

NATIONAL TRANSPORTATION SAFETY BOARD

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



August 4, 2021

MATERIALS LABORATORY FACTUAL REPORT

Report No. 21-057

A. ACCIDENT INFORMATION

Place : St. Louis, Missouri
Date : August 22, 2020
Vehicle : Cessna 180, N7620A
NTSB No. : CEN20LA360
Investigator : Michael Folkerts (AS-CEN)

B. COMPONENTS EXAMINED

Mixture cable and hardware

C. DETAILS OF THE EXAMINATION

The accident aircraft experienced a loss of engine power during flight that necessitated a forced landing. During the subsequent teardown the mixture cable was observed detached from the mating fixturing. The mixture cable was sectioned away from the attaching end and removed. The section of mixture cable and the mating hardware – including the bolt, washers, and nut – were submitted for examination to the NTSB Materials Laboratory.

The section of mixture cable is shown in Figure 1. The central wire extended approximately 1 inch out of the surrounding external coil. The wire was stuck fast inside the external coil and could not be extended further without causing damage. Consequently, evidence of pull-thru could not be determined.

Figure 2 shows the end of the central wire that clamped inside the mating bolt and nut assembly. Multiple flat areas, indicated by yellow brackets, were observed around the outer diameter (OD) of the wire. The end of the wire was V-shaped, which is consistent with a shearing cut made by opposing blades. Several grooves, indicated by red arrows, were observed adjacent to the cut end, possibly due to prior miscuts of the wire. No kinks or sharp bends were observed in the exposed wire end.

The submitted bolt, nut, and washers are shown in the as-received configuration in the top image of Figure 3. Photos of the hardware taken during the on-scene examination prior to disassembly showed the washers in a different stack-up configuration. The washers were examined and re-ordered to match the on-scene photos, and the resulting original configuration is shown in the bottom image of Figure 3. The washers were labeled A–F from the bolt head to the nut, as indicated.

Bands of wear were observed on the OD of the bolt, consistent with rub damage from the mating washers. The bands of wear are indicated by yellow brackets in Figure 4. Red arrows point to rolled material around the edge of the hole in the bolt. The rolled material was consistent with contact from a wire being inserted through the hole and pressed up against the edge during clamping. The threads on the bolt were intact and no flattening was observed.

The disassembled washers are shown in Figures 5-10. The faces of the washers had circumferential wear marks consistent with rub damage from mating washers. Grooves were observed on the washers, as indicated by the red arrows. The grooves were consistent with contact from the mating wire threaded through the bolt. Most of the washers had multiple grooves on them, including ones that were not touching the wire in the stack-up configuration at the time of the accident.

