

NATIONAL TRANSPORTATION SAFETY BOARD

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



March 1, 2019

MATERIALS LABORATORY FACTUAL REPORT

Report No. 18-009

A. ACCIDENT INFORMATION

Place : Suffolk, New York
Date : June 12, 2017
Vehicle : Cessna 172M, N13306
NTSB No. : ERA17LA203
Investigator : Heidi Kemner, ASI-ERA

B. COMPONENTS EXAMINED

Components from a Lycoming O-320-series engine as follows:

1. Crankshaft Gear (Vibratory pen marking: (5,S?)203507-2;
2. Two accessory gears;
3. Bolt;
4. Lockplate.

C. DETAILS OF THE EXAMINATION

A crankshaft gear from a Lycoming O-320-series engine was submitted to the NTSB Materials Laboratory for examination along with two accessory gears, the locking bolt, and lockplate, as shown in figure 1. In normal operation, the crankshaft gear sits inside a counterbore recess at the aft end of the crankshaft. The rotational alignment of the gear with respect to the crankshaft is set by an alignment dowel that is press fit into the crankshaft counterbore recess. A machined hole in the crankshaft gear pilot flange accepts the alignment dowel and sets the rotational alignment of the gear with respect to the crankshaft. In the as-received condition, the alignment dowel had fractured, with one half retained with the crankshaft (not shown) and the other half retained in the pilot flange hole, as indicated in figures 2a and 2b.

The piece of the alignment dowel was extracted from the hole with a punch and the fracture surface cleaned using standard laboratory procedures. The fracture surface, as shown in figure 3a, exhibited a flat appearance with multiple curved crack arrest marks progressing across the fracture. Multiple crack origin areas were observed on approximately opposite sides of the fracture. The crack from the origin area on the right of figure 3a covered approximately 80% of the fracture surface while the crack from the origin area on the left side of the figure covered approximately 20% of the fracture. The two cracks met along a line of final separation as indicated in figure 3a. The dowel surface exhibited wear marks, as indicated in figure 3b. On one side of the dowel, the wear had removed approximately 0.015 inch of material while the wear mark on the other side was

comparatively superficial. Taken together, the features were consistent with a fatigue fracture of the alignment dowel that initially progressed under unidirectional bending and transitioned to reverse bending.

The pilot flange outer diameter exhibited rubbing damage along its interface with the crankshaft counterbore recess, as indicated in figures 4a through 4c for the three flange segments. The segments were labelled A, B, and C for convenience and are labelled in figure 2 as well. Rub marks were also seen on the counterbore face of the pilot flange segments, as seen in figures 5a through 5c, and at the interface between the lockplate and the gear, as shown in figures 6a and 6b. The tab on the locking plate was bent, but the bend was not aligned with the locking tab's plastic hinge, as indicated in figure 6b.

