NATIONAL TRANSPORTATION SAFETY BOARD
Office of Research and Engineering
Materials Laboratory Division
Washington, D.C. 20594

July 08, 2015

MATERIALS LABORATORY FACTUAL REPORT Report No. 15-077

A. ACCIDENT INFORMATION

Place	:	Anchorage, Alaska
Date	:	March 14, 2015
Vehicle	:	Eurocopter AS350-B2
NTSB No.	:	ANC15LA015
Investigator	:	Shaun Williams

B. COMPONENTS EXAMINED

Pieces of the rotating plate and stationary plate subassembly for the tail rotor drive system.

C. DETAILS OF THE EXAMINATION

A photograph of the as received components (oriented in accordance with approximate assembly order) is shown in Figure 1. An illustrated parts diagram for the tail rotor drive system is shown in Figure 2.

Pieces from the stationary plate subassembly are shown in Figure 3. The single and double lip seals are damaged and much of the seal material is missing. The outer ball bearing raceway surfaces exhibit galling scars consistent with sliding contact. The inner surfaces of the ball cage exhibit adhesive wear scars around the circumference. The ball pockets of the cage retained accumulated wear debris. A cotton swab was wiped along the circumference of the raceway of the outer ball bearing race in order to collect any grease residue. Fourier transform infrared spectroscopy analysis of the cotton swab revealed that no grease was detected[1].

The protective cap was removed from the grease fitting as depicted in Figure 4. As indicated in the figure, sessile drops of liquid were discovered on the inlet portion of the grease fitting and on the inside surface of the protective cap. A cotton swab was used to sample a sessile drop. Fourier transform infrared spectroscopy analysis of the cotton swab revealed that no grease was detected. As documented in the figure, the grease fitting was removed from the stationary plate housing. The bottom (outlet side) of the grease fitting was covered with accumulated wear debris. A cotton swab was

[1]Specification grease for this bearing is Mobilgrease® 28, ExxonMobil Corporation, Fairfax, VA.

used to sample this surface. Fourier transform infrared spectroscopy analysis of the cotton swab revealed that no grease was detected.

The ball bearing inner half-race from the outboard side of the assembly identified in Figure 1 is shown at closer views in Figure 5. The bearing half-race was examined under a 5X to 50X stereo zoom microscope. The raceway exhibited galling scars consistent with sliding contact. The inside diameter and edge surfaces of the inner half-race was covered with a deposit of tribo-transferred aluminum. The edge surface was also marked with serial numbers under the deposited aluminum. A sodium hydroxide solution was applied to the edge of the bearing race half to dissolve the deposited aluminum (see Figure 6). Two letter/number strings were revealed after cleaning as shown in Figure 6: NR 7842 and AG 2358. After cleaning in sodium hydroxide, the NR 7842 letter/number string was etched with 4% nital metallurgical etchant for enhancement.

The tube portion of the rotating plate fractured where the stationary plate assembly is located as shown in Figure 1. Both halves of the tube fracture surfaces are shown in Figures 7 and 8. Examined under a 5X to 50X stereo zoom microscope, the fracture surface in Figure 7 (see also Figure 1 Fracture B) was damaged over about 50% of the surface and the undamaged areas exhibited features consistent with overstress fracture. The bearing inner half-race seating surfaces exhibited galling and adhesive wear scars. The mating bearing inner half-race is shown in Figure 5.

As identified in Figure 1, the portion of the rotating plate that contained the joining nut separated from the assembly as shown in Figure 8. The other half of the inner bearing half-race remained with the joining nut portion. Examined under a 5X to 50X stereo zoom microscope, the raceway surface of the inner bearing half-race exhibited galling scars consistent with sliding contact The fracture surface of the tube portion of the rotating plate was damaged over 100% of the surface. The internal brush assembly was partially worn or fractured.

Figures 9 and 10 show pieces of rotating plate and stationary pate respectively. The part markings are identified.

