

NATIONAL TRANSPORTATION SAFETY BOARD

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



October 03, 2019

MATERIALS LABORATORY FACTUAL REPORT

Report No. 19-053

A. ACCIDENT INFORMATION

Place : Jacksonville, Florida
Date : June 10, 2019
Vehicle : Rockwell 690
NTSB No. : CEN19LA168
Investigator : Courtney Liedler

B. COMPONENTS EXAMINED

1. Nose gear spacer with fractured split spring pin pieces.

C. DETAILS OF THE EXAMINATION

The purpose of this laboratory investigation is to identify the mode of fracture of a slotted spring pin in a nose gear spacer block. Multiple views of the as-received spacer block with the fractured slotted spring pin pieces are shown in Figures 1 and 2, with key features identified.

The blind hole diameter was measured using a half-ball gage and micrometer at four locations approximately 90° apart: 0.2482, 0.2480, 0.2492, 0.2488 inch. To reveal the fracture surfaces of the slotted spring pin, the spacer was sectioned with a water-cooled wafering saw according to the dashed lines shown in Figure 3. Images of the as-sectioned blind hole portion of the spacer are shown in Figures 4 (as-cut) and 5 (after ultrasonic cleaning in detergent).

Figures 6-10 show digital microscope close views of the fracture faces of the slotted spring pin before and after cleaning. The annotated image in Figure 10 shows the direction of fracture. The fracture surfaces exhibit features consistent with the application of bending and shear stresses, resulting in overstress fracture.

As shown in Figure 11, digital microscope images reveal that the shaft in the blind hole was pulled towards the opening of the blind hole leaving scratch marks as shown in the lower images in Figure 11.

Michael Budinski
Chief, Materials Laboratory Division



Figure 1 Image of the as-received nose gear spacer with fractured split spring pin pieces.

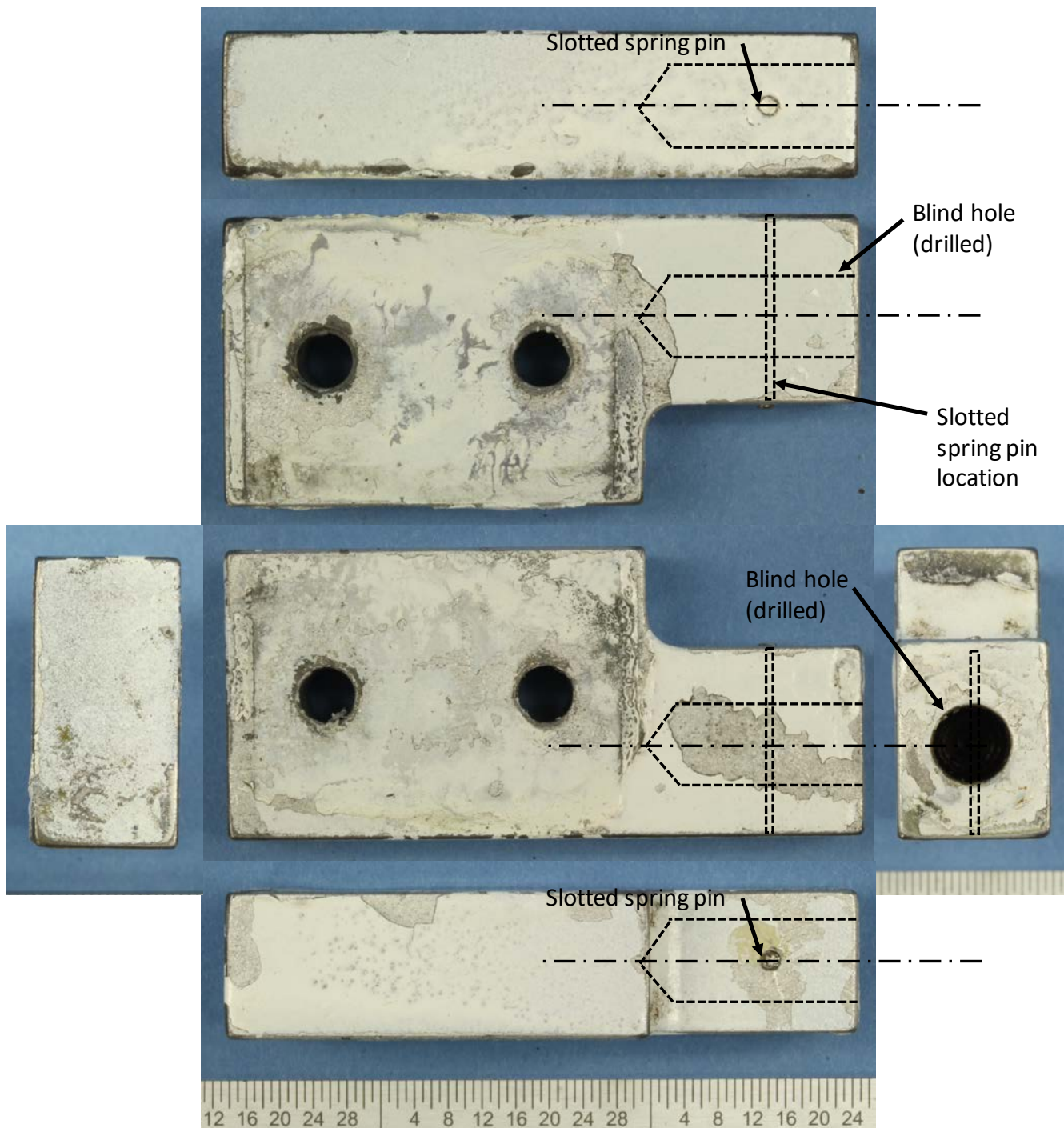


Figure 2 Same image is Figure 1 with key features identified.