Adrienne V. Lamm
Materials Engineer

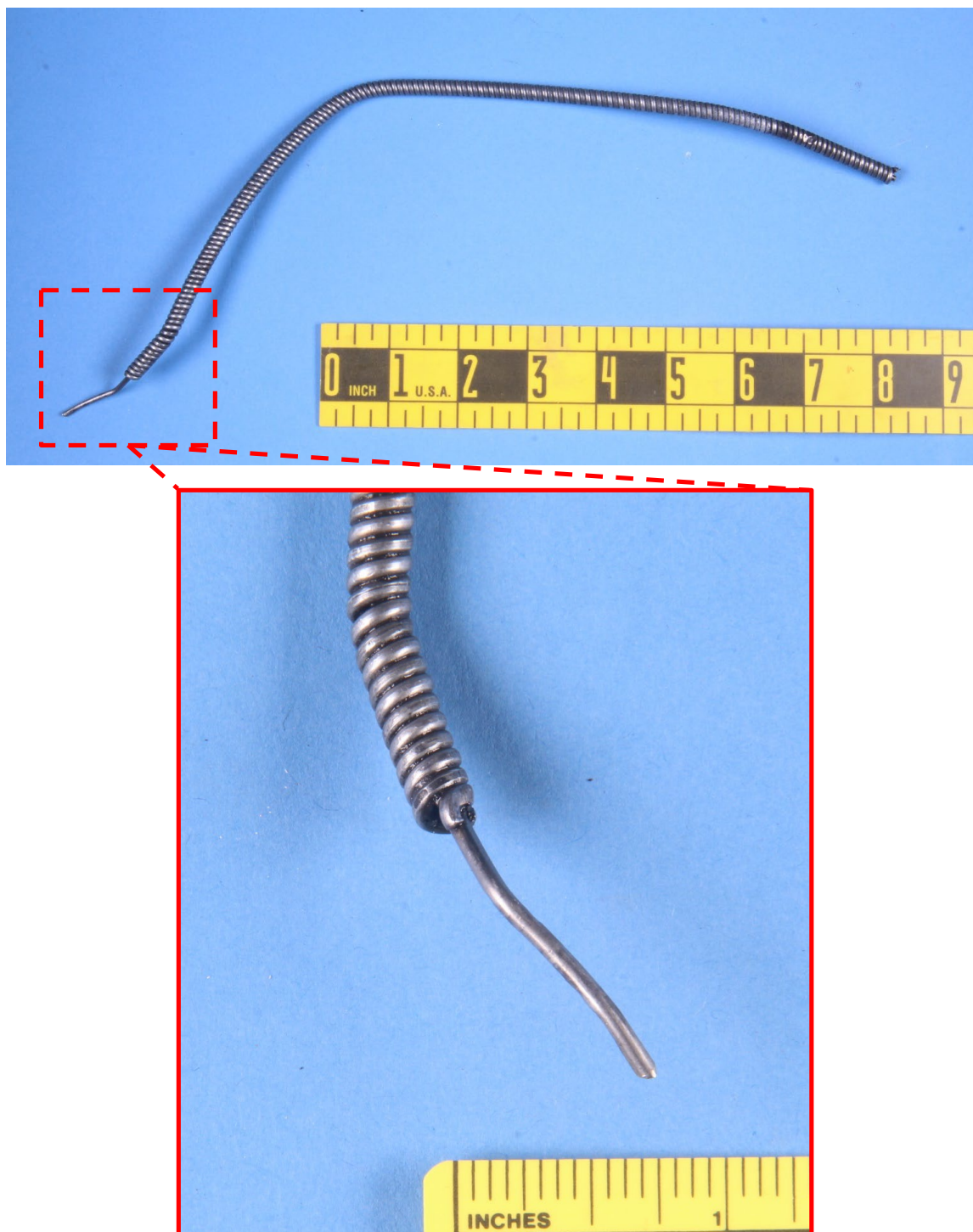


Figure 1: Overall (top) and close-up (bottom) photos of the submitted section of mixture cable.

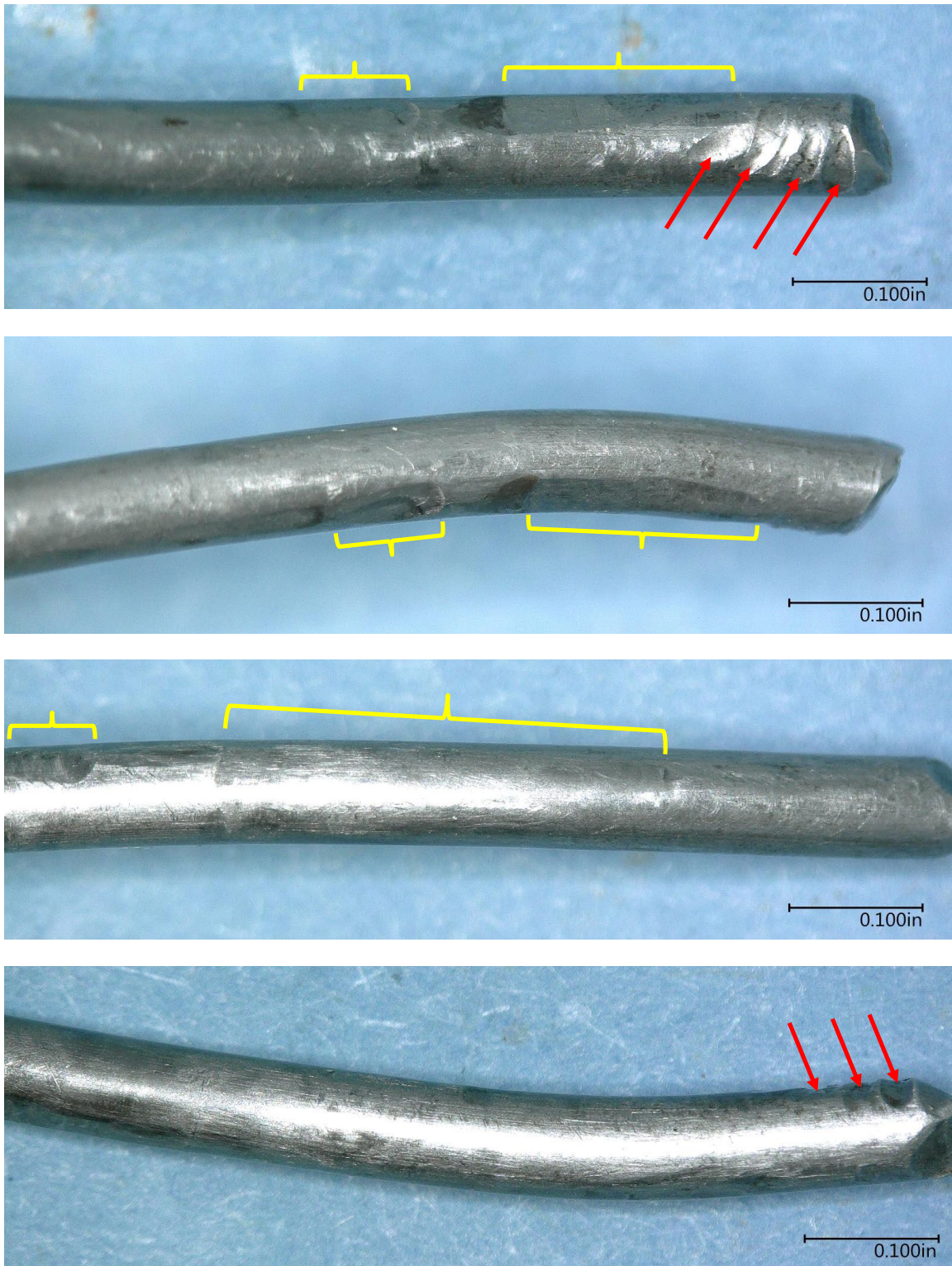


Figure 2: Digital microscope images of the central wire. The yellow brackets indicate flat areas on the OD of the wire. The red arrows point to grooves adjacent to the V-shaped wire end.

