

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Materials Laboratory Division
Washington, D.C. 20594



February 11, 2021

MATERIALS LABORATORY FACTUAL REPORT

Report No. 21-007

A. ACCIDENT INFORMATION

Place : Upland, California
Date : 06/24/2020
Vehicle : Reser Thacher CX4 (N274DR)
NTSB No. : WPR20LA193
Investigator : Joshua Cawthra

B. COMPONENTS EXAMINED

1. Portion of a fractured crankshaft from a 2400 cc 4 cycle Volkswagen engine.

C. DETAILS OF THE EXAMINATION

The as-received crankshaft portion is shown in Figure 1. Profile views of the fracture at the propeller shaft end are identified in the images. Top-down views of the fracture surface are shown in Figure 2. The fracture origin regions are identified, and the directions of fracture propagation are noted.

A higher magnification digital microscope image of the fracture surface is shown in Figure 3 with the fracture origin regions identified, and the directions of crack propagation noted. As indicated in the image, two fractures initiated at the termination of a square keyway slot in the shaft. Closer views of the keyway slot are shown in Figure 4 with the locations of the fracture origins indicated. Profile views of the fracture origin regions are documented in Figure 5. The presence of ratchet marks at the fracture origins and the presence of progressions marks along the fracture path are indicative of fatigue fracture initiation and growth. A small region of final fracture is noted in Figure 3.

