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

March 26, 2013

MATERIALS LABORATORY FACTUAL REPORT Report No. 12-126

A. ACCIDENT INFORMATION

Place	:	Westminster, MD
Date	:	June 15, 2012
Vehicle	:	Remos GX
NTSB No.	:	ERA12FA395
Investigator	:	Luke Schiada, AS-ERA

B. COMPONENTS EXAMINED

Pieces from left aileron, right aileron, and elevator control tube quick fasteners.

C. DETAILS OF THE EXAMINATION

The purpose of this report is to examine the elevator quick-fastener to determine if there are any signatures or markings consistent with in-flight separation. Additionally, dimensional measurements will be performed to determine if the elevator quick-fastener conforms to manufacturer specifications. The as-received pieces of wreckage are shown in Figure 1. The elevator quick-fastener system arrived in the unassembled condition.

A closer side-view of the unassembled elevator quick-fastener assembly is shown in Figure 2 with key features identified. As indicated through the series of images in Figure 3, the assembly was functionally evaluated by assembling the connectors, actuating the lock button and sliding the lock sleeve into the closed position. All functions performed as-designed.

Through the sequence of images in Figure 4, the fastener bolt connector assembly (see Figure 2) was disassembled as indicated. The slotted headless screw was seized in place and was ground off to allow removal of the lock sleeve. Once the lock sleeve was removed, the lock button and spring were removed. White salts, consistent with aluminum corrosion product were observed in the cross-drilled hole that housed the spring and lock button (bolt connector is manufactured from type 6061 aluminum alloy). Closer views of the corrosion product with the cross-drilled hole and on the outside diameter of the lock button are shown in Figures 5 and 6. Dark deposits consistent with fretting wear scars and fretting corrosion are present on the flanks and root of the connector notch as indicated in Figure 5.

Figure 7 shows an image of the fastener clevis connector with an area exhibiting dark deposits consistent with fretting wear and fretting corrosion due to contact with the inside surface of the lock sleeve (when placed in the locked position.) A mating fretting wear scar was observed on the inside surface of the lock sleeve. The flanks and root of the clevis connecter also exhibited mating fretting wear scars similar to those observed on the bolt connector.

Employing calipers, micrometers, and an optical comparator, the critical-to-locking dimensions on the bolt connector, clevis connector, lock sleeve, and lock button were measured. The dimensions are summarized in Figures 8-11 and are compared with the manufacturer's specified dimensions. A few dimensions were determined to be slightly outside specifications limits (Figure 8 B1, C1, E1 and Figure 11 B4, C4.)

The left aileron and right aileron control tube quick fasteners were evaluated for functionality and found to assemble and disassemble as designed by the manufacturer.