Donald Kramer, Ph.D.
Sr. Materials Engineer

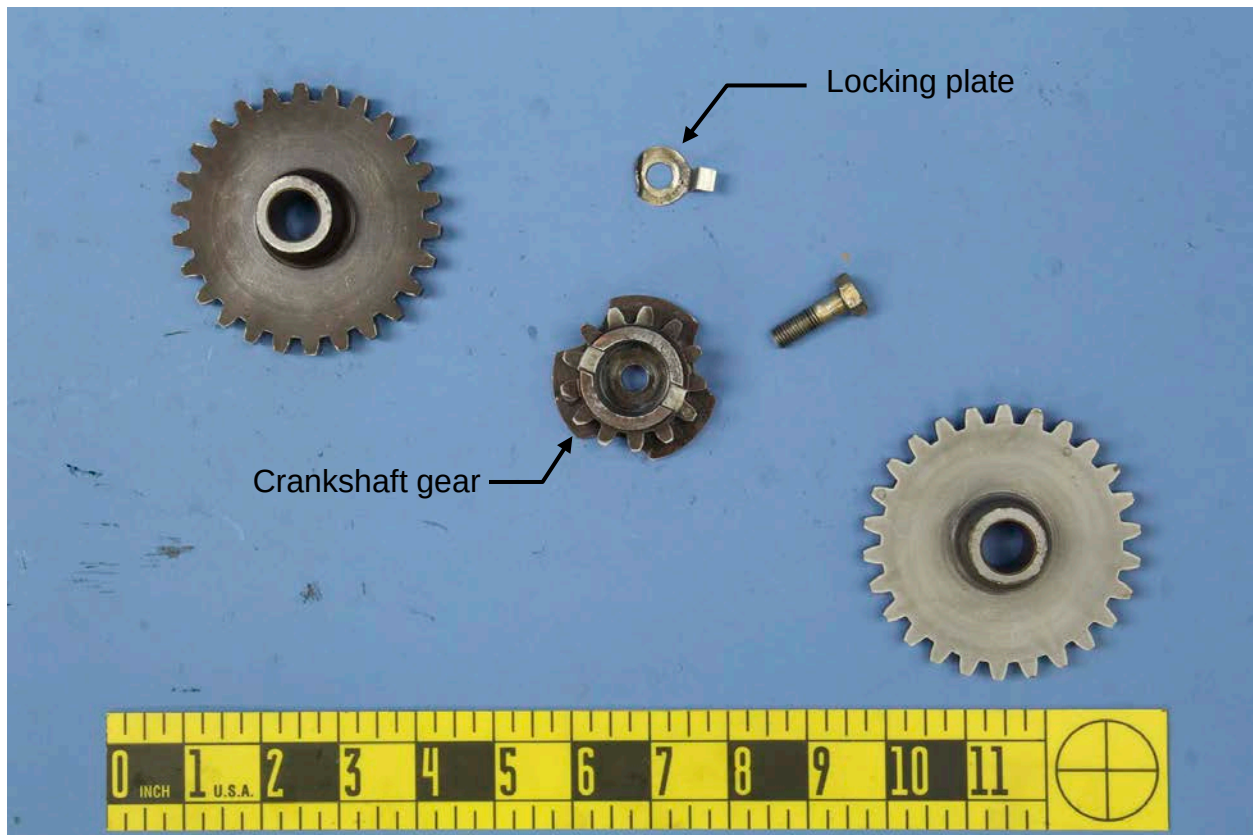


Figure 1: The crankshaft gear, two accessory gears, bolt, and locking plate, as received by the lab.