Red dashed lines show the wafering saw cuts to open the blind hole and reveal the fractured ends of the slotted spring pin

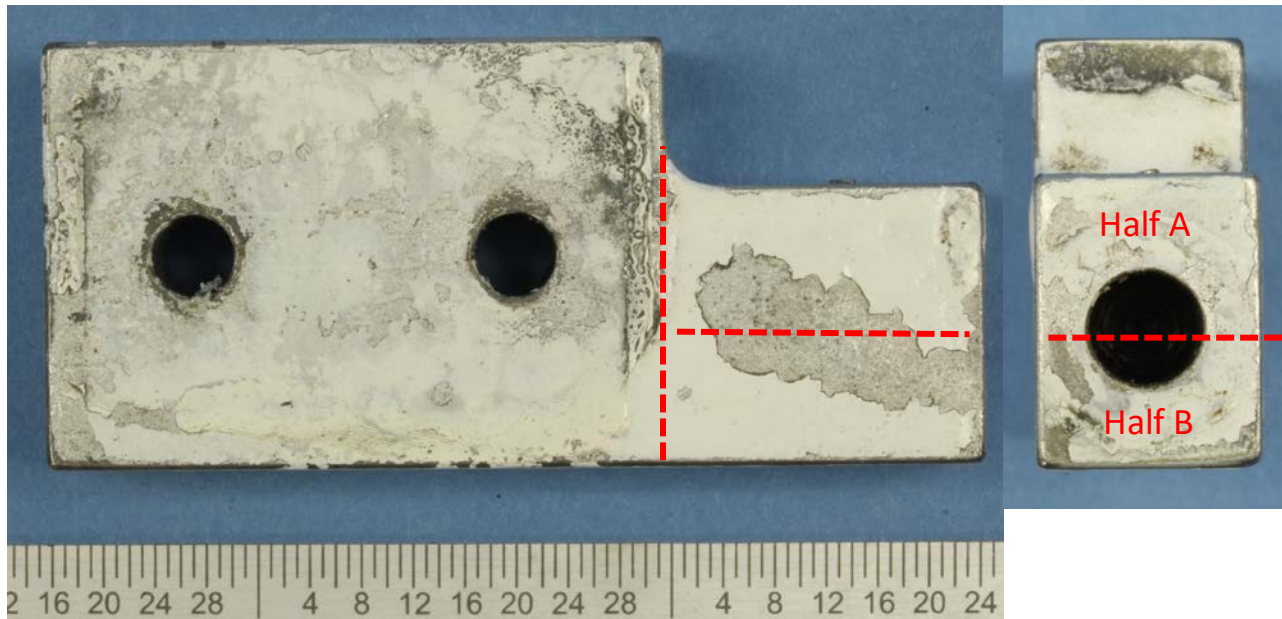


Figure 3 To reveal the fracture surfaces of the slotted spring pin, the spacer was sectioned according to the dashed lines.