Michael Budinski
Chief, Materials Laboratory

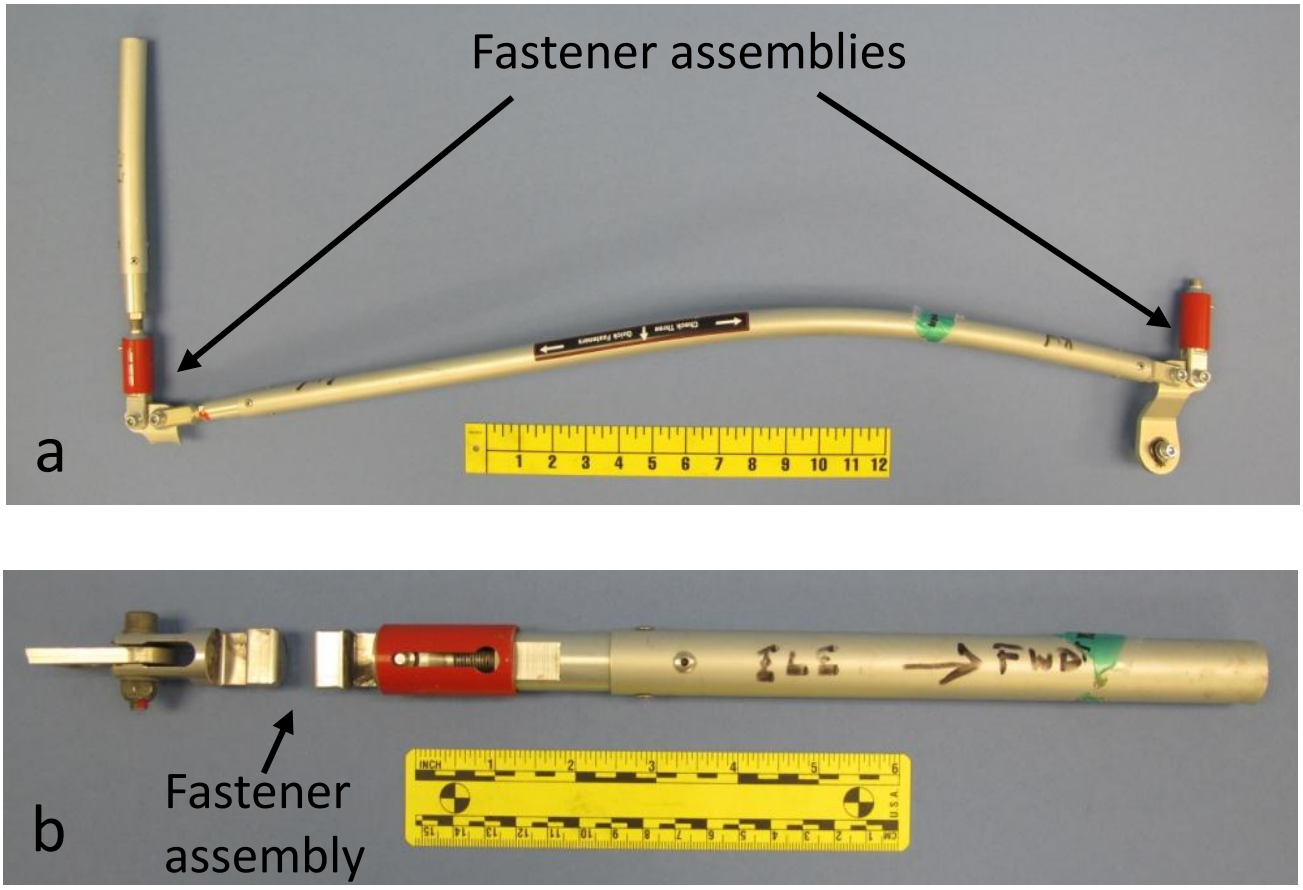


Figure 1 Pictures of the as-received parts. View (a) shows pieces of the left aileron and right aileron control tubes and quick fastener assemblies. View (b) shows pieces of the elevator control tube and quick fastener assembly.

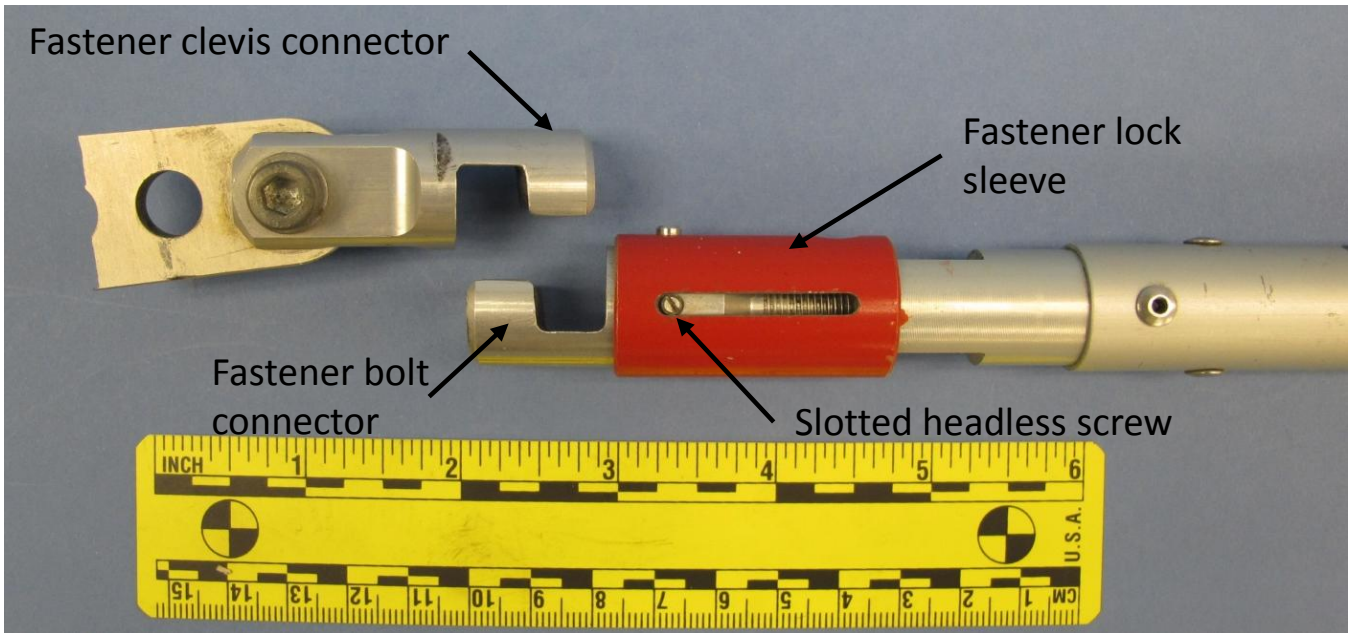


Figure 2 Closer view of pieces of the elevator control tube and quick fastener assembly. The key components of the quick fastener assembly are identified.