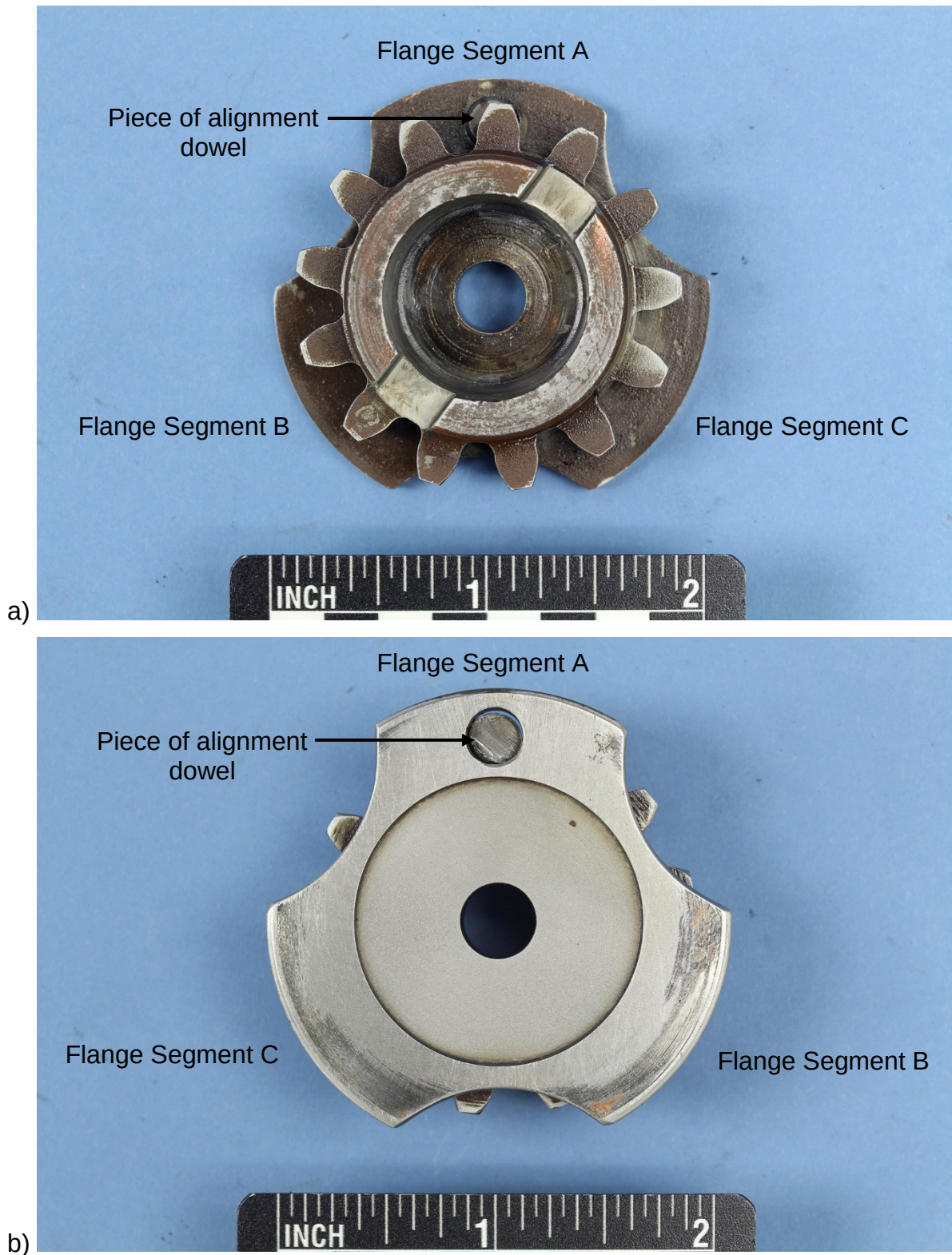


Figure 2: Images of the crankshaft gear: a) Outward-facing view of the gear and b) view of the counterbore face of the gear. For convenience the three flange segments are labelled A through C.