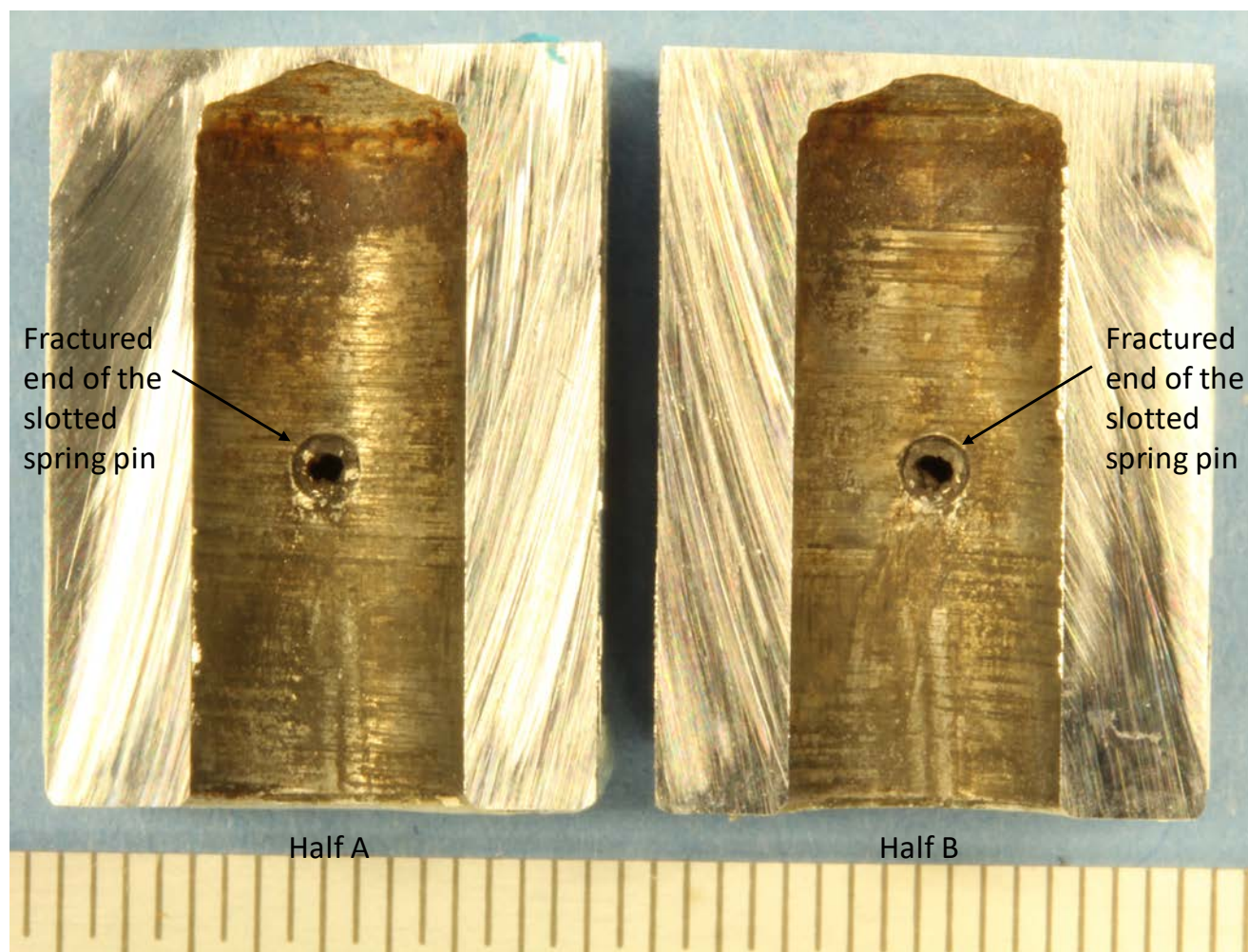


Figure 4 As-sectioned image of both halves of the sectioned blind hole, showing the fracture faces of the slotted spring pin.