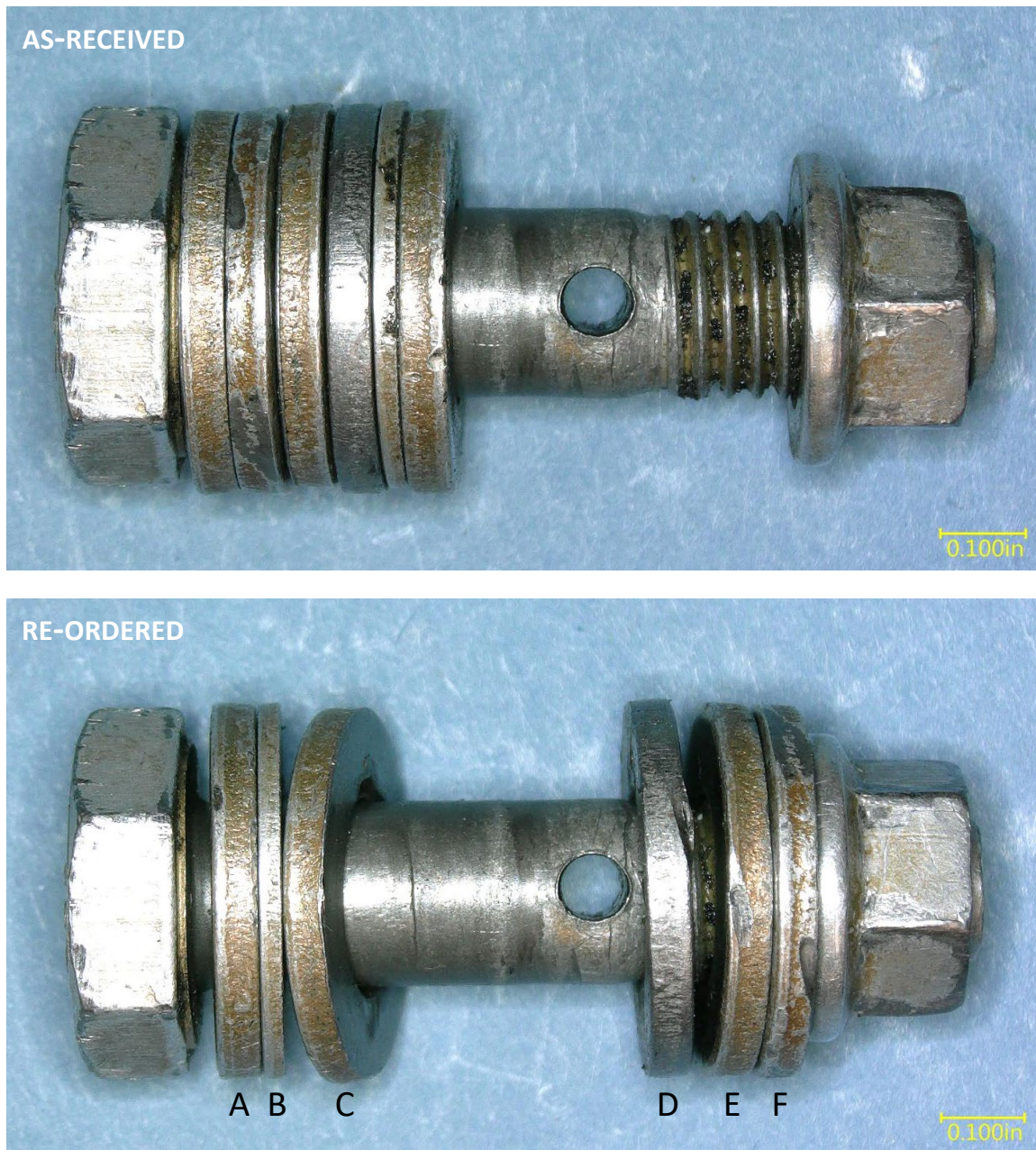


Figure 3: Digital microscope images of the bolt, nut, and washers in the as-received and re-ordered configurations (top and bottom images, respectively). The washers were labeled A – F as indicated.