Michael Budinski
Chief, Materials Laboratory

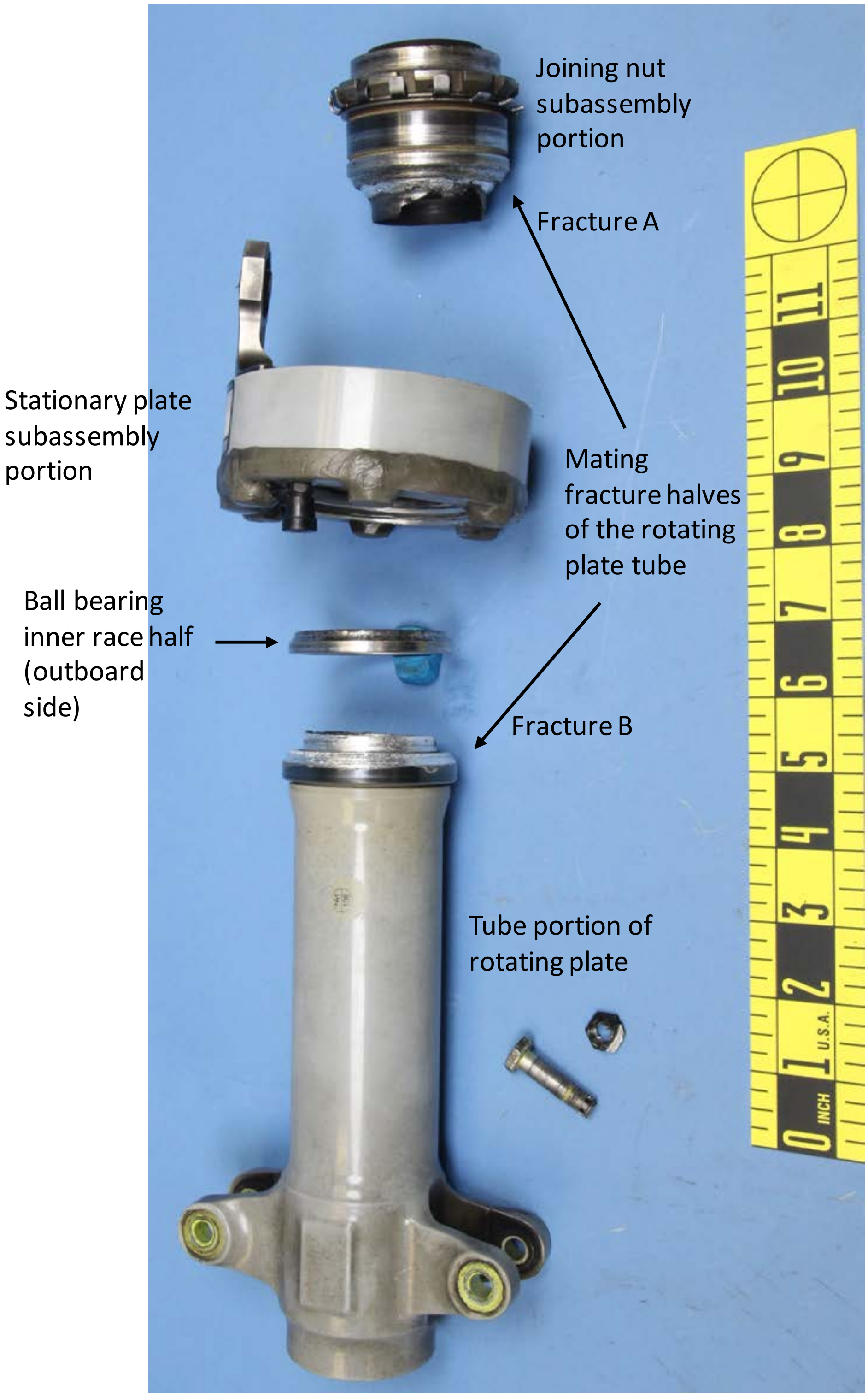

Figure 1 As-received pieces of the rotating and stationary plate assembly. Depicted in approximate order of assembly.