Michael Budinski
Chief, Materials Laboratory Division

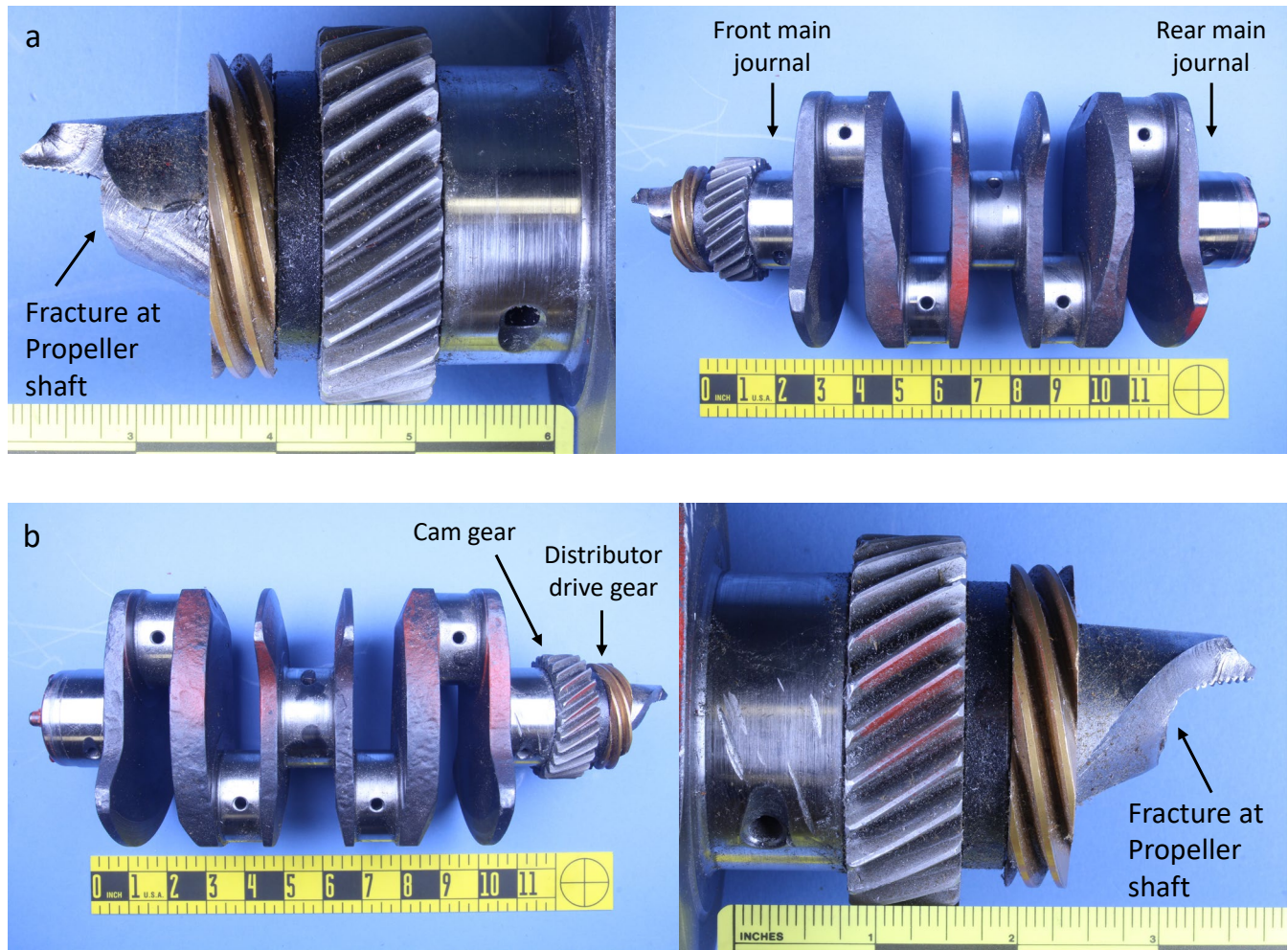


Figure 1 Images of the as-received fractured crankshaft.