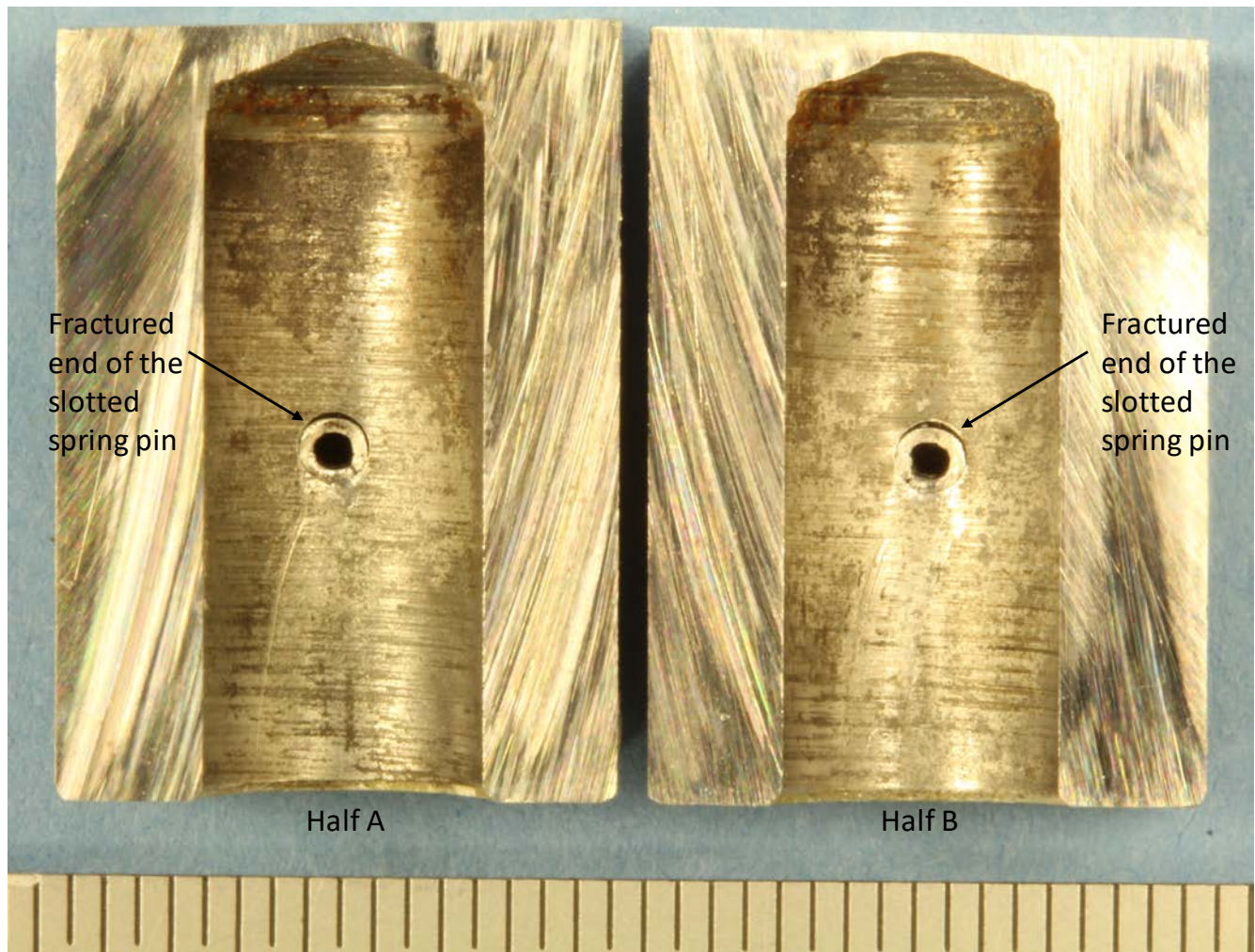


Figure 5 After ultrasonic cleaning in detergent image of both halves of the sectioned blind hole, showing the fracture faces of the slotted spring pin.

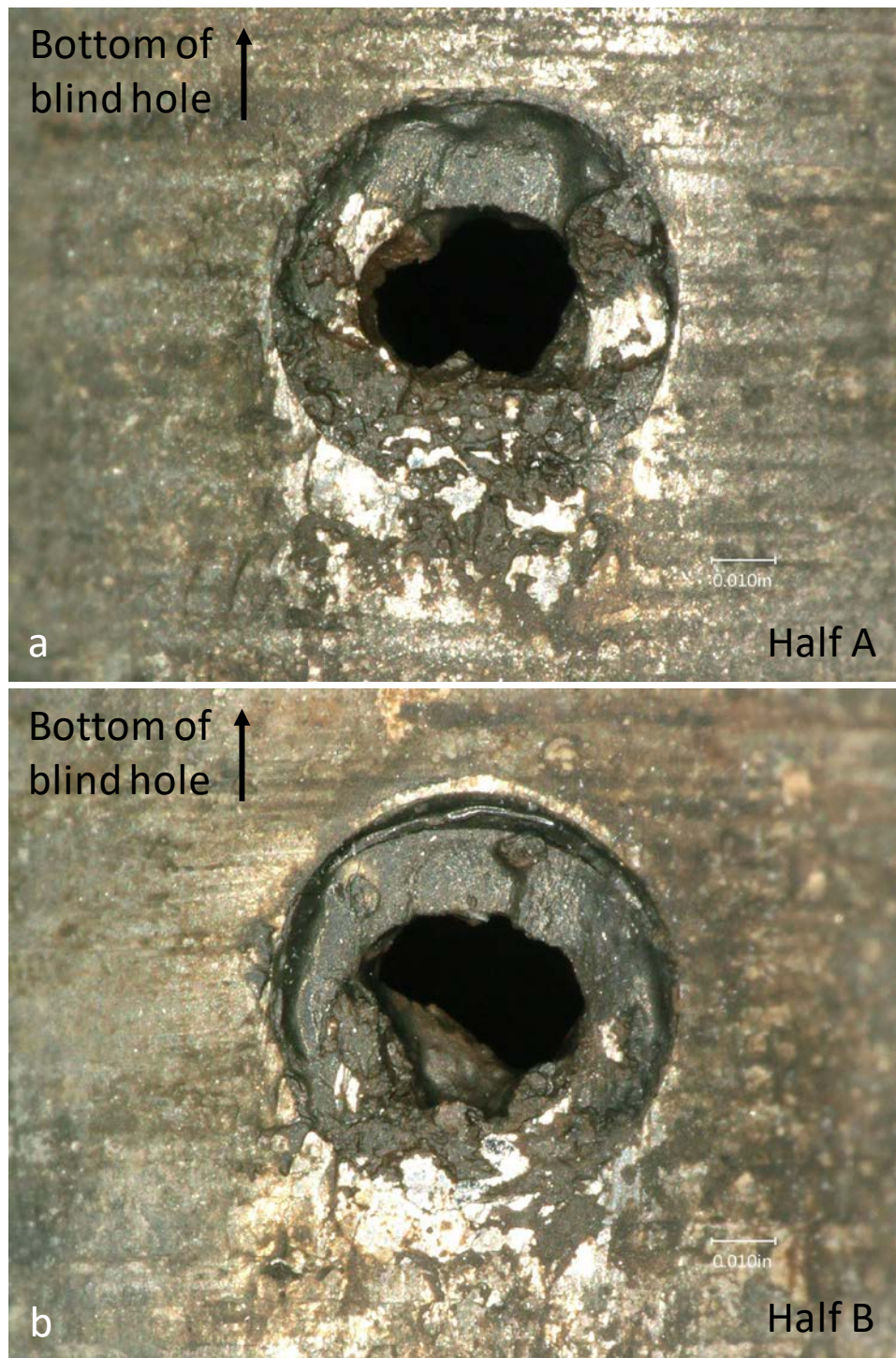


Figure 6 Digital microscope close views of the fracture faces of the slotted spring pin, before cleaning.