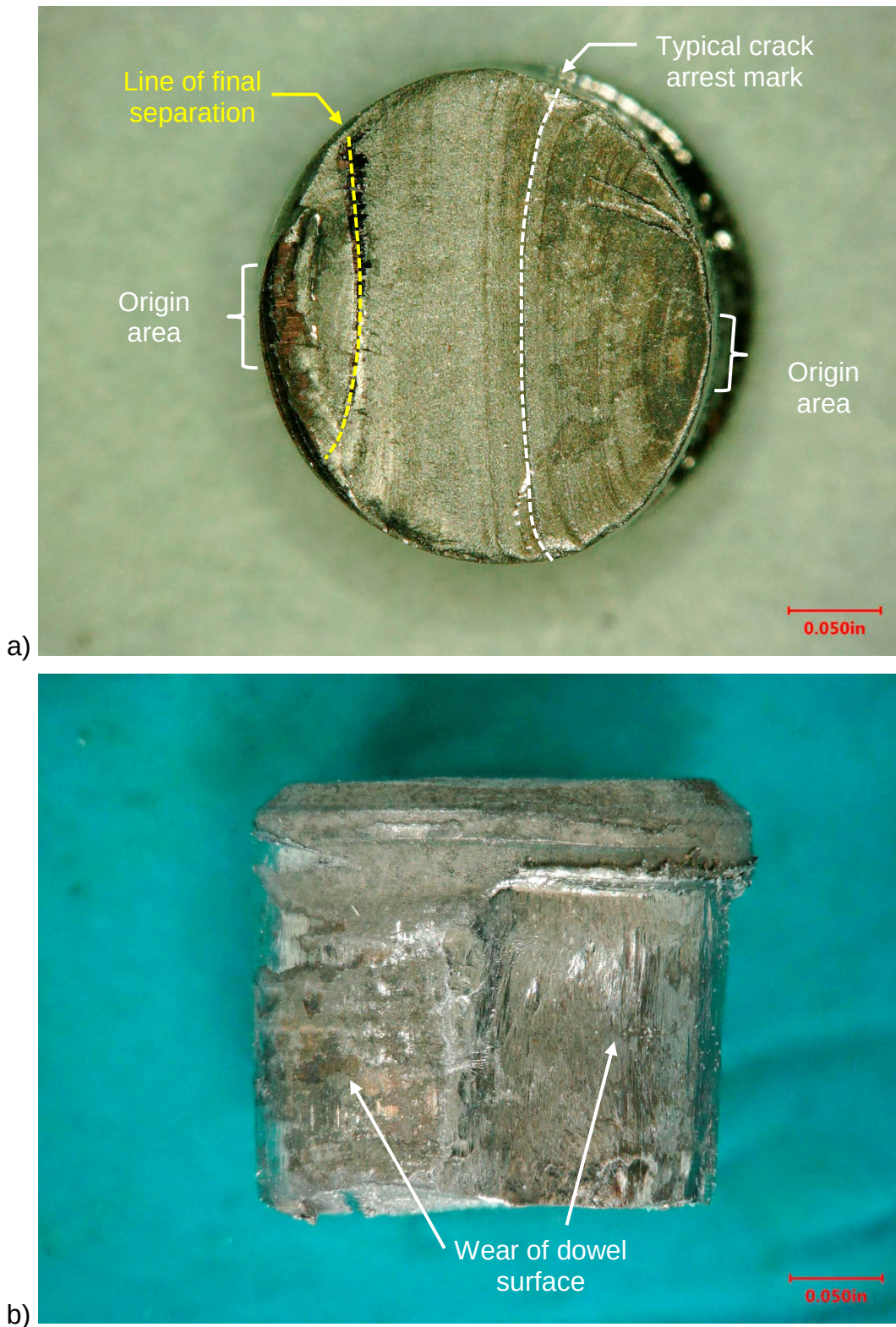


Figure 3: a) Image of the fracture surface on the piece of alignment dowel and b) side view of the piece showing wear of the dowel surface.