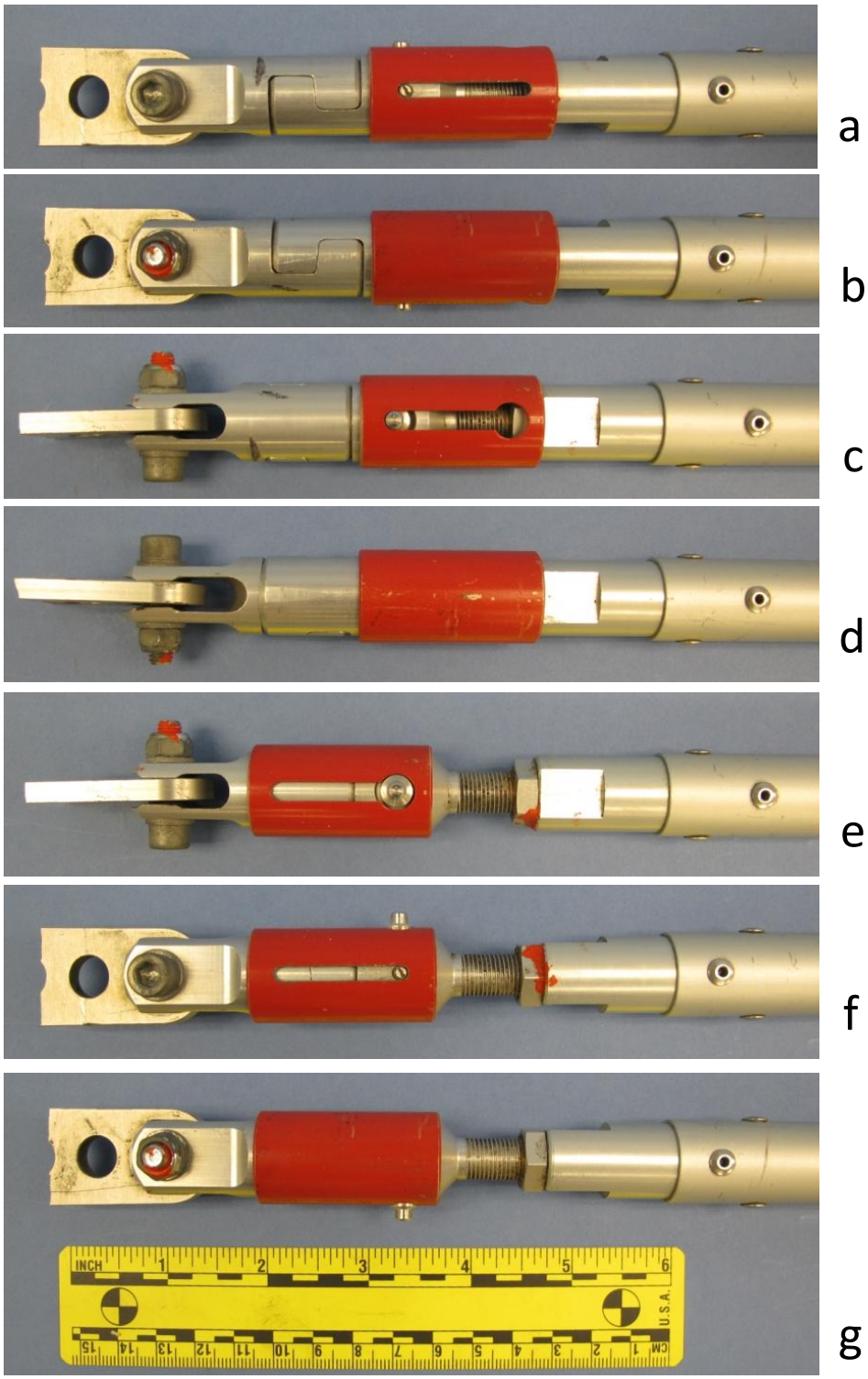


Figure 3 Multiple views of the elevator quick fastener assembly. Views (a-d) show images of the quick fastener assembly with the sleeve lock open. Views (e-g) show images of the quick fastener assembly with the sleeve lock fully closed and lock button extended.