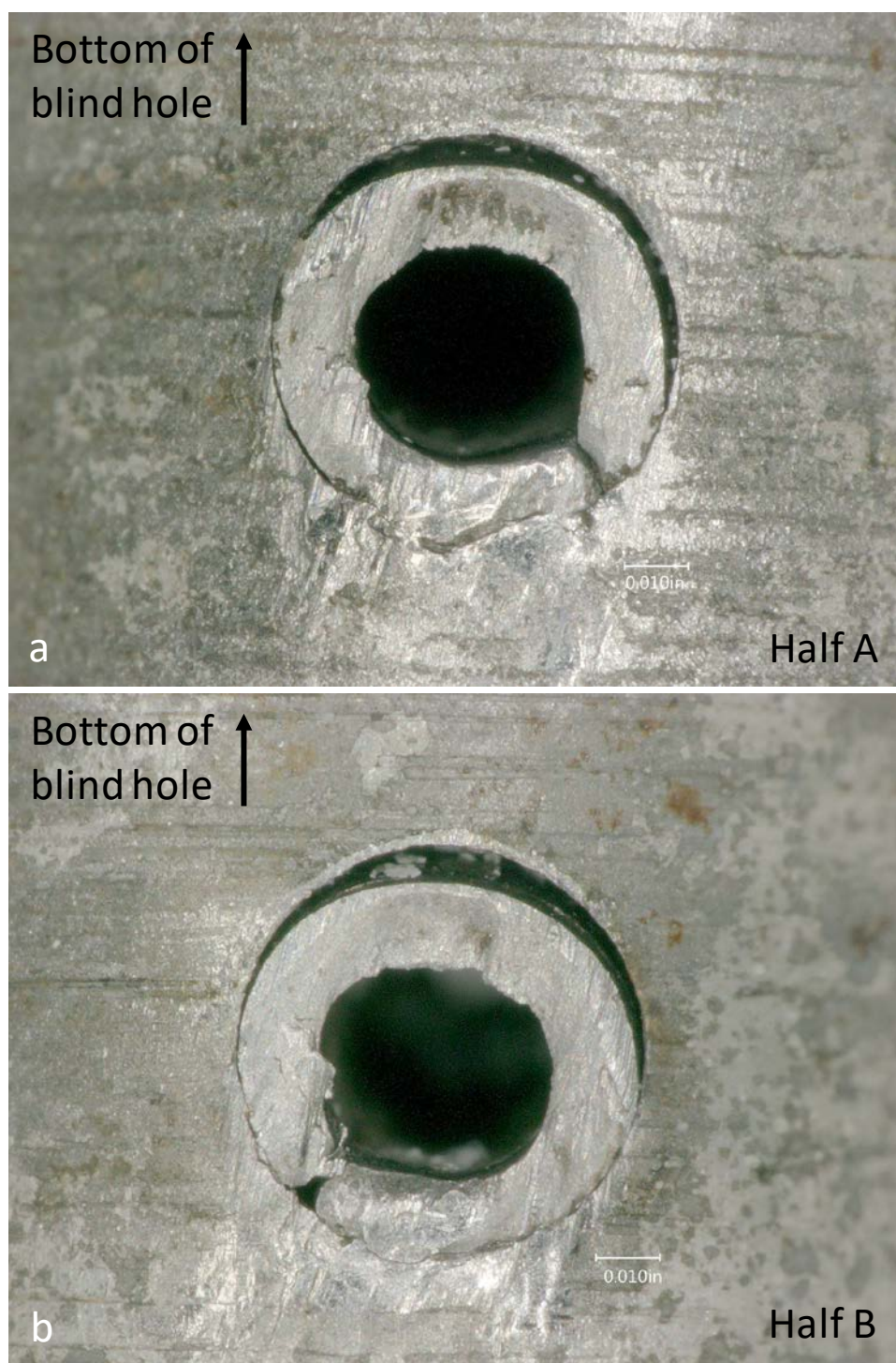


Figure 7 Digital microscope close views of the fracture faces of the slotted spring pin, after cleaning.