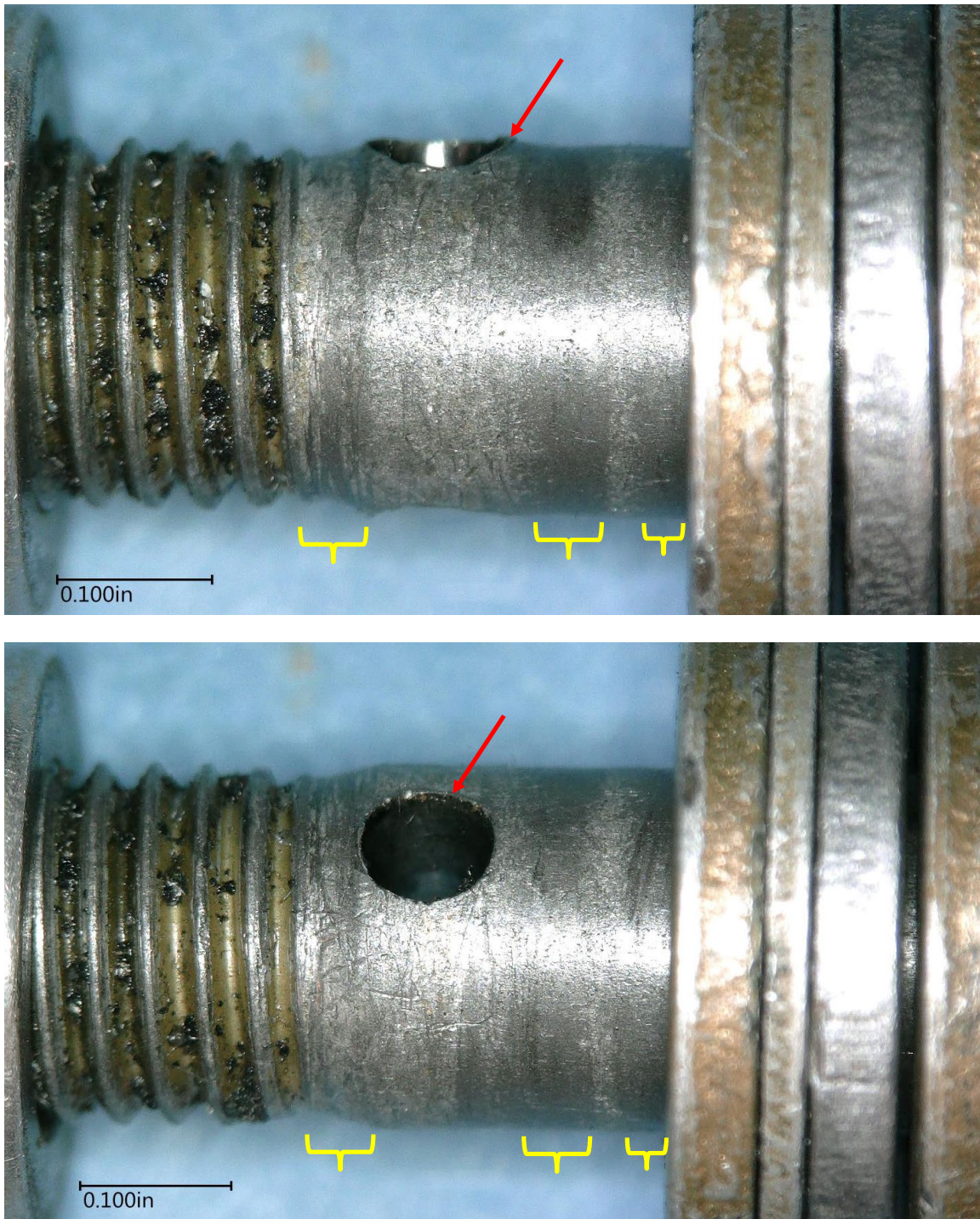


Figure 4: Digital microscope images of the OD and center hole in the bolt. The yellow brackets indicate bands of circumferential wear. The red arrows point to rolled material along the edge of the hole.

