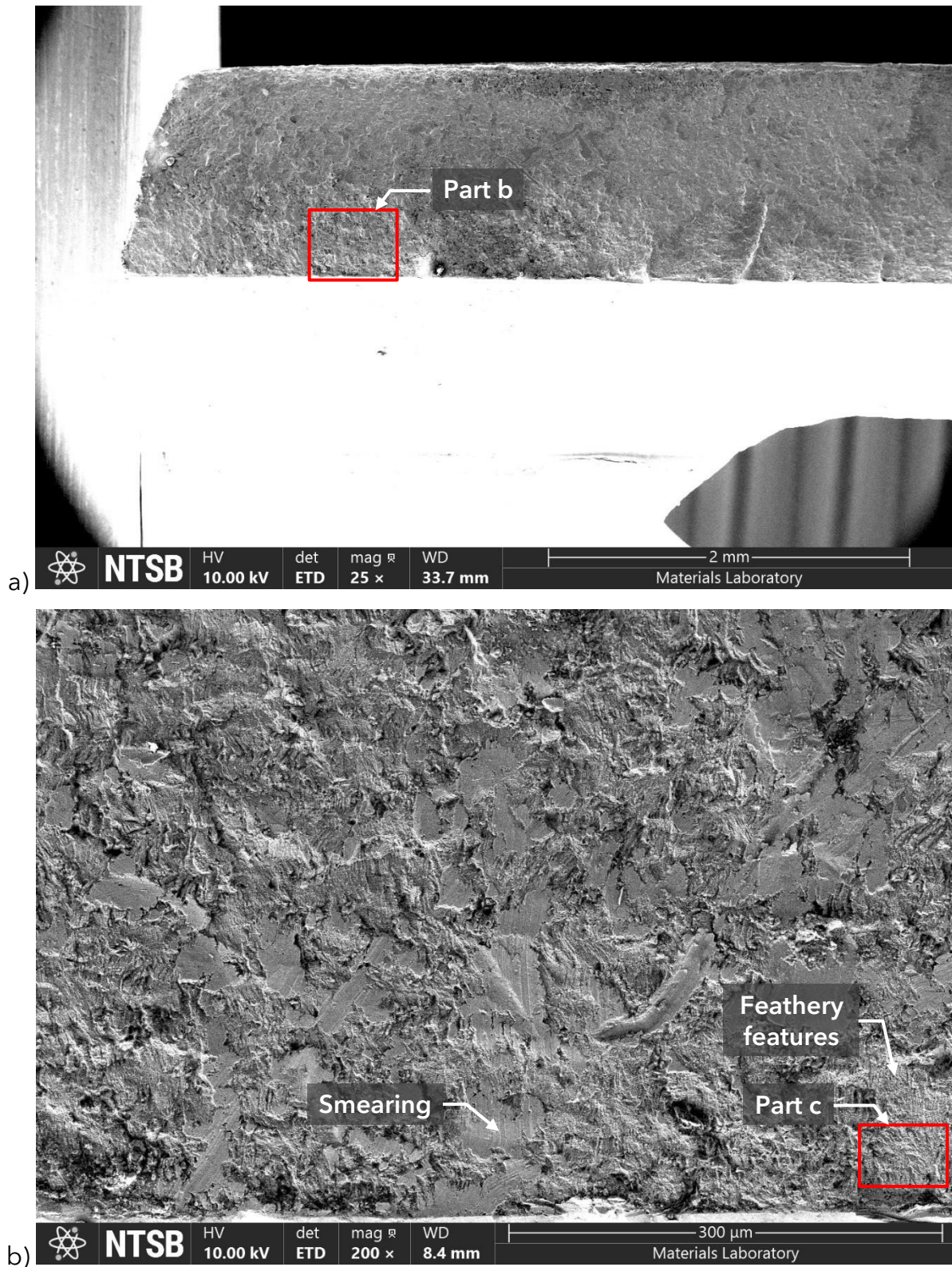


Figure 5. Scanning electron microscope images of the fractured float bracket: a) overview image; b) higher magnification image as indicated in part a; and