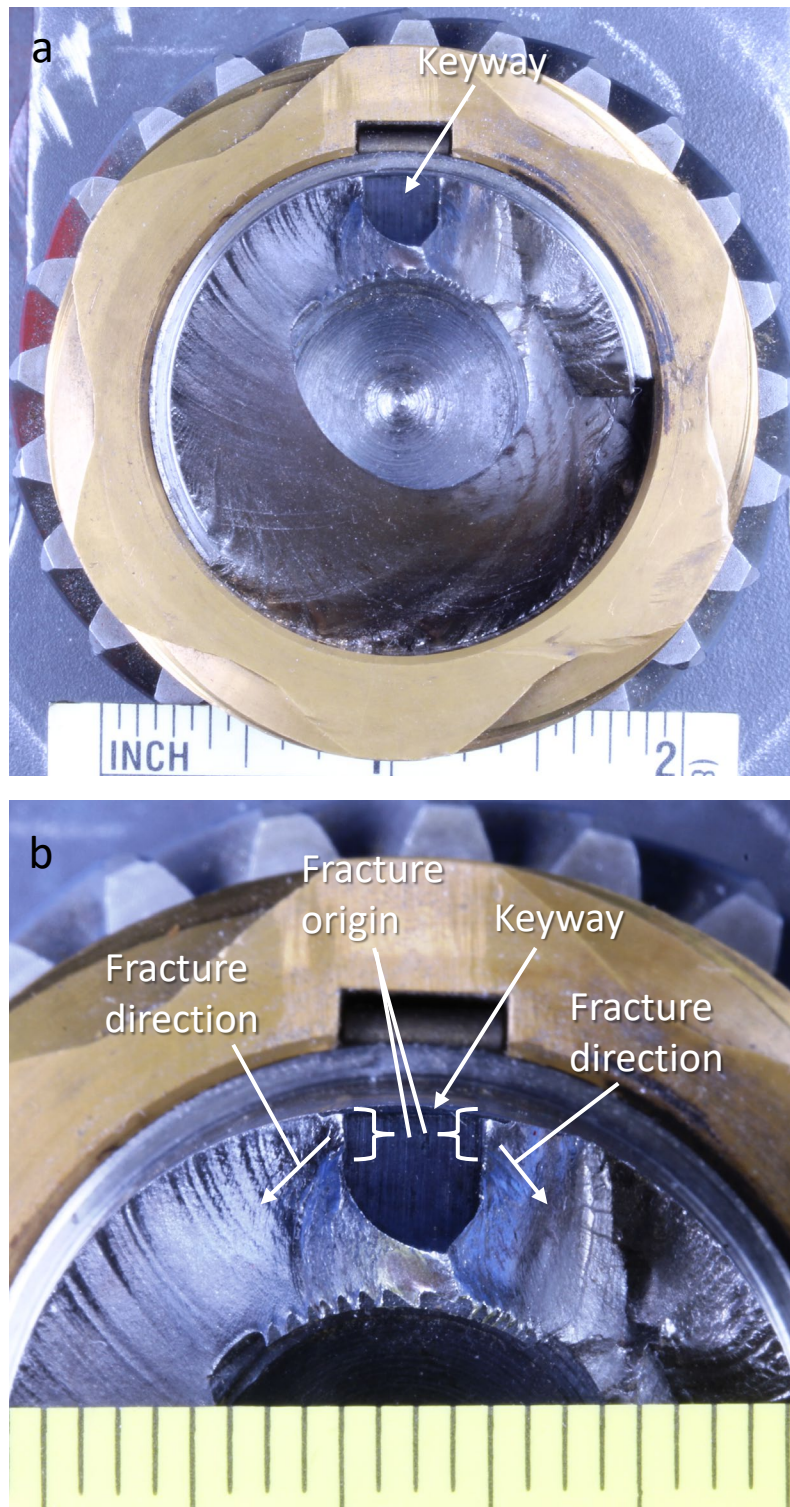


Figure 2 Top-down views of the fracture surface in the crankshaft.

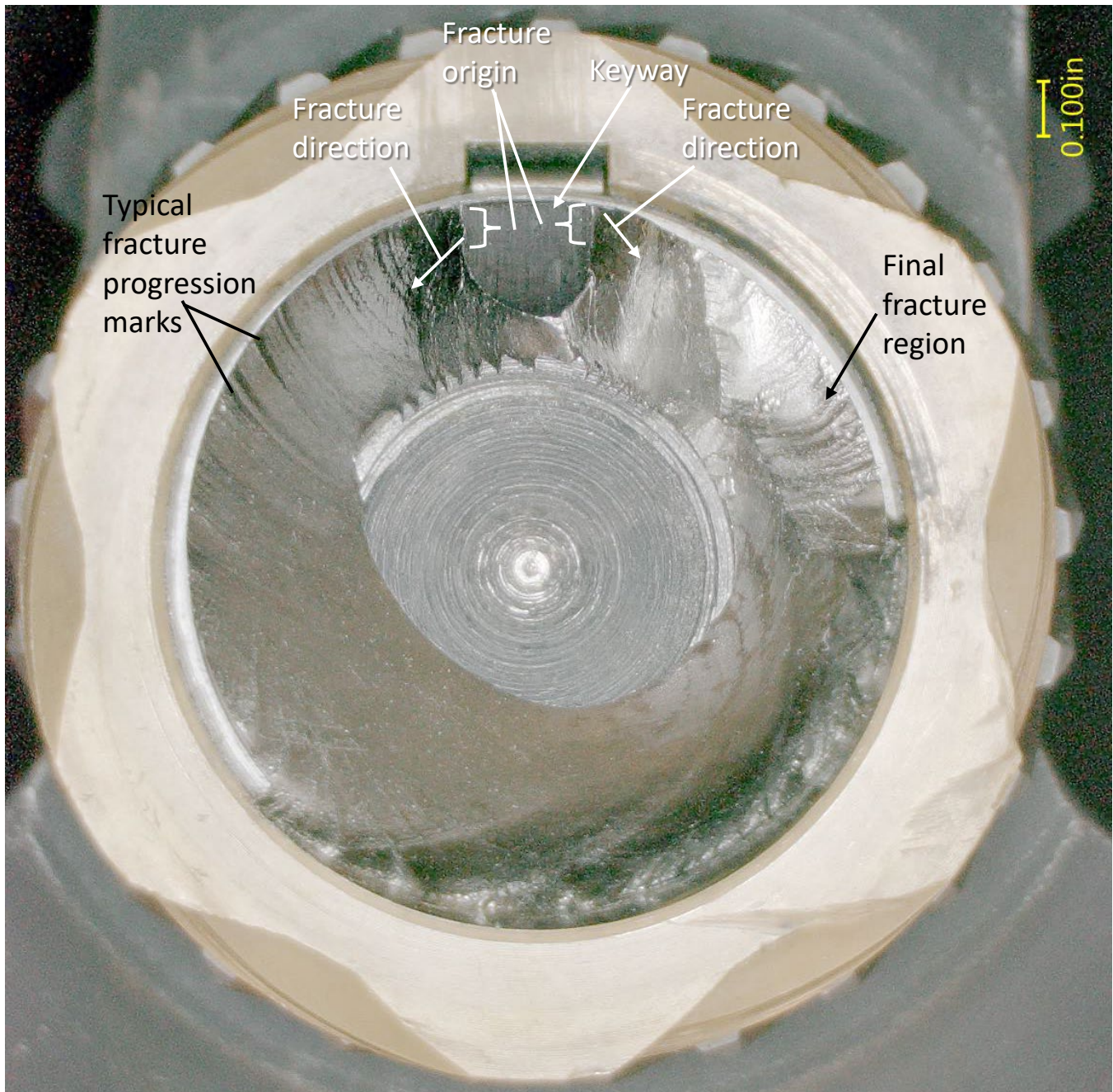


Figure 3 Digital microscope image showing a top-down view of the crankshaft fracture surface. The fracture origins at the termination of the square keyway are identified. Typical fracture progression marks are noted.