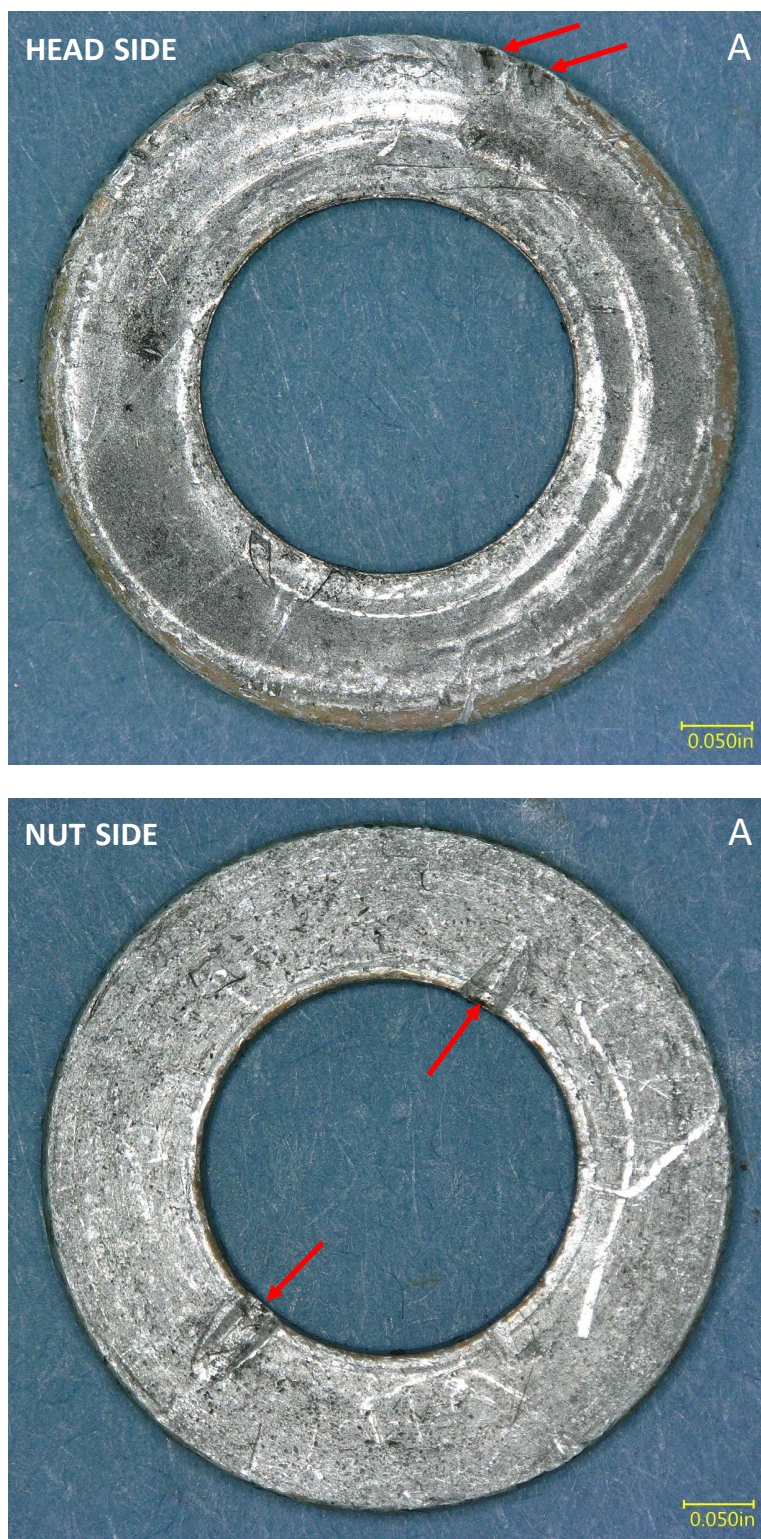


Figure 5: Digital microscope images of the faces on washer A. The red arrows point to grooves observed from contact with a mating wire.

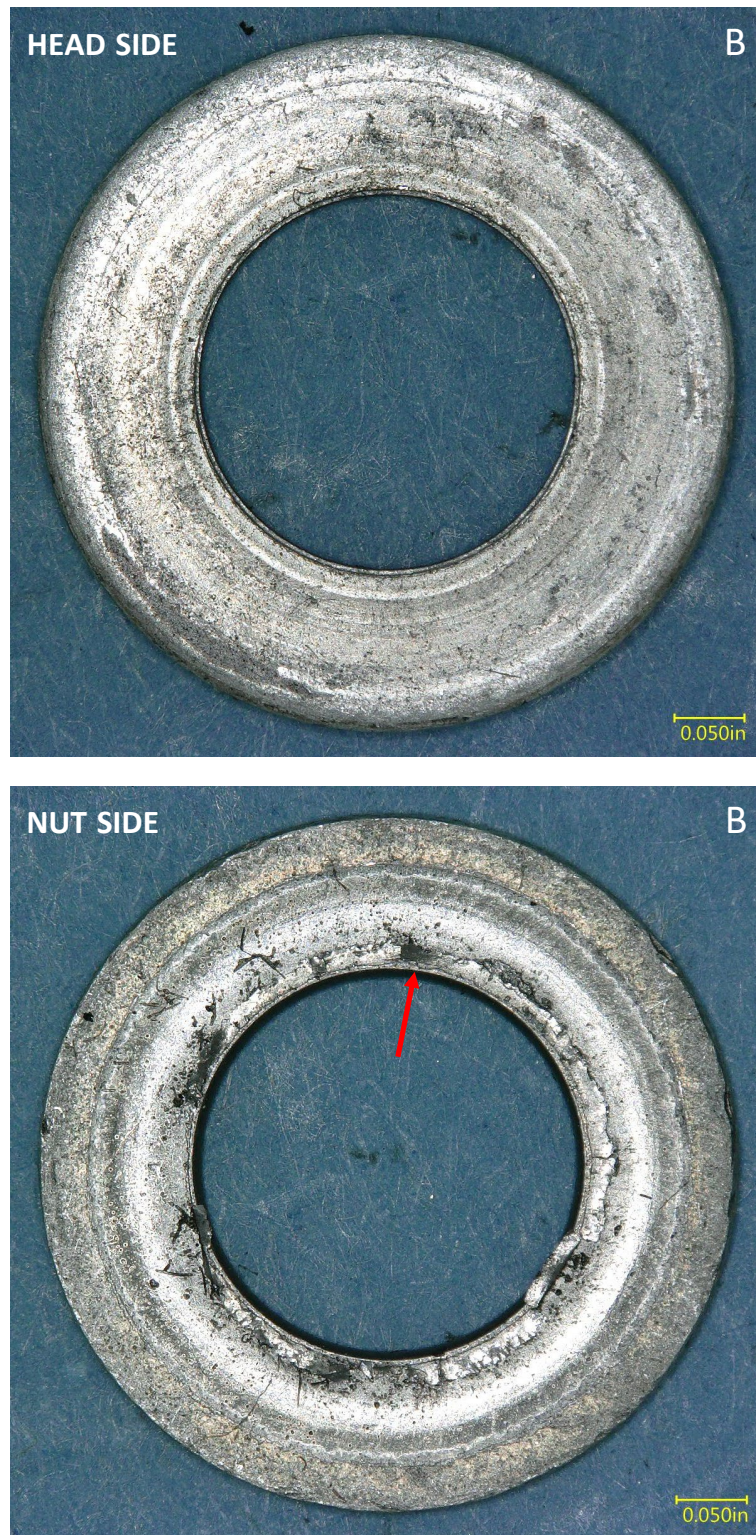


Figure 6: Digital microscope images of the faces on washer B. The red arrows point to grooves observed from contact with a mating wire.