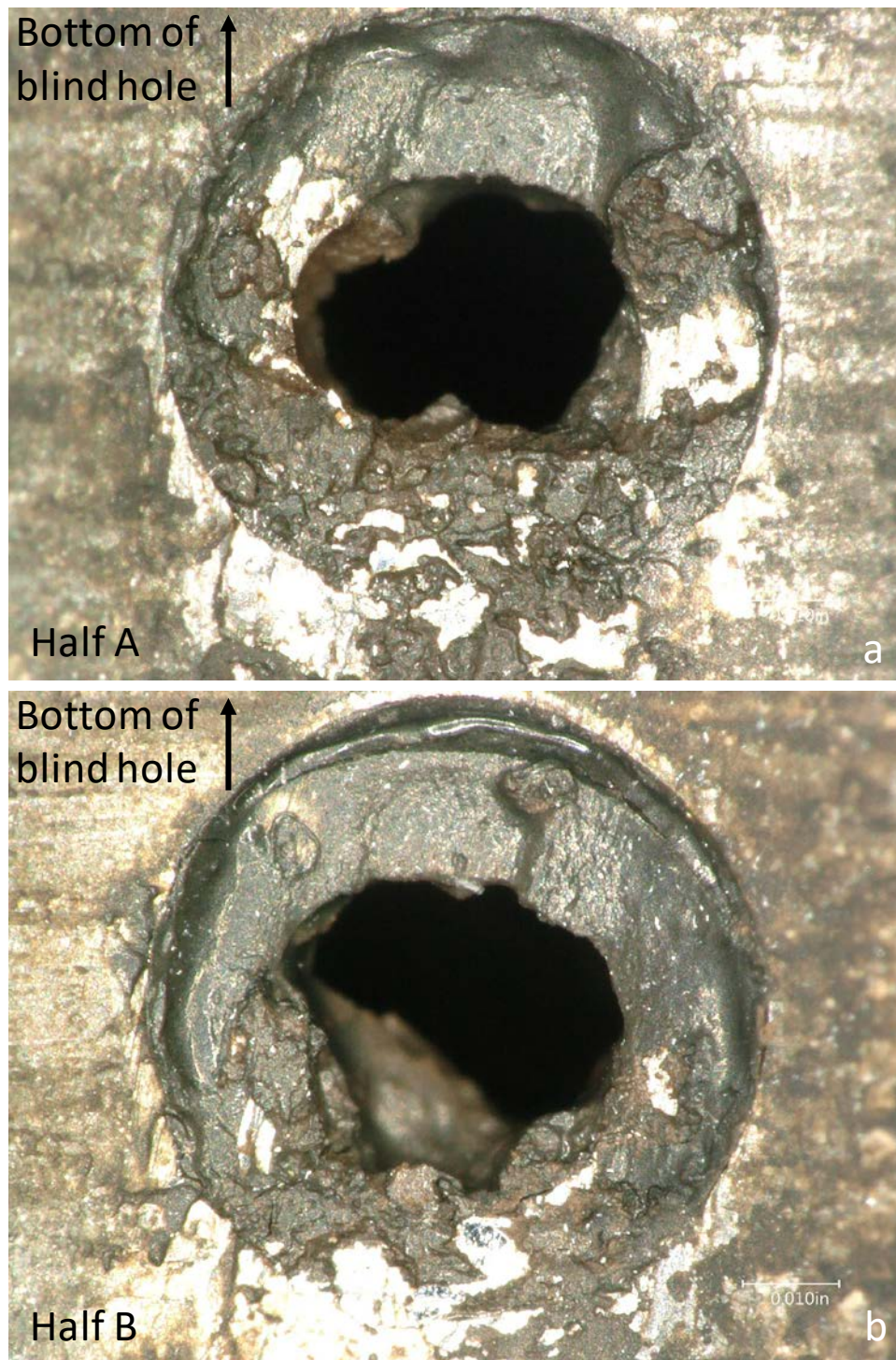


Figure 8 Higher magnification views of the images in Figure 6 showing the fracture faces of the slotted spring pin, before cleaning.