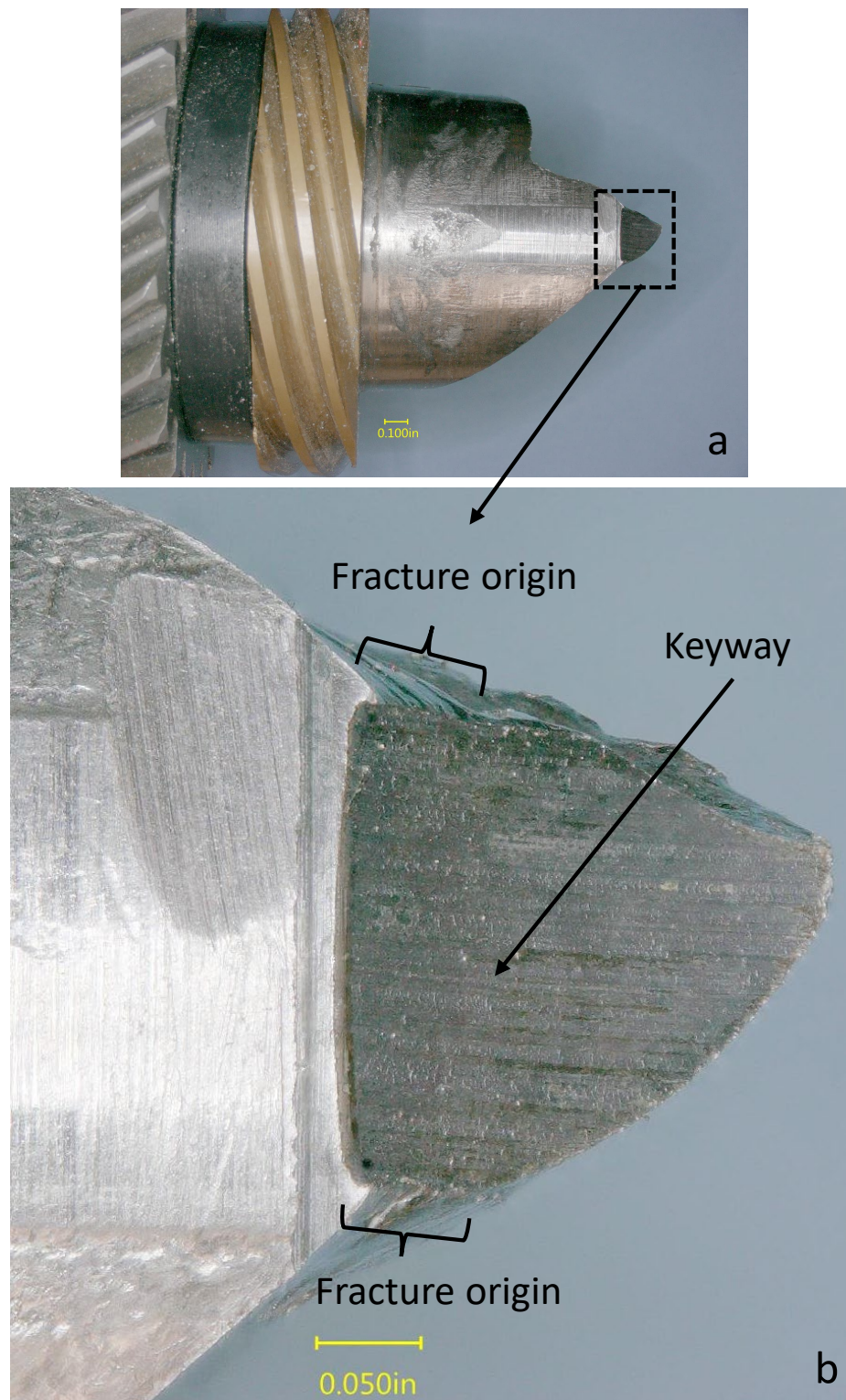


Figure 4 Digital microscope images of the keyway termination area on the crankshaft. The two fracture origin sites are noted. Ratchet marks were observed at the origin sites.