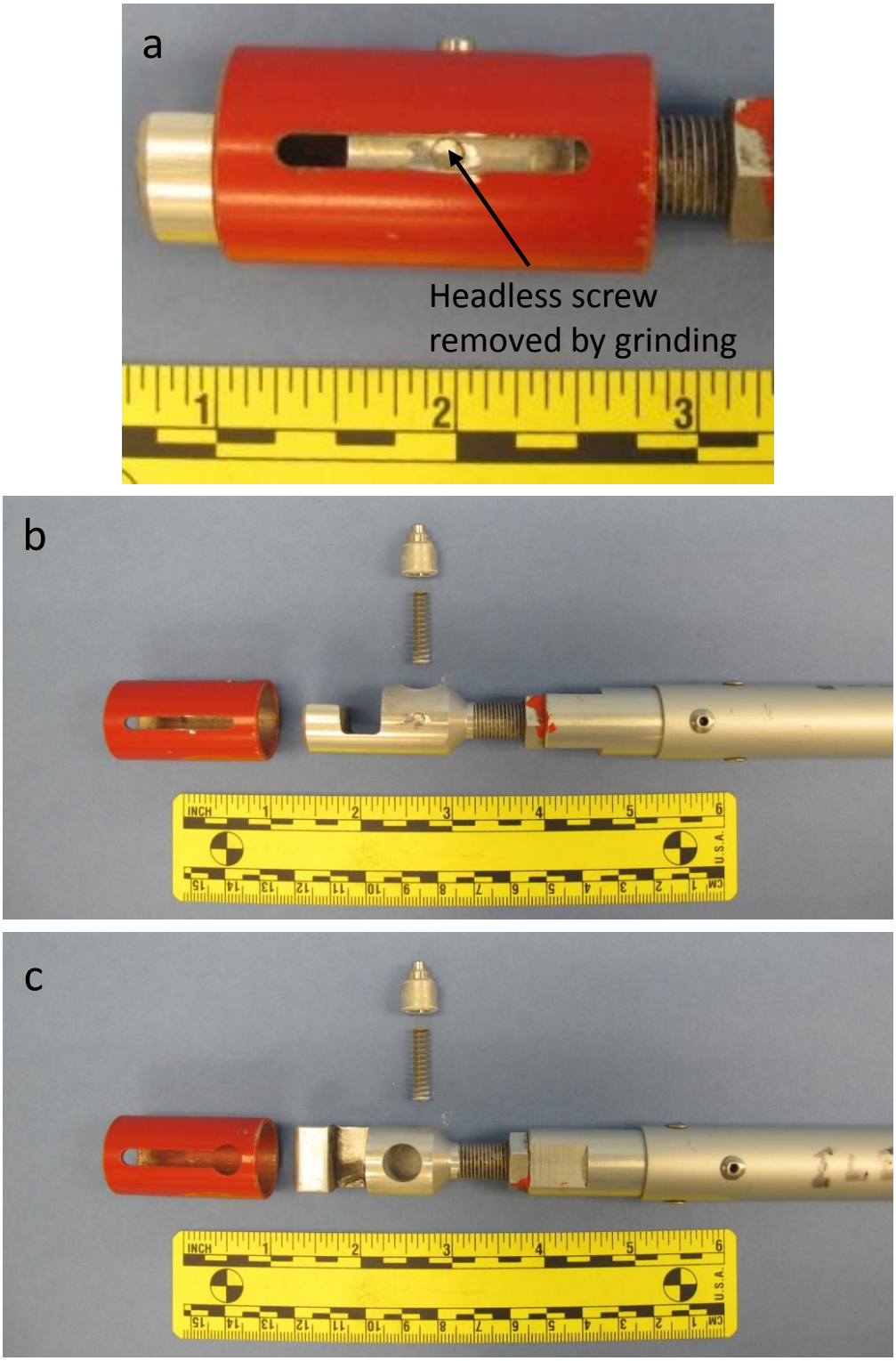


Figure 4 Images of the a portion of the elevator quick fastener assembly documenting removal of the headless screw (View a), and removal of the lock sleeve and lock button (Views b and c).

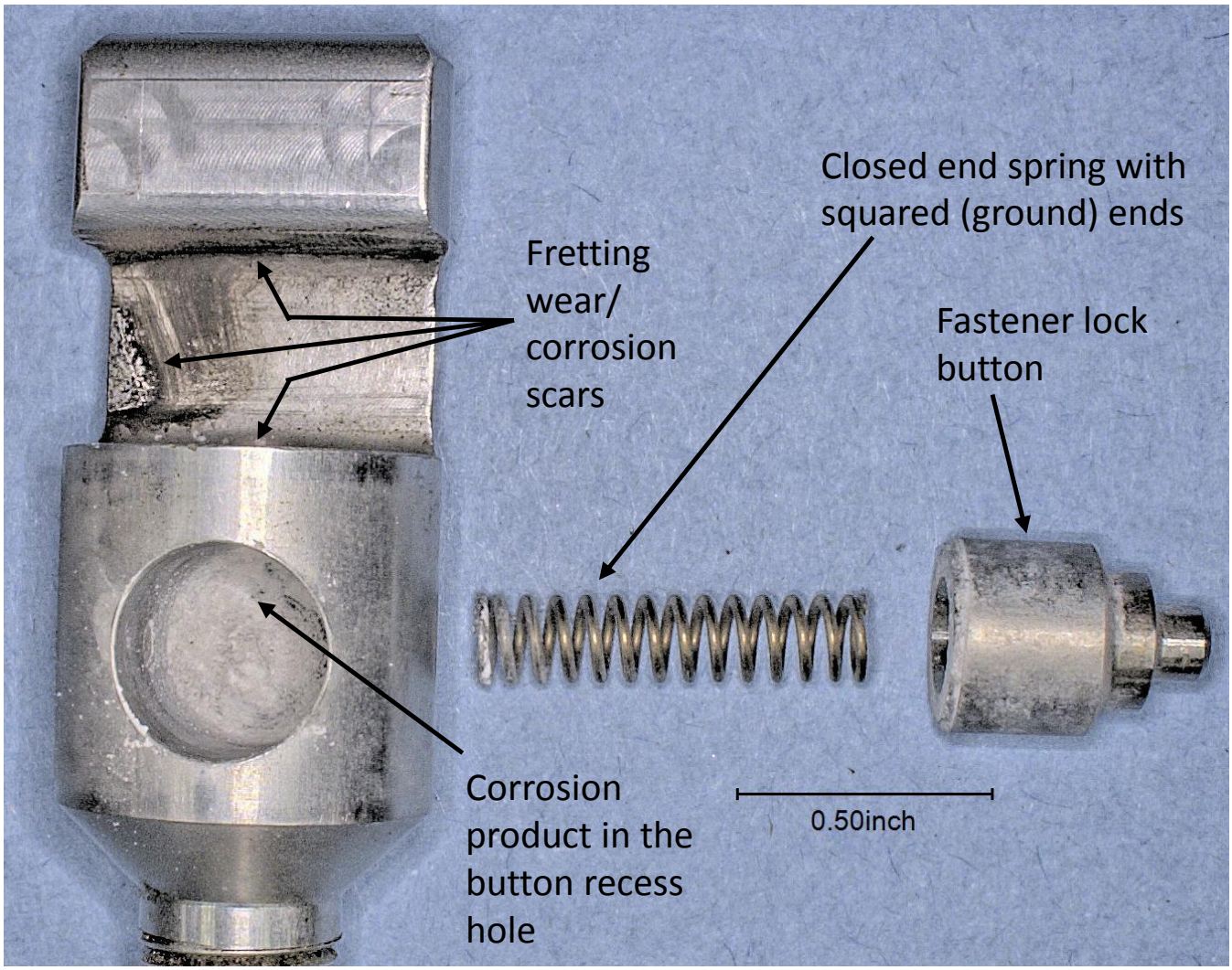


Figure 5 Closer image showing the fastener lock button, retraction spring, and bolt connector. Note the presence of white corrosion product in the button recess hole.

