

NATIONAL TRANSPORTATION SAFETY BOARD

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



December 30, 2016

MATERIALS LABORATORY FACTUAL REPORT

Report No. 16-112

A. ACCIDENT INFORMATION

Place : Bloomfield, New Mexico
Date : October 28, 2016
Vehicle : Cirrus SR22, N234PJ
NTSB No. : CEN17LA030
Investigator : Tim Sorensen, ASI-CEN

B. COMPONENTS EXAMINED

1. Tee fitting from throttle body metering unit;
2. Cap.

C. DETAILS OF THE EXAMINATION

A tee fitting and cap, part of the aircraft engine throttle body metering unit, were submitted to the NTSB Materials Laboratory for examination. The fitting and cap, as they were received, are shown in figure 1a. As indicated in the figure, the fitting had a male NPT connection at one end of the run, a male (external) flare connection at the other end of the run, and a male (external) flare connection at the end of the branch. The fitting was stamped with a "C" on one side. There were no other identifiable markings on the fitting. The cap was a two-piece design with a flared sealing disk floating in a female-threaded body. A handheld x-ray fluorescence spectrometer indicated that the fitting body was made from a leaded brass. Examination of the cap by the same technique indicated that it was made from a cadmium-plated low alloy carbon steel. The cap was installed against the external flare on the branch of the tee.

Examination of the external flare at the end of the branch indicated that it was deformed and exhibited circumferential wear marks, as shown in figures 1b and 2a. Deformation, to a lesser degree, was also observed on the external flare at the end of the run as shown in figure 2b. The flare angle, as measured on a digital optical microscope, was approximately 37.5°, consistent with the requirement on the manufacturer's engineering drawing. The thread pitch on the tee, as measured on the optical microscope, was approximately 20 threads/inch and the cap was stamped with the number "4", consistent with a flare fitting for 1/4" diameter tubing.¹

¹ Air force – Navy Aeronautical Standard AN824, Tee – Flared tube, 1982.

The diameter of the opening for each flare fitting was measured on a digital optical microscope as shown in figures 3a and 3b for the run and branch ends, respectively. The opening at the run end had a diameter of approximately 0.167 inch. The opening at the branch end had a diameter of approximately 0.142 inch. The requirement on the manufacturer's engineering drawing was 0.169 inch to 0.175 inch.

The major and minor thread diameters for the threads on the branch of the tee were measured and were found to be in conformance with the limits as specified by the manufacturer. The threads were specified to be in conformance with 0.4375-20UNF-2A (7/16-20). The major and minor thread diameters on the branch of the tee were measured using a digital optical microscope and were 0.430 inch and 0.376 inch, respectively. The limits for the major diameter were 0.4281 inch to 0.4362 inch. The limit for the minor diameter was a maximum of 0.3767 inch.

The major and minor thread diameters for the internal threads on the cap were measured and similarly found to be in conformance with the limits as specified by the manufacturer (0.4375-20UNF-2B). The internal threads were measured by filling part of the cap with a flexible silicone rubber molding compound, breaking the mold out of the cap (see figure 4), and measuring the major and minor thread diameters on the mold using an optical vision measurement system. The major and minor thread diameters were 0.444 inch and 0.392 inch, respectively. The limit for the major diameter was a minimum of 0.4375 inch. The limits for the minor diameter were 0.383 inch to 0.395 inch.