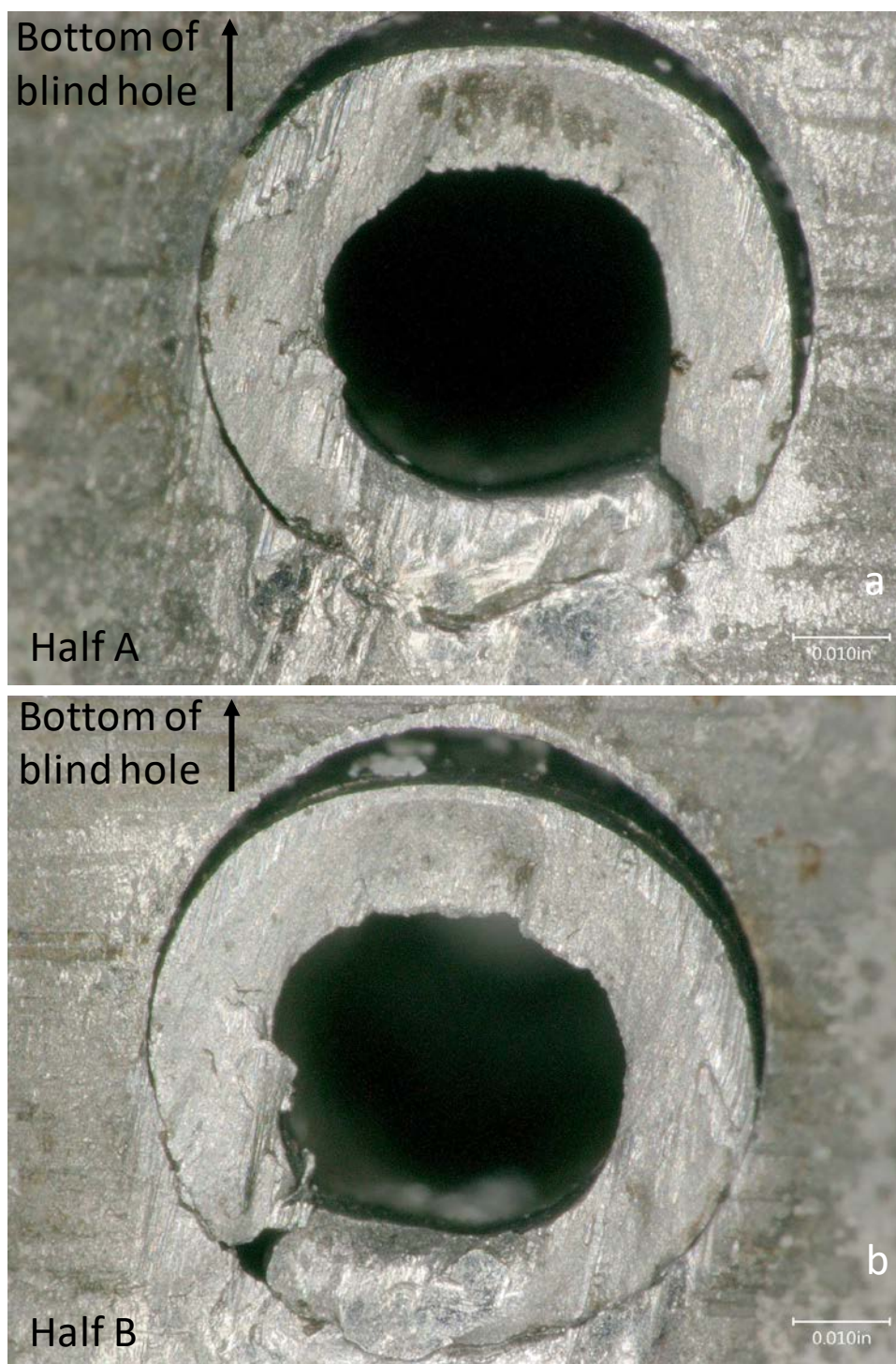


Figure 9 Higher magnification views of the images in Figure 7 showing the fracture faces of the slotted spring pin, after cleaning.