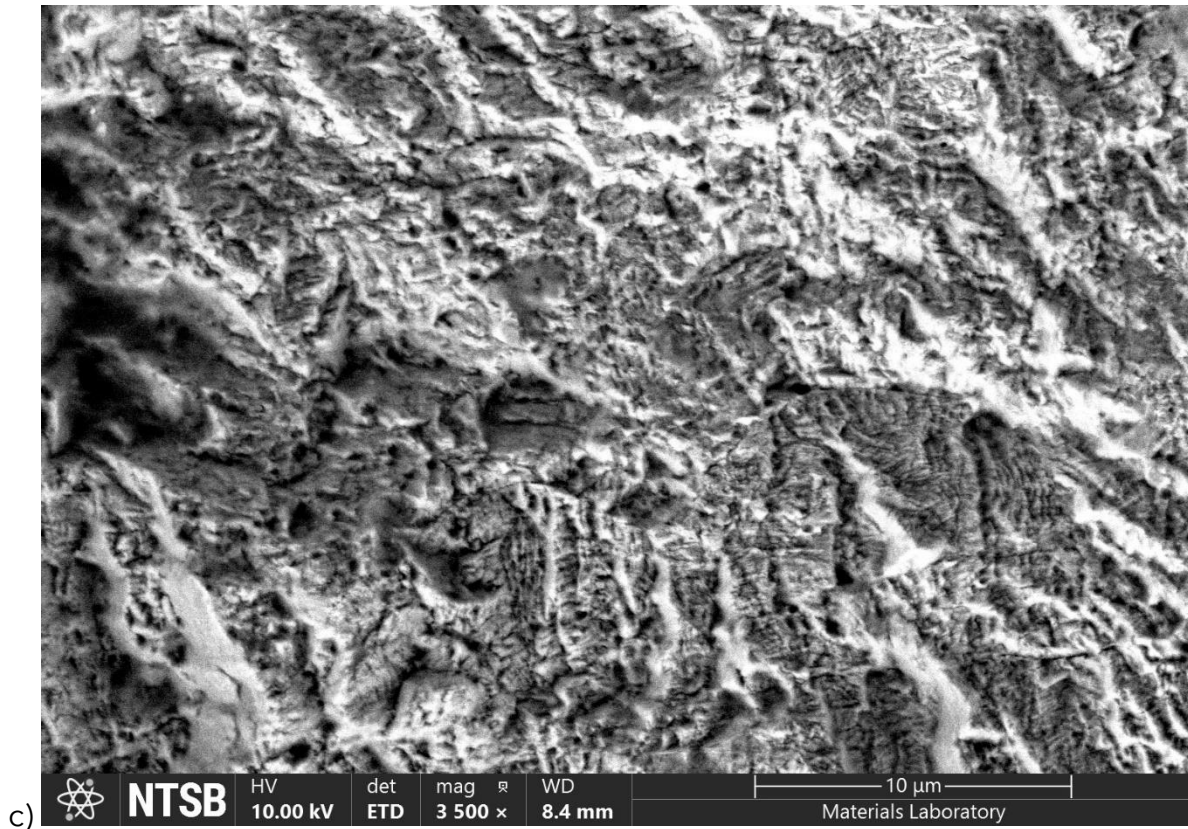


Figure 5 (cont.). c) higher magnification image as indicated in part b. The fracture has a feathery appearance consistent with high-cycle low amplitude fatigue.