5.2.3. TAIL ROTOR DRIVE COMPONENTS

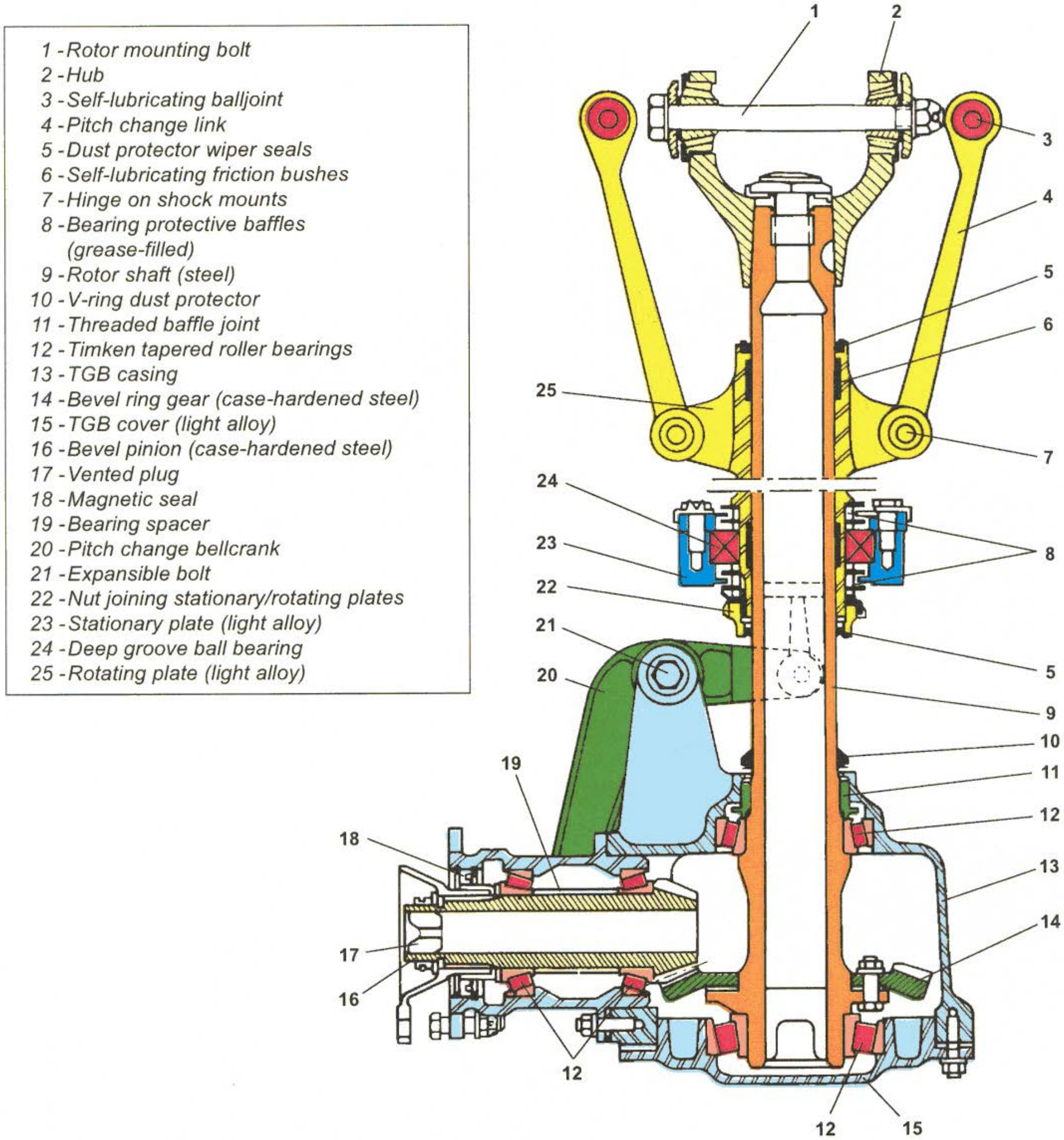

Figure 2 Illustrated parts diagram of the tail rotor drive components.