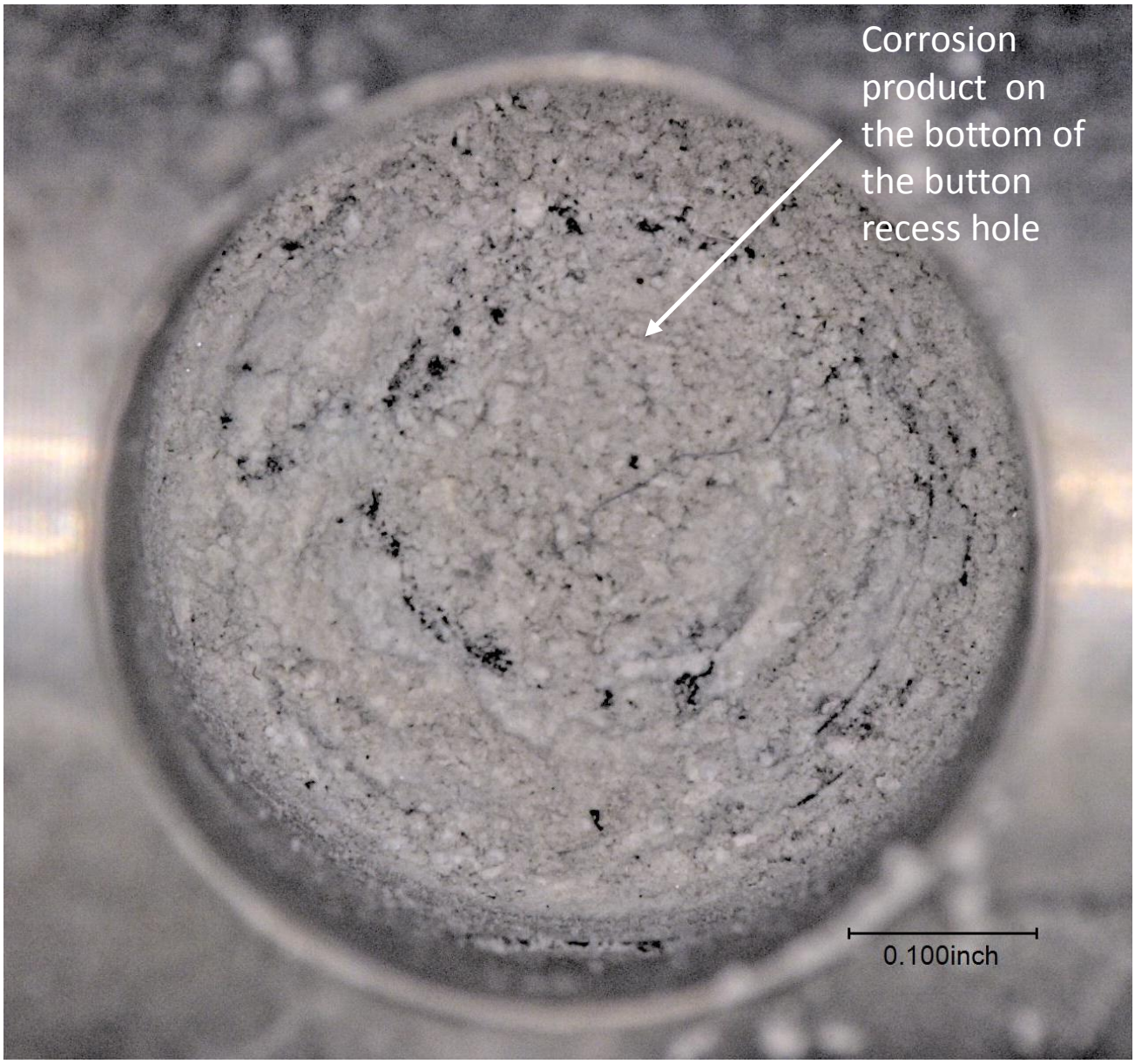


Figure 6 Higher magnification image of the button recess hole and the presence of corrosion product.