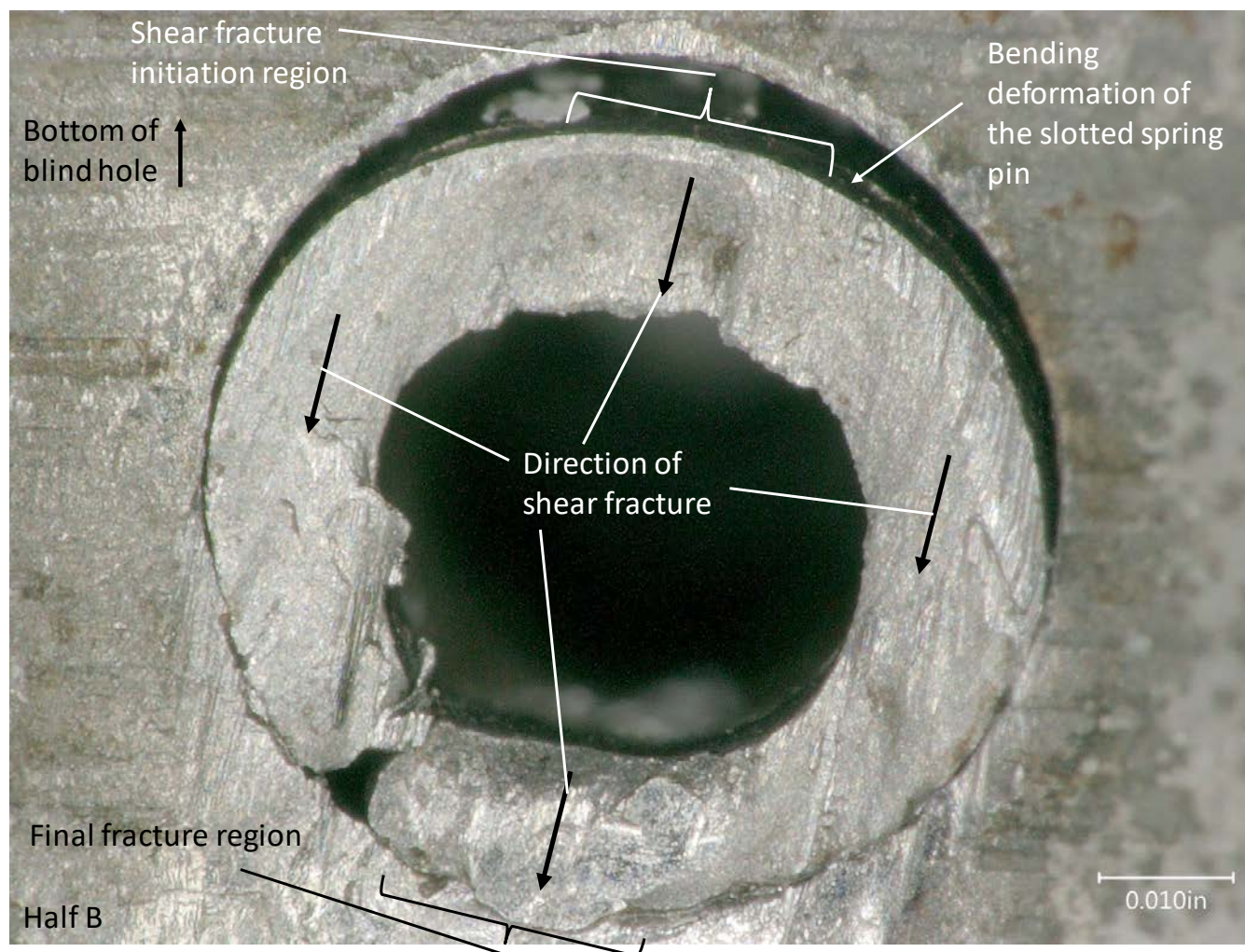


Figure 10 Image of Figure 9 view b with annotations indicating the fracture initiation region and the direction of fracture.

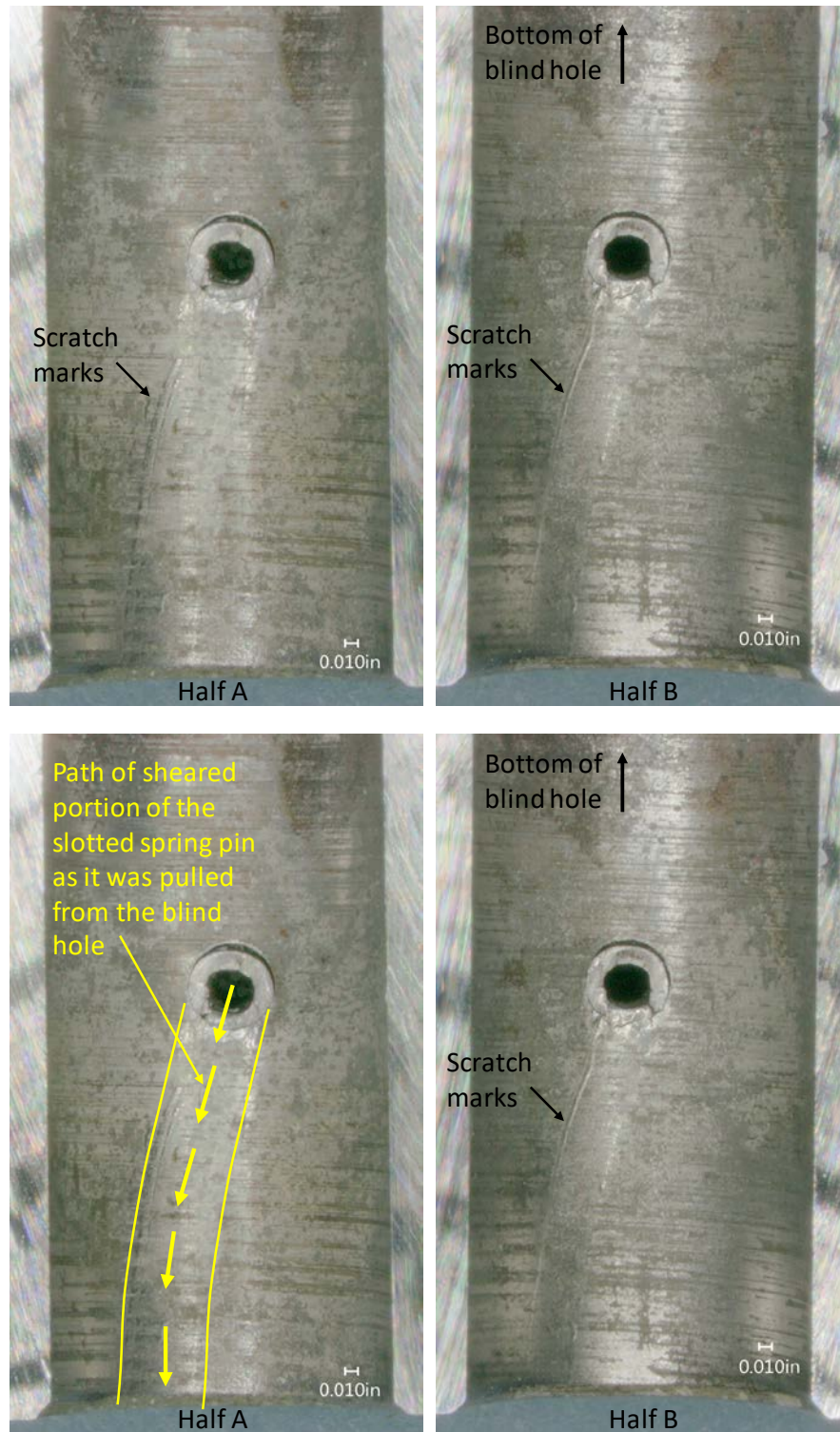


Figure 11 Digital microscope images of the sectioned bore of the blind hole identifying scratch marks on the bore surface that indicate the direction of travel of the shaft after the slotted spring pin fractured.