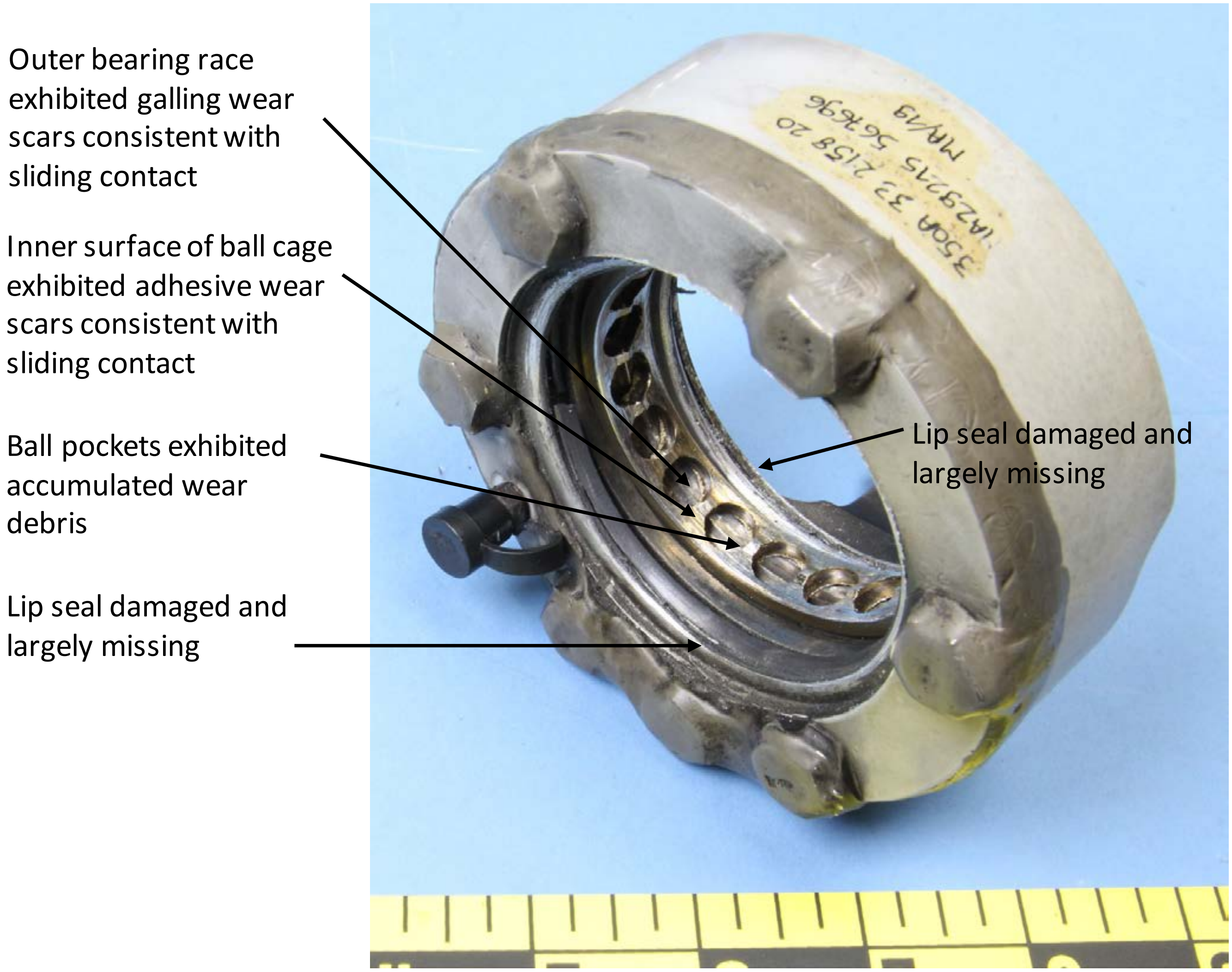

Figure 3 Photograph of a portion of the stationary plate for the tail rotor drive assembly is shown. Damage observations are annotated in the image.