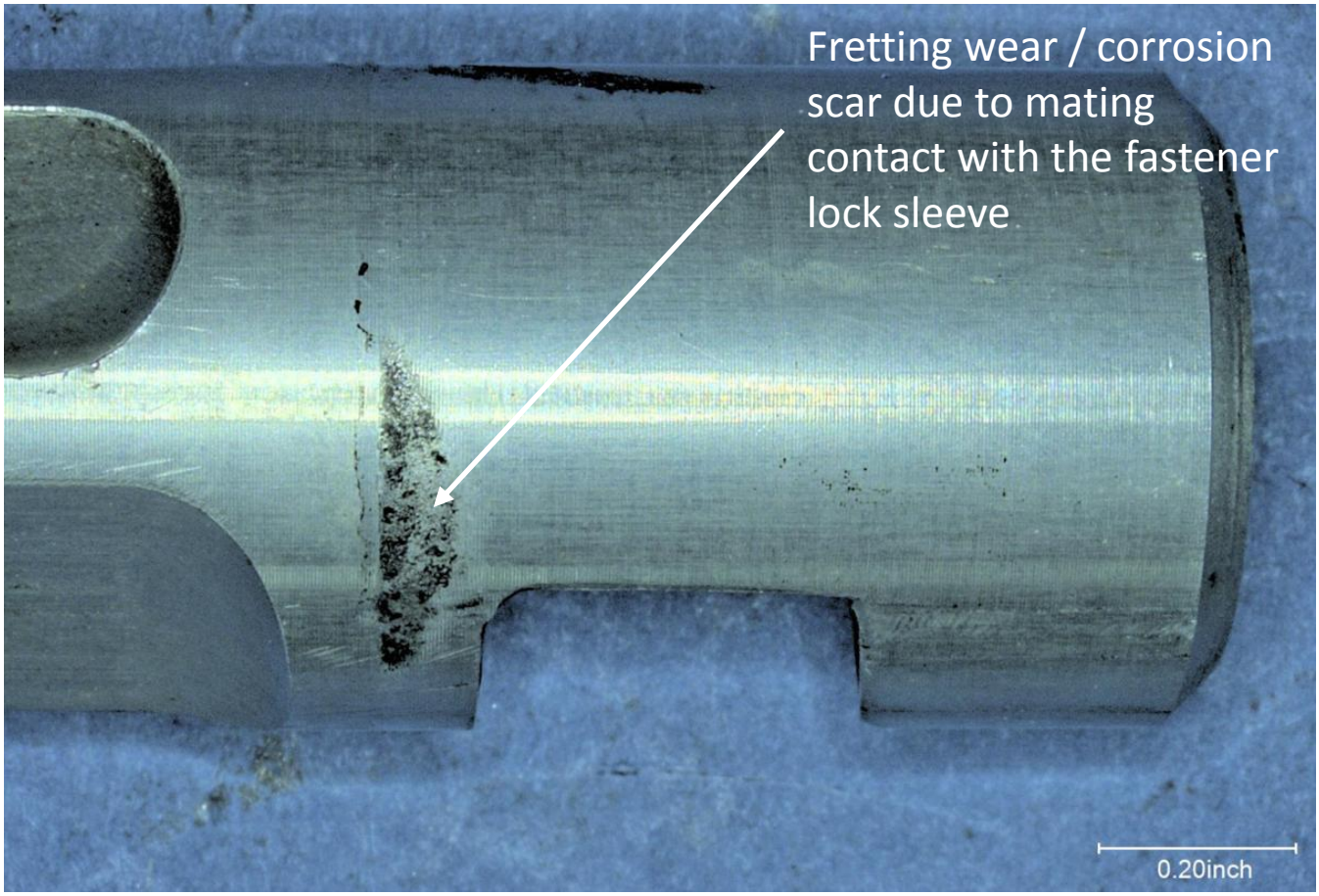
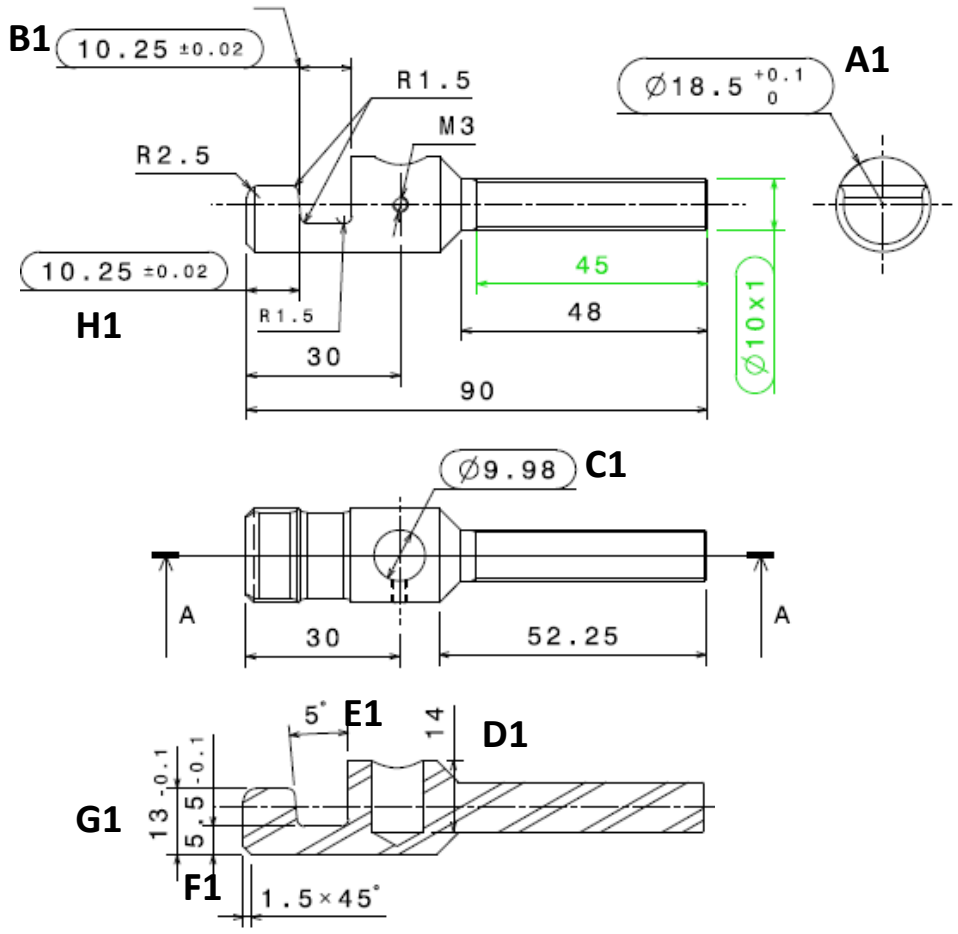