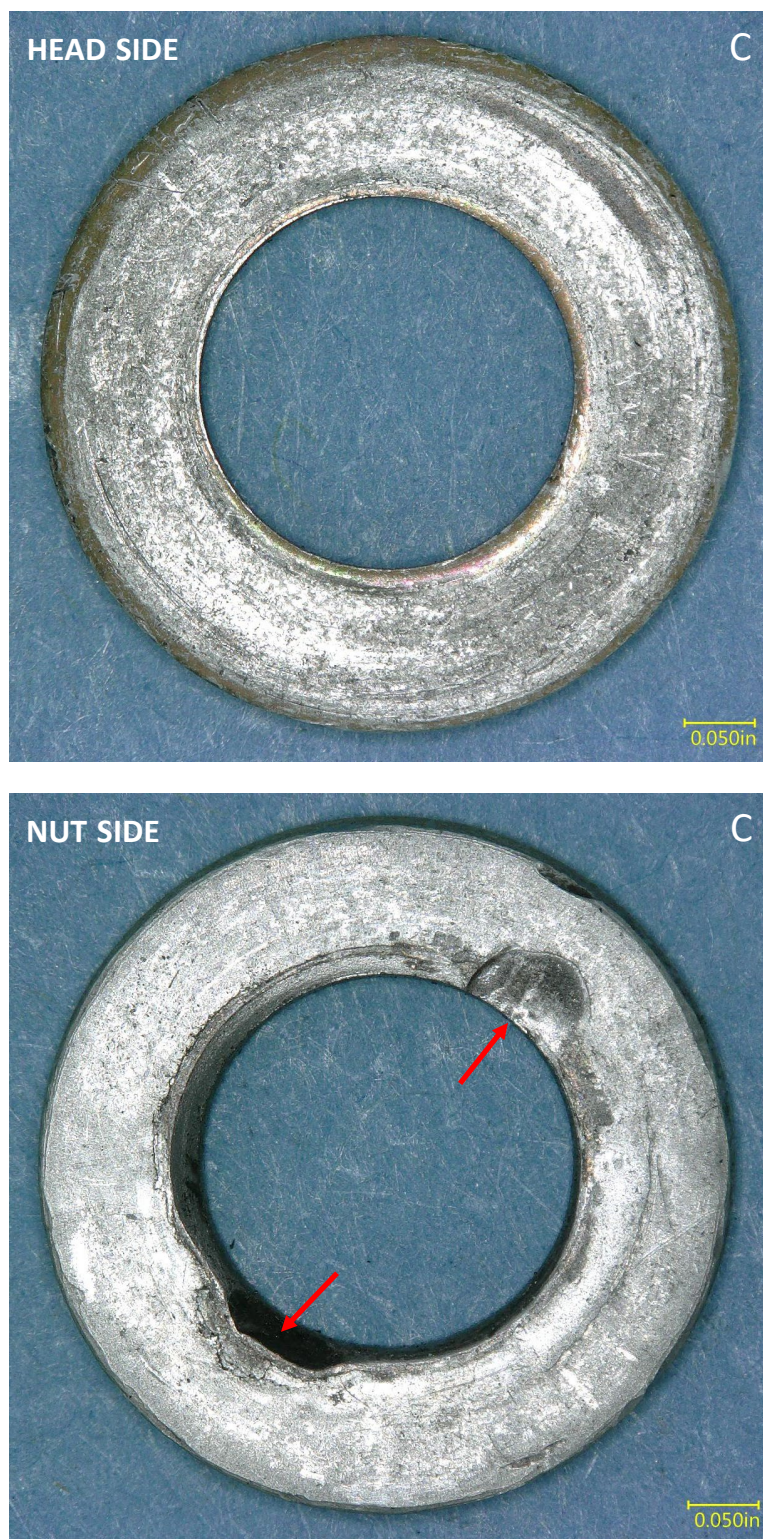


Figure 7: Digital microscope images of the faces on washer C. The red arrows point to grooves observed from contact with a mating wire.