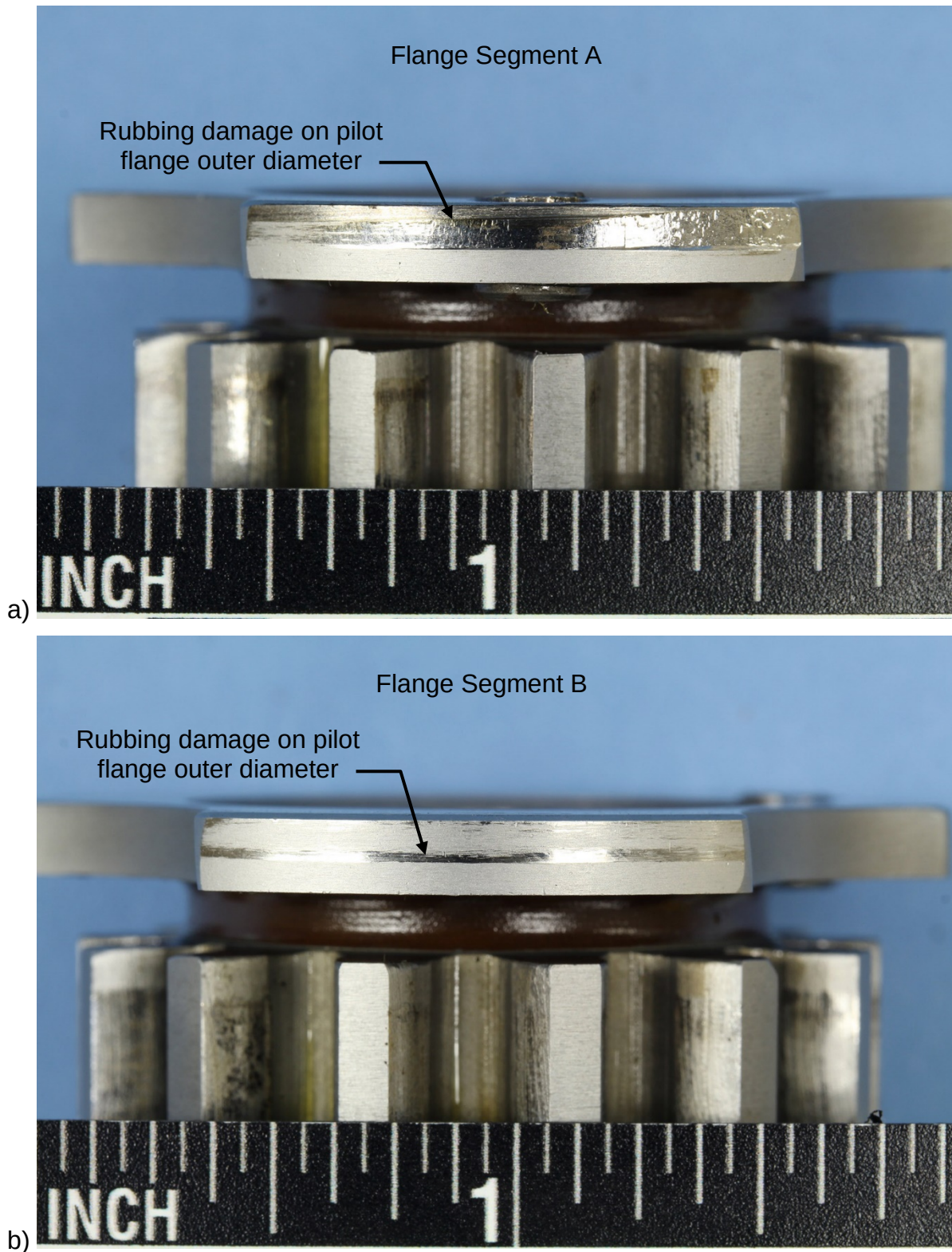


Figure 4: Images of rubbing damage to the pilot flange outer diameter: a) Segment A; b) Segment B.