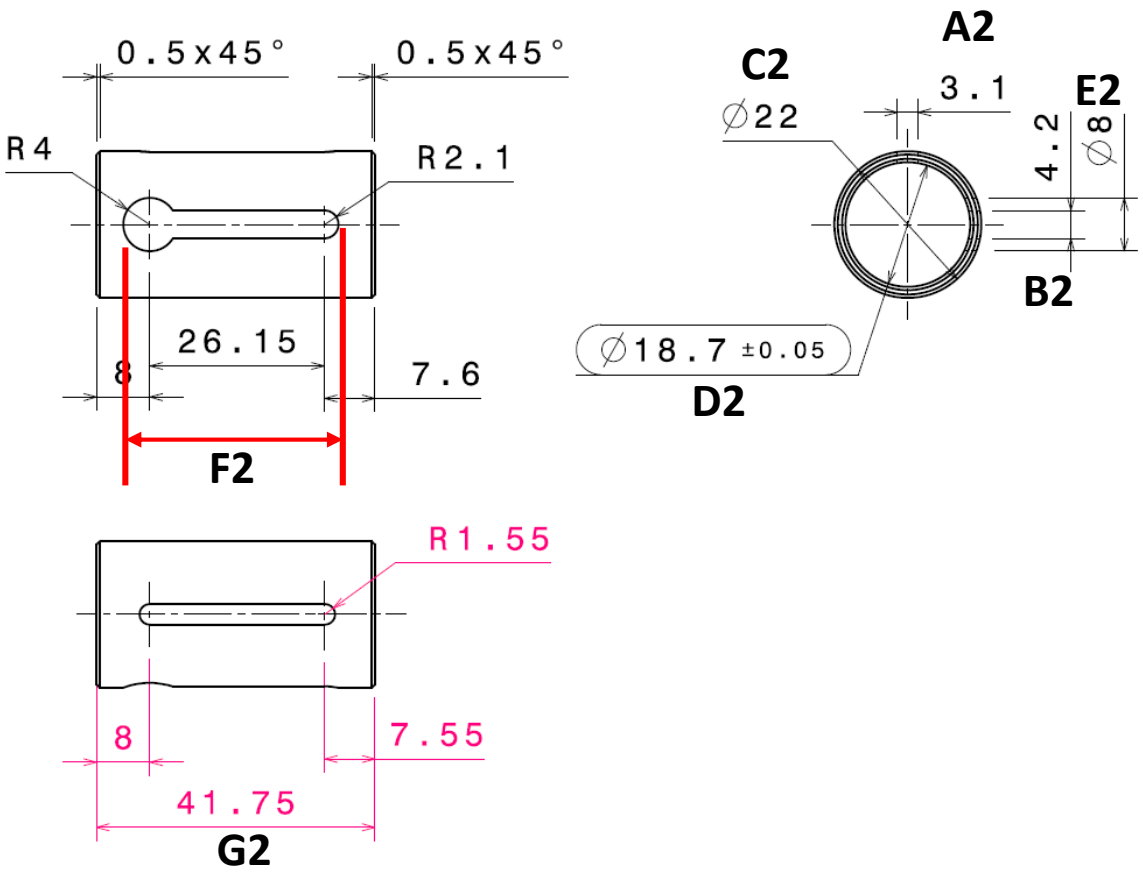