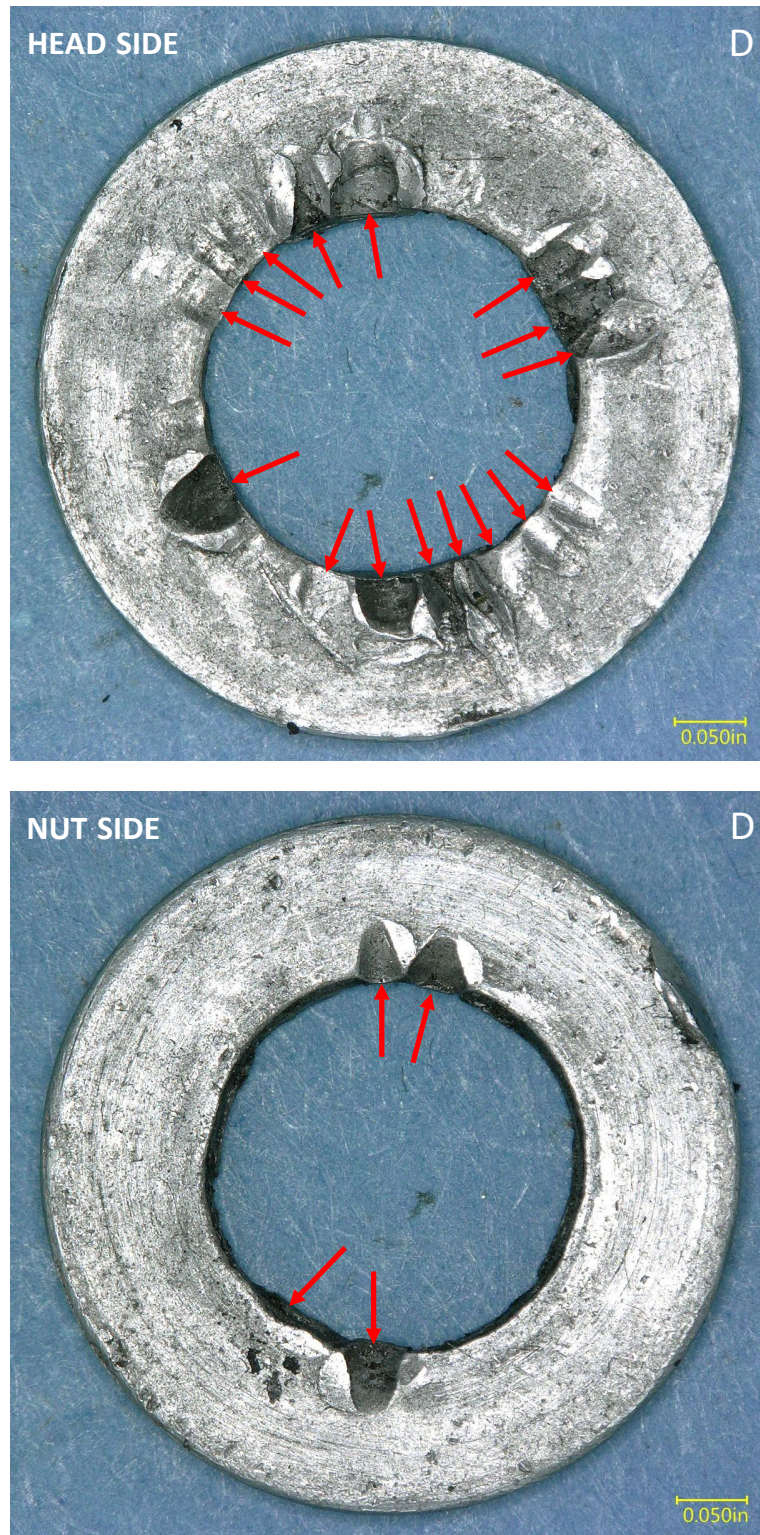


Figure 8: Digital microscope images of the faces on washer D. The red arrows point to grooves observed from contact with a mating wire.