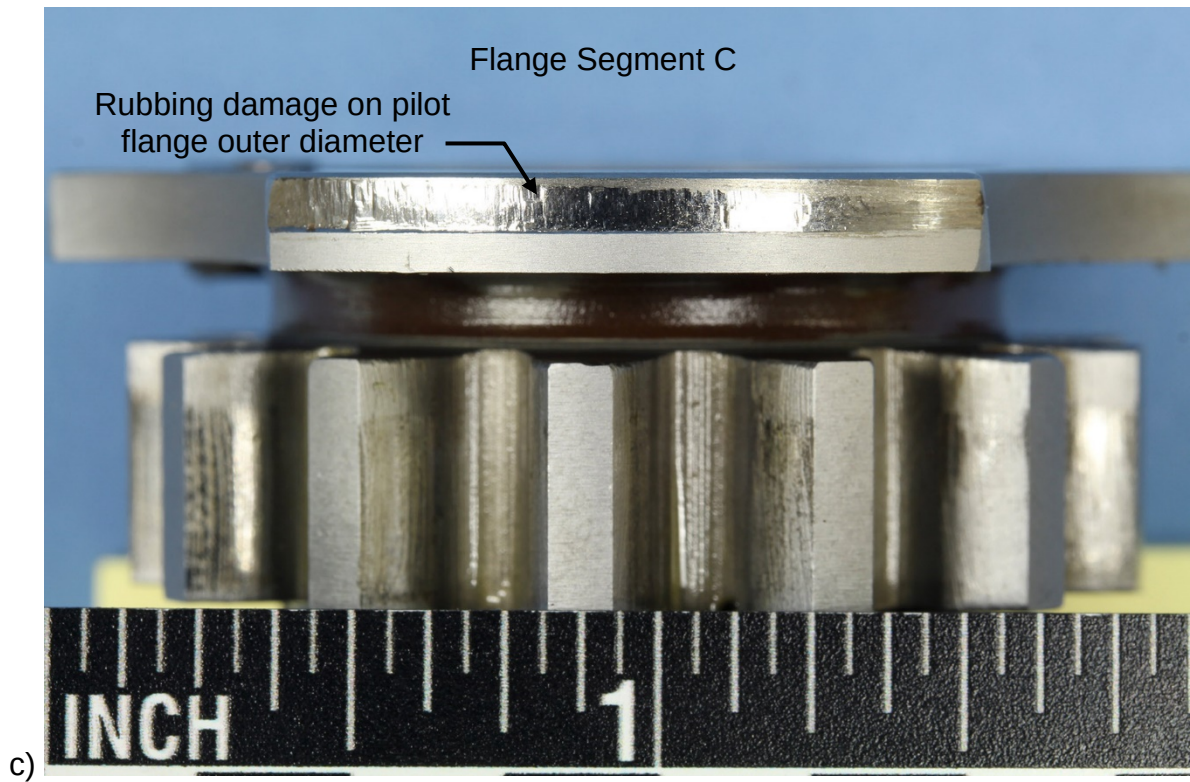


Figure 4 (cont.): c) Segment C.