Figure 4 Portion of the stationary plate assembly depicting the presence of a liquid meniscus on the inlet portion of the grease fitting and metallic wear debris accumulated on the outlet portion of the grease fitting.

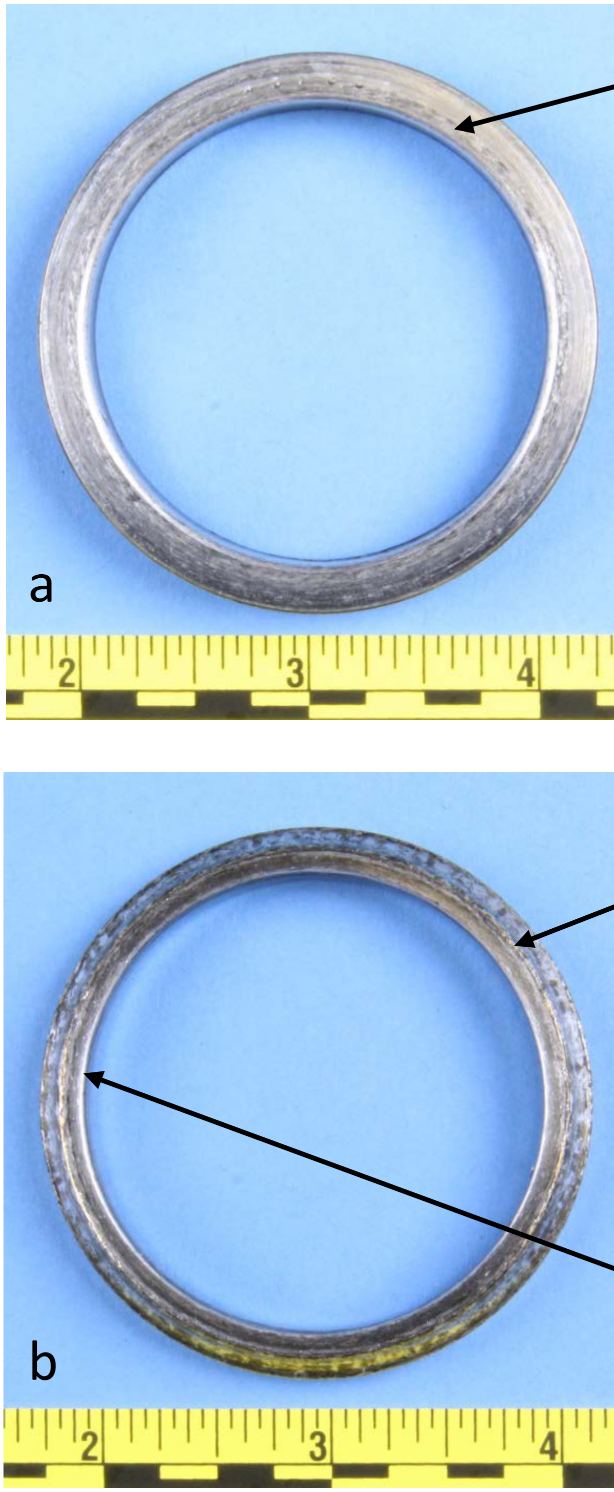

Figure 5 Images of the edge and raceway of one half of the inner bearing half-race (see Figure 1).

Figure 6 Images of the edge of the inner bearing half-race shown in Figure 5. The edge has been cleaned to reveal serial numbers.