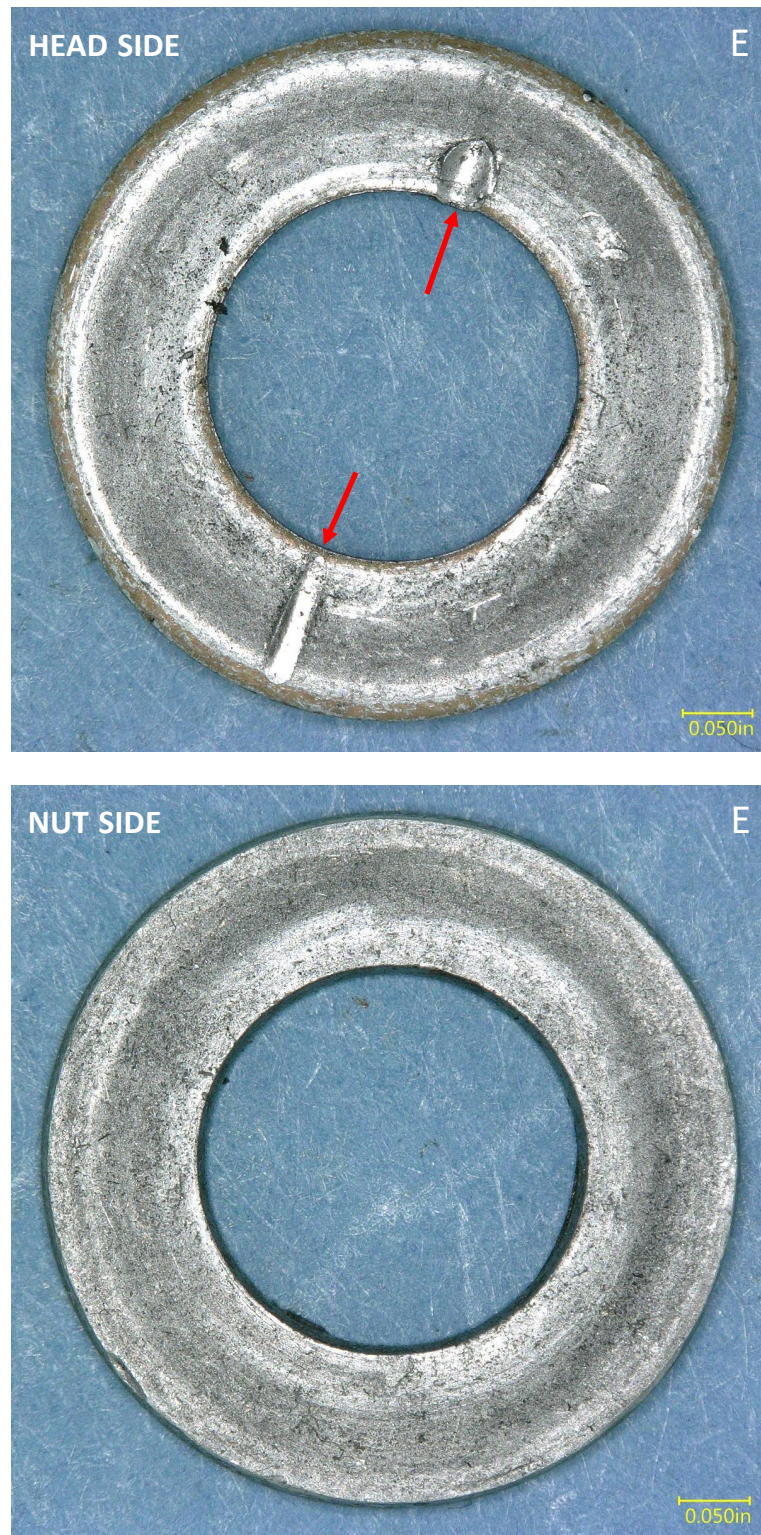


Figure 9: Digital microscope images of the faces on washer E. The red arrows point to grooves observed from contact with a mating wire.

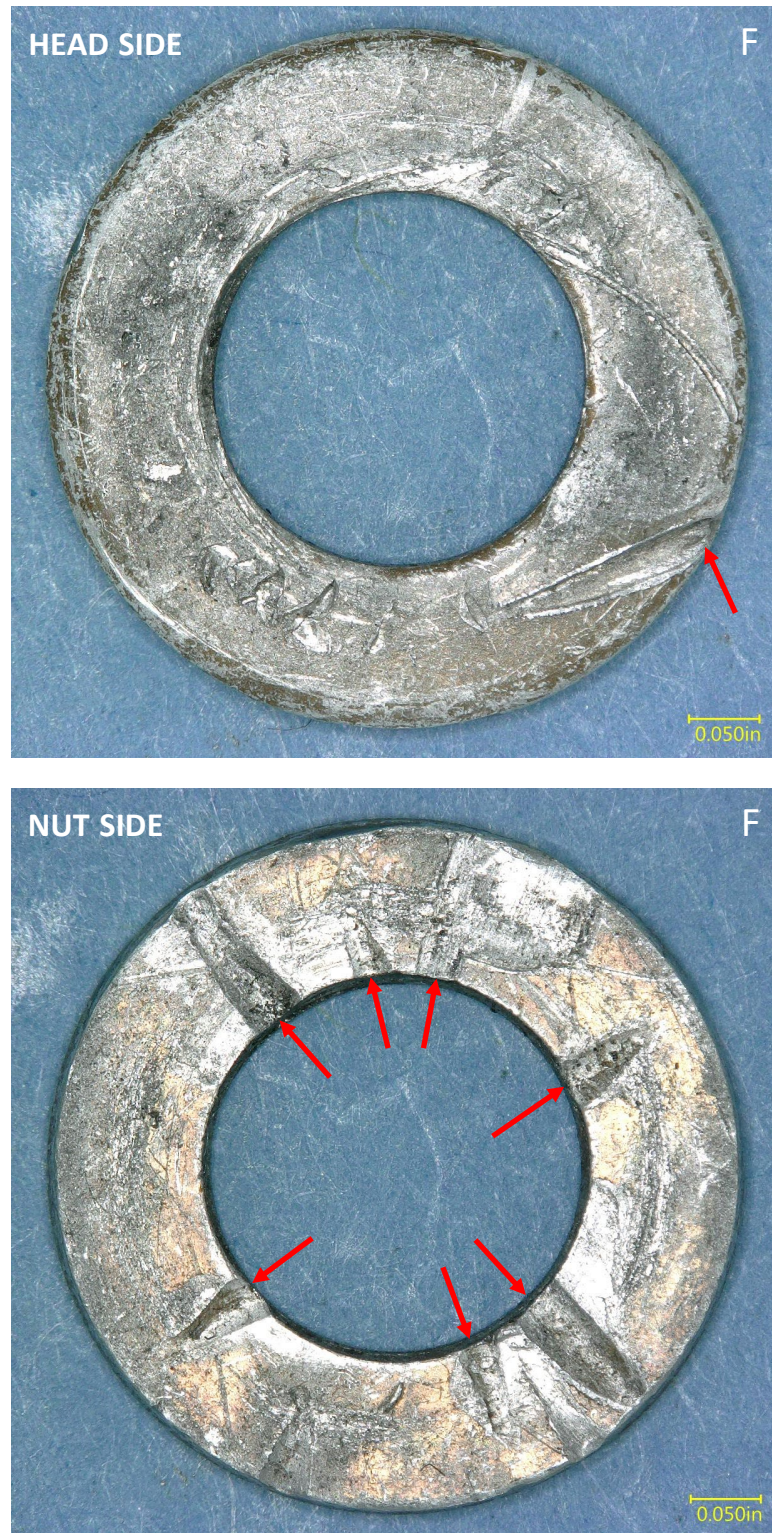


Figure 10: Digital microscope images of the faces on washer F. The red arrows point to grooves observed from contact with a mating wire.