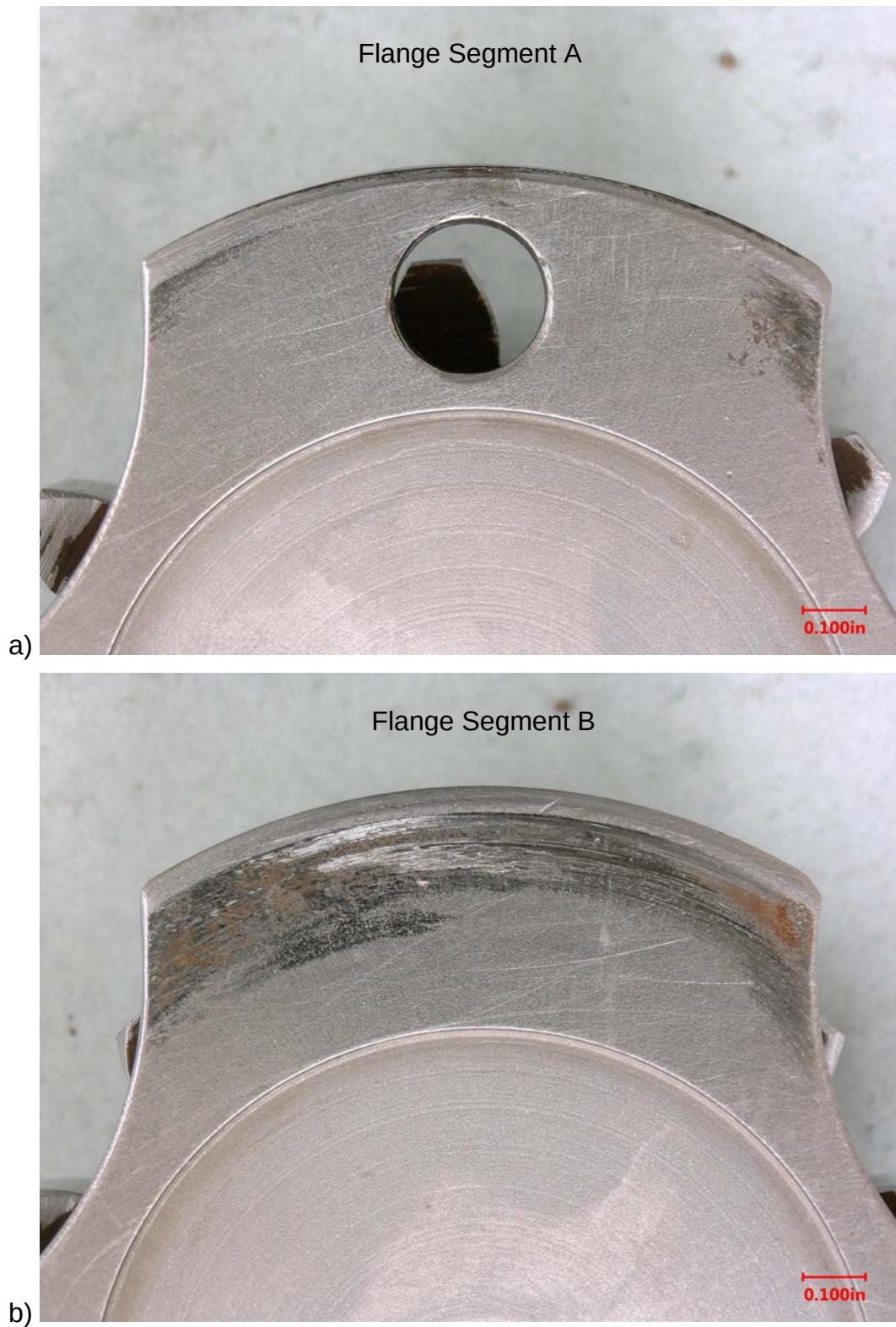


Figure 5: Images of rubbing marks on the counterbore face of the pilot flange: a) Segment A; b) Segment B;

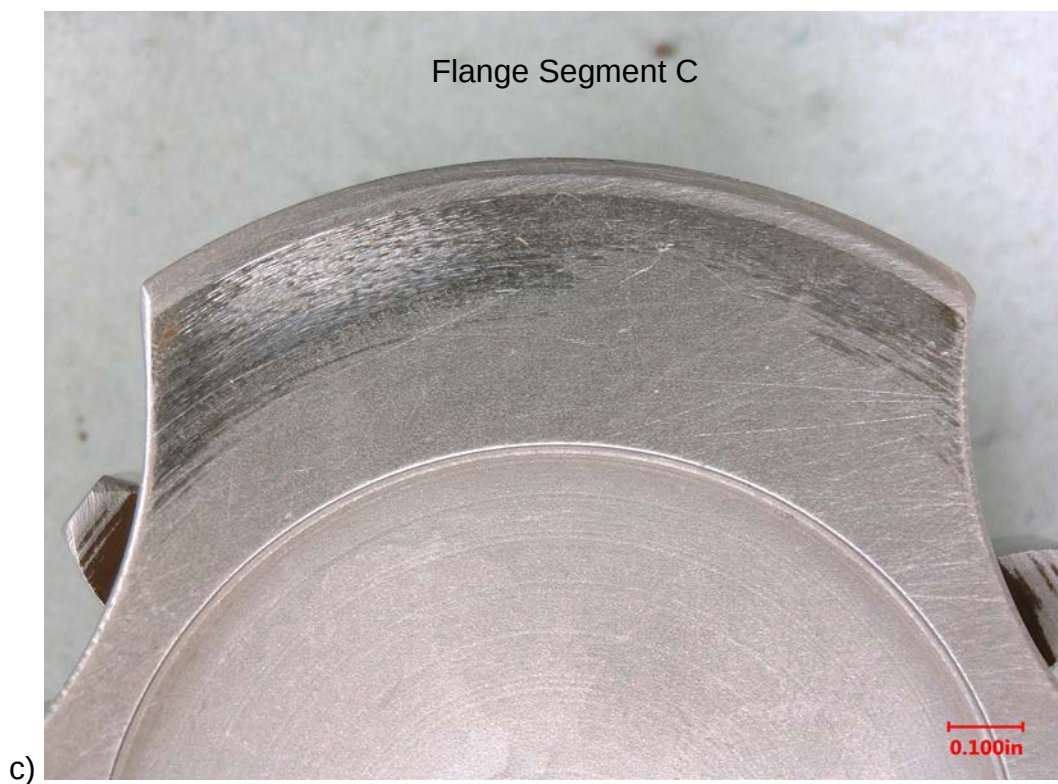


Figure 5 (cont.): c) Segment C.