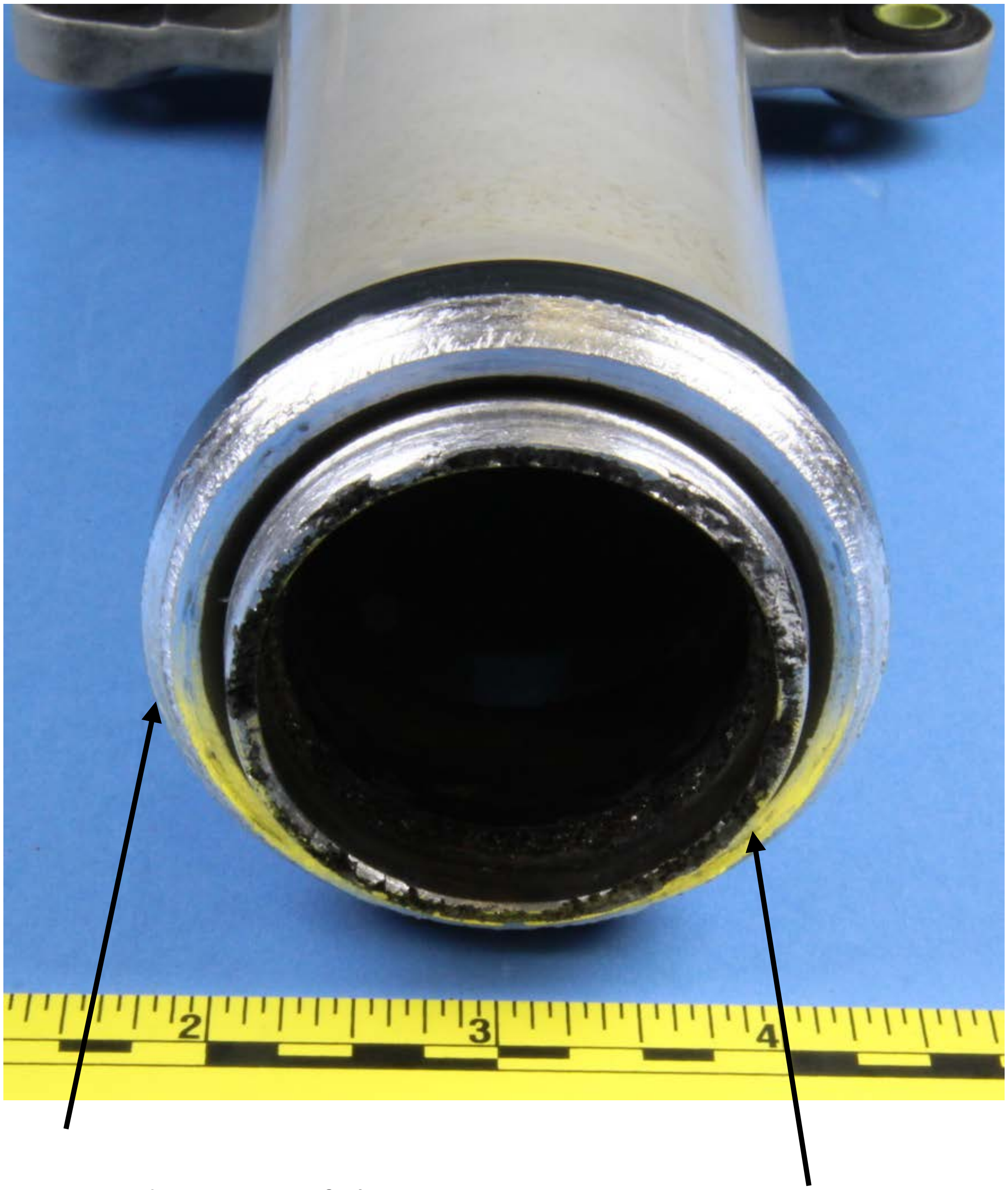

Figure 7 Image of the tube portion of the rotating plate (see Figure 1).

Figure 8 Image of the joining nut subassembly portion of the rotating plate (see Figure 1).