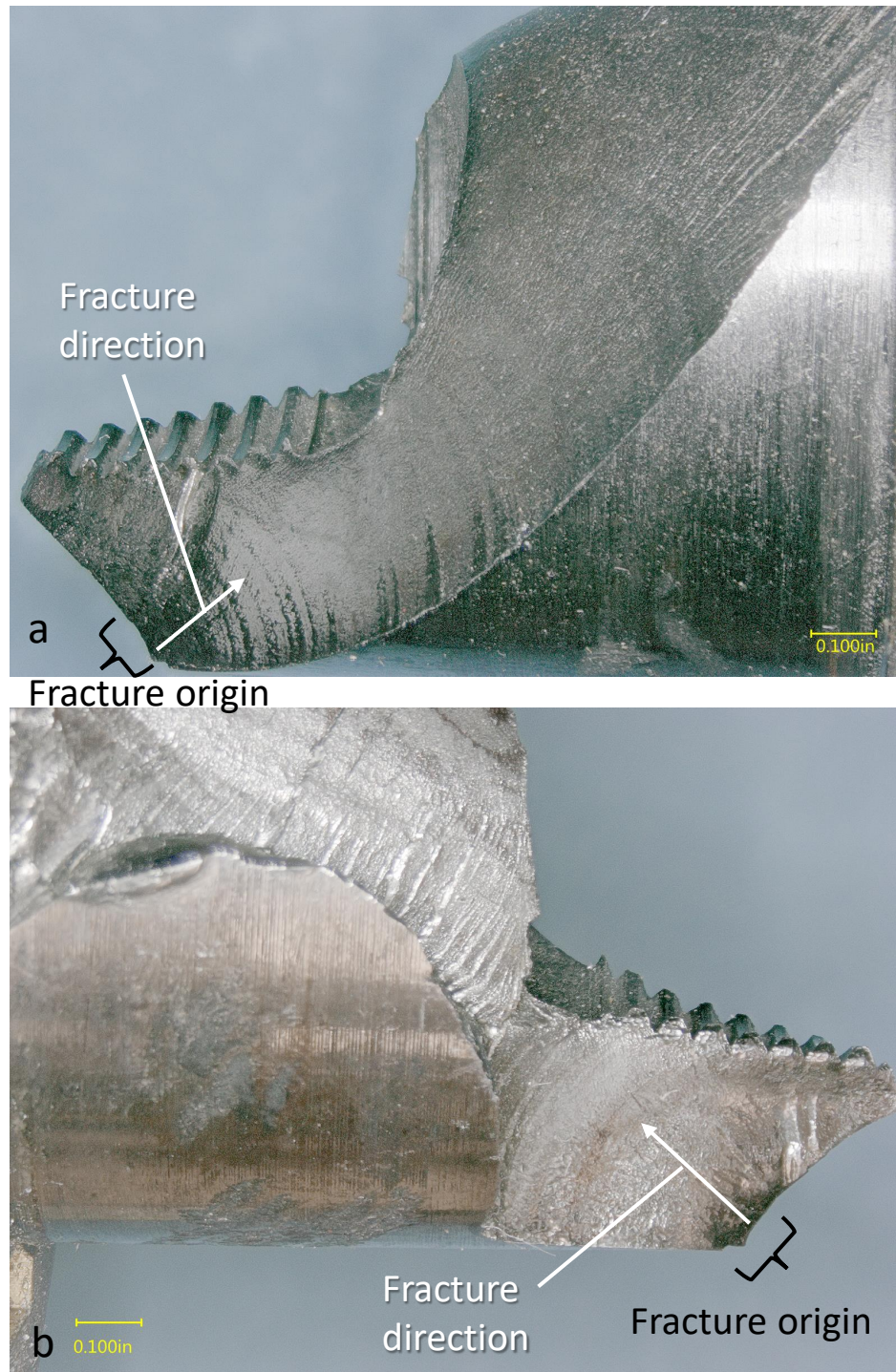


Figure 5 Digital microscope images showing profile views of the crankshaft fracture with the fracture origin regions identified.