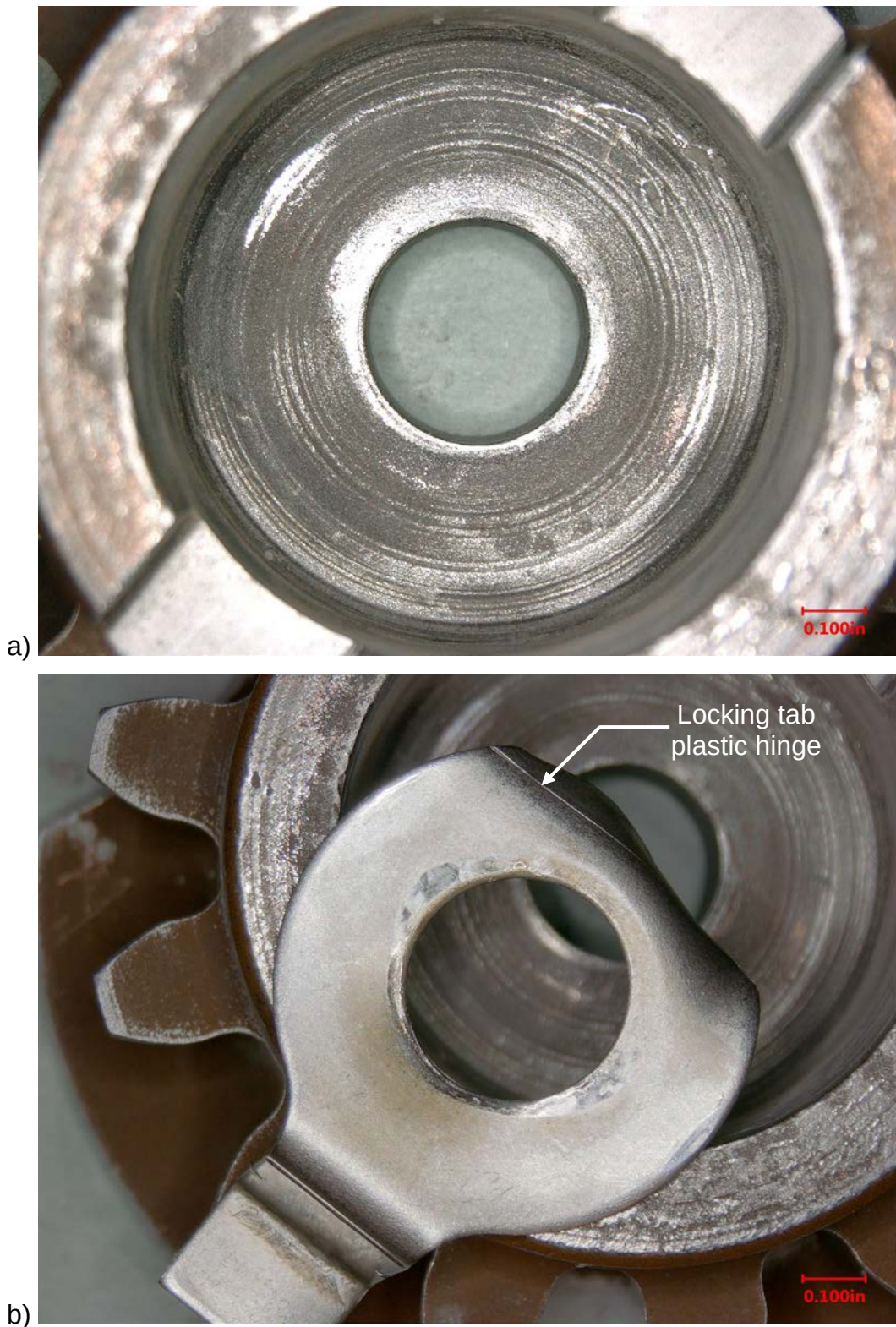


Figure 6: Rubbing marks at the interface between the locking plate and the crankshaft gear: a) gear-side of interface; b) locking plate side of interface.