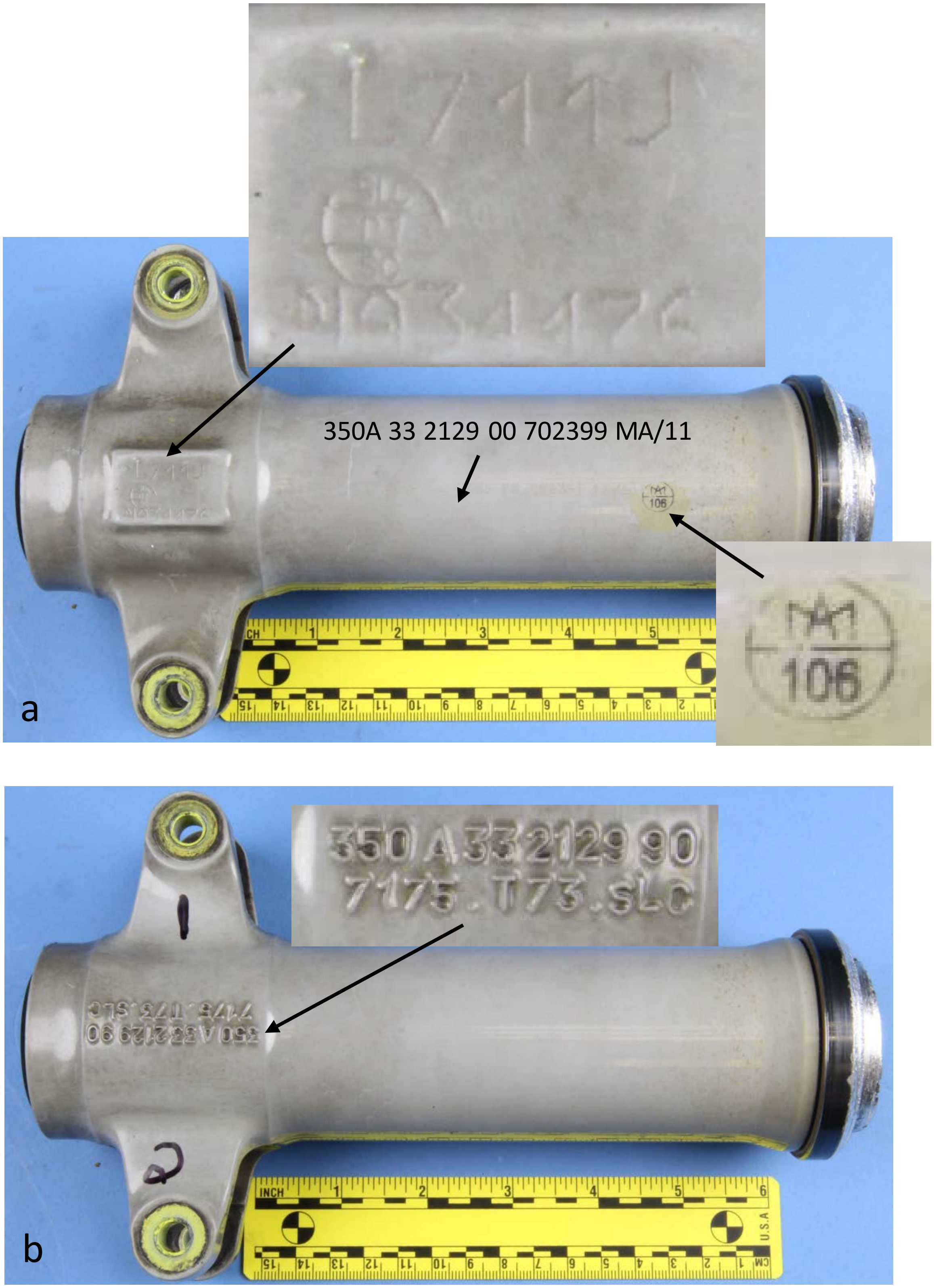

Figure 9 Image of a portion of the rotating plate, showing part identification markings.

Figure 10 Image of the stationary plate showing part identification markings.