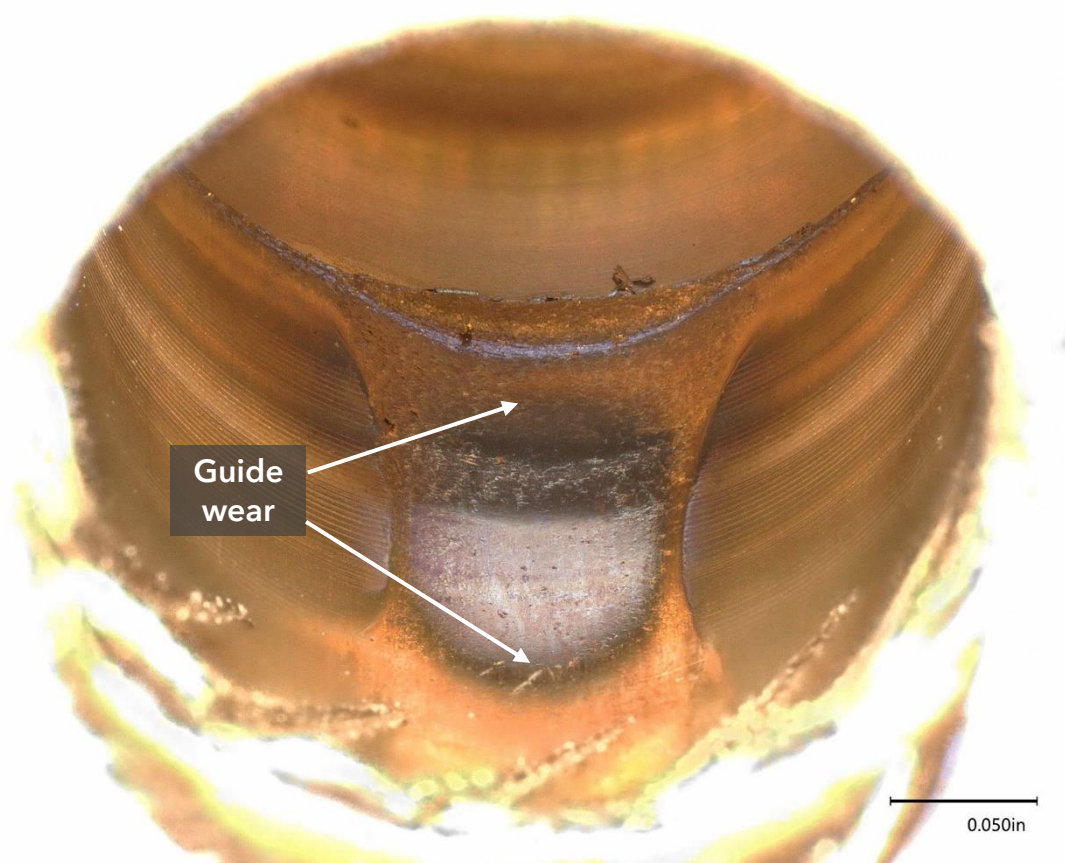
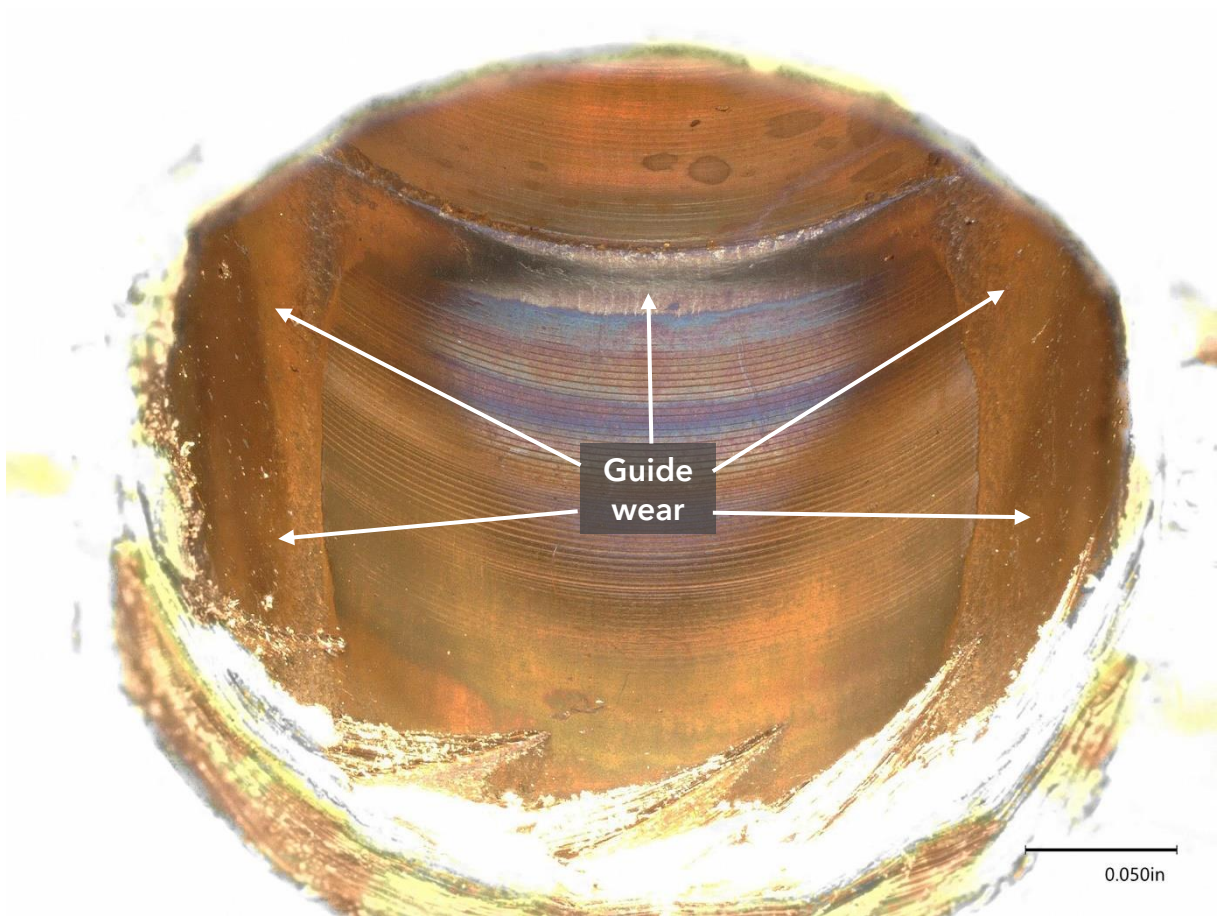


Figure 6. Images of the float valve seat: a) float valve seat after removal from the throttle body and bowl cover assembly; b) image showing wear of the valve guide; and



c)

Figure 6 (cont.). c) image showing wear of the valve guide, rotated 60° relative to part b.