Figure 7 Image of the fastener clevis connector showing areas with fretting wear and fretting corrosion.



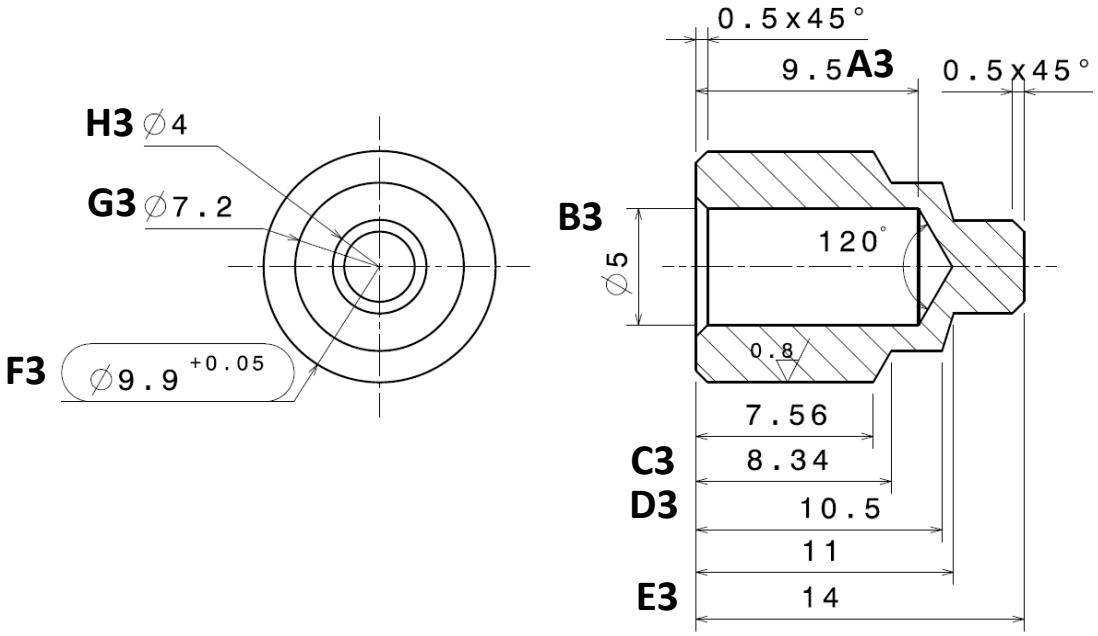
Feature	Measured nominal dimension (mm)	Specified dimension (mm)
A1	18.6	18.5 to 18.6
B1	10.37	10.23 to 10.27
C1	10.02	9.98
D1	14	14
E1	5°2’	5°
F1	5.45	5.5 to 5.4
G1	12.84	12.90 to 13.00
H1	10.26	10.23 to 10.27

Figure 8 Summary of dimensional measurements for the locking features on the bolt connector.



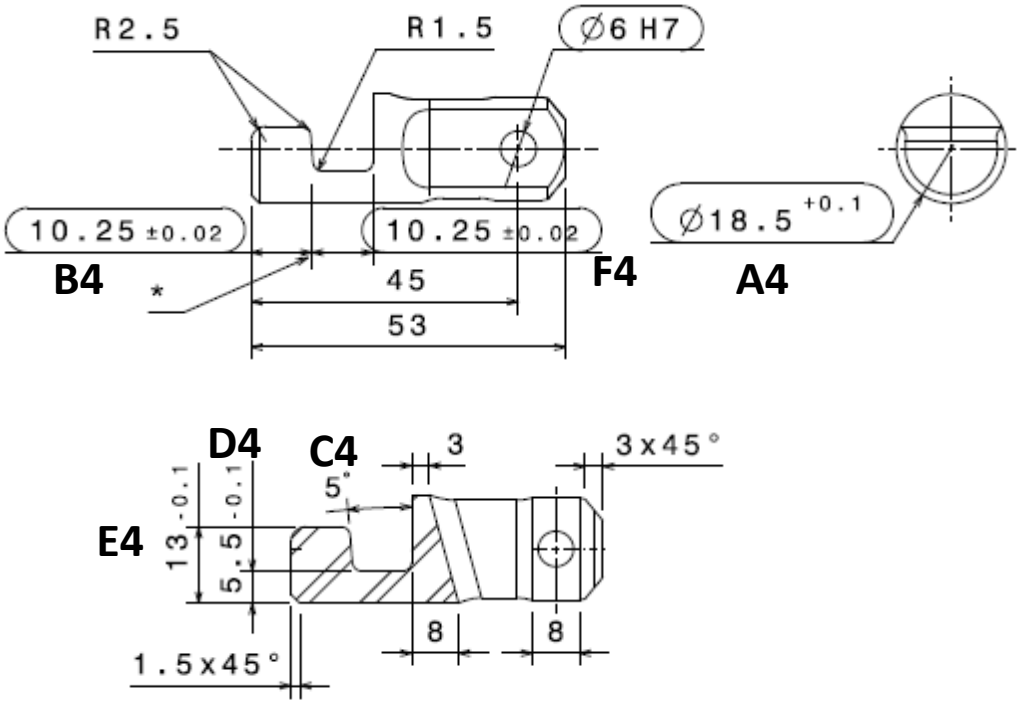
Feature	Measured nominal dimension (mm)	Specified dimension (mm)
A2	3.17	3.1
B2	4.27	4.2
C2	21.90	22
D2	18.88	18.65 to 18.75
E2	8.04	8
F2	32.25	32.25
G2	41.71	41.75

Figure 9 Summary of dimensional measurements for the locking features on the lock sleeve.



Feature	Measured nominal dimension (mm)	Specified dimension (mm)
A3	9.54	9.5
B3	5.07	5
C3	8.38	8.34
D3	10.98	10.5
E3	14.07	14
F3	9.93	9.90 to 9.95
G3	7.18	7.2

Figure 10 Summary of dimensional measurements for the locking features on the lock button.



Feature	Measured nominal dimension (mm)	Specified dimension (mm)
A4	18.56	18.5 to 18.6
B4	10.28	10.23 to 10.27
C4	5°7’	5°
D4	5.46	5.4 to 5.5
E4	12.96	12.90 to 13.00
F4	10.38	10.23 to 10.27

Figure 11 Summary of dimensional measurements for the locking features on the clevis connector.