Donald Kramer, Ph.D.
Sr. Materials Engineer

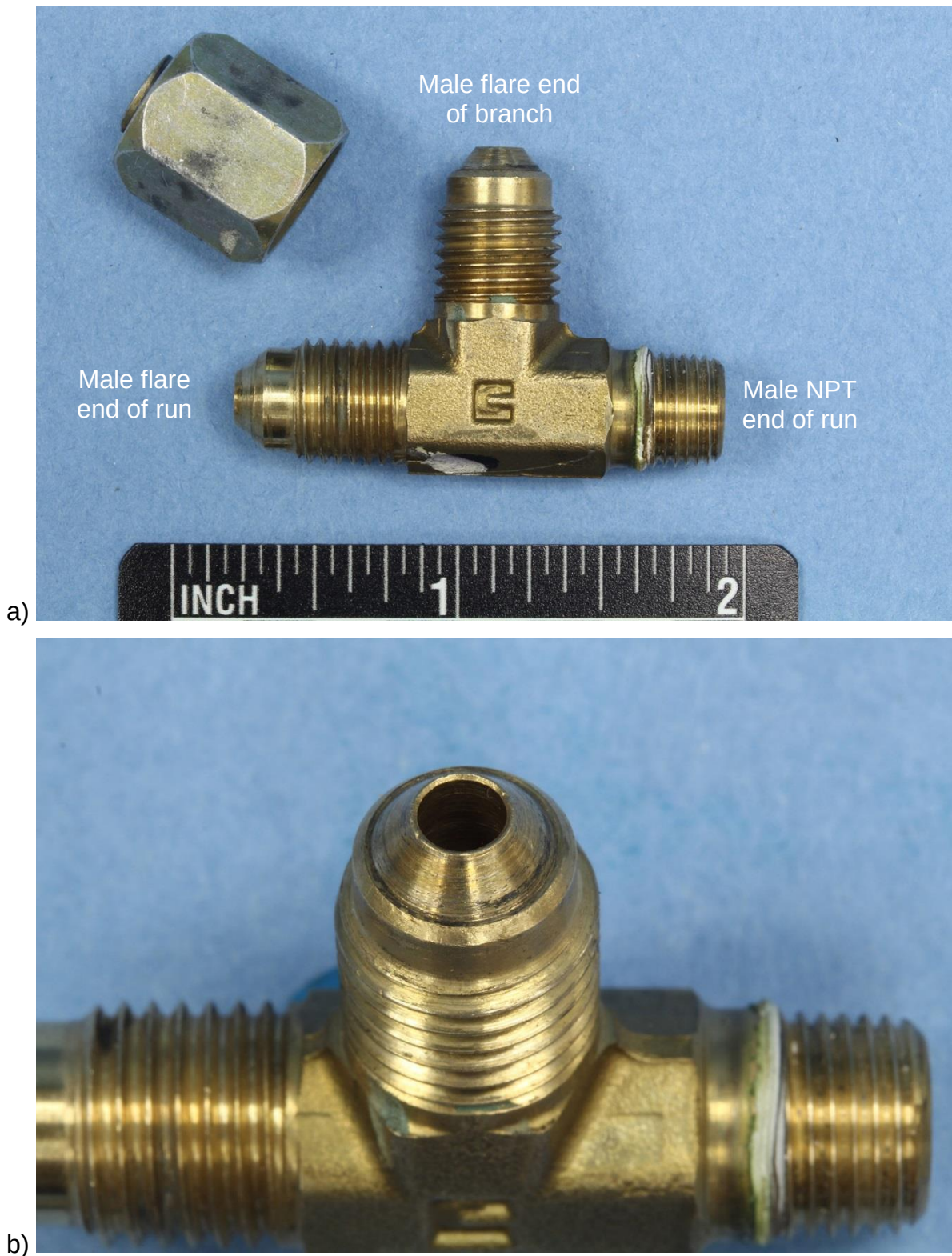


Figure 1: a) Image of tee fitting and cap as received. The fitting was stamped with a “C” on one side; b) inclined view of male flare at end of branch showing deformation to external flare end and circumferential marks.

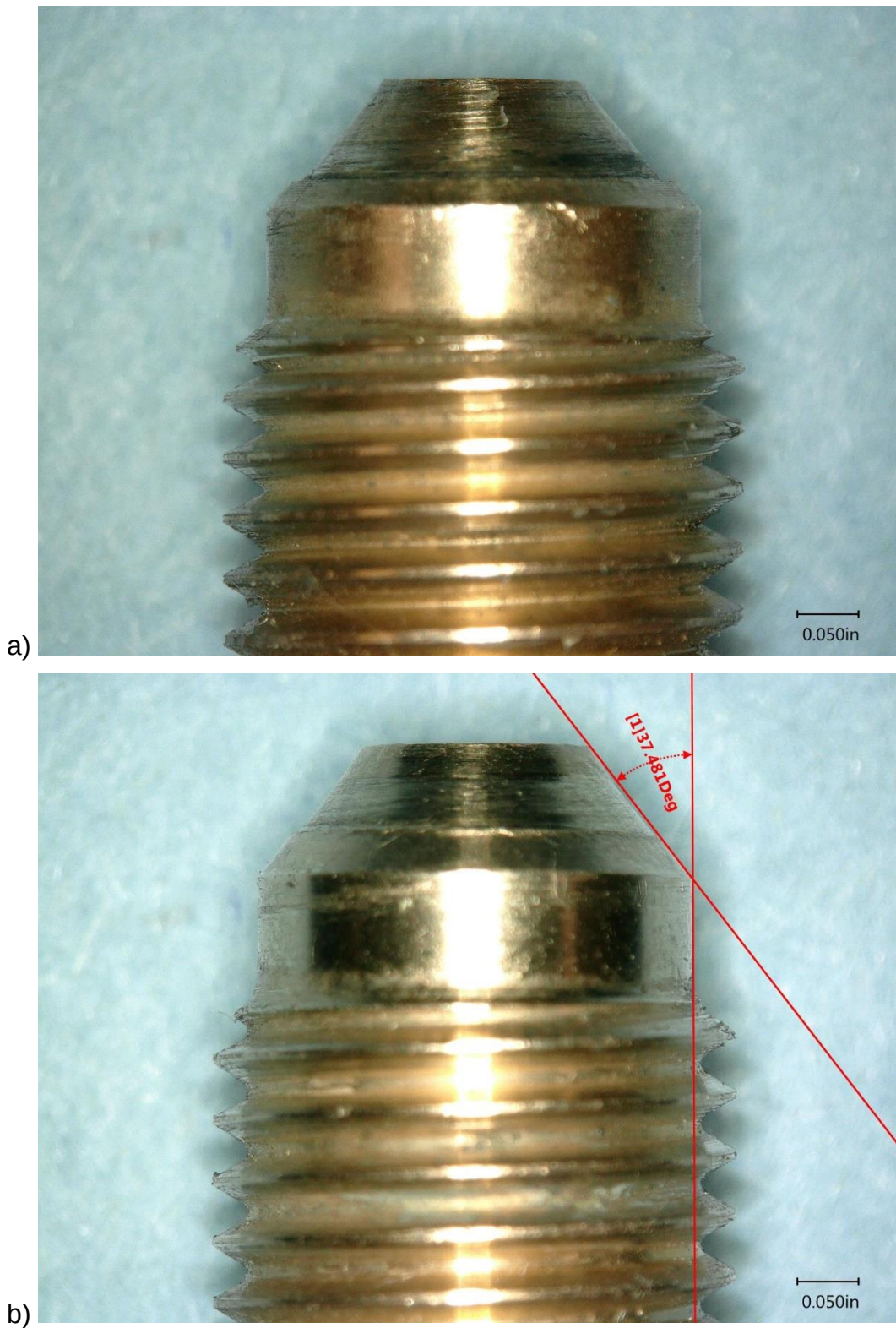


Figure 2: a) Side view of the external flare at the end of the branch showing deformation to the external flare end of the fitting; b) image of external flare at end of run. The angle of the flare was approximately 37°, consistent with an AN- or JIC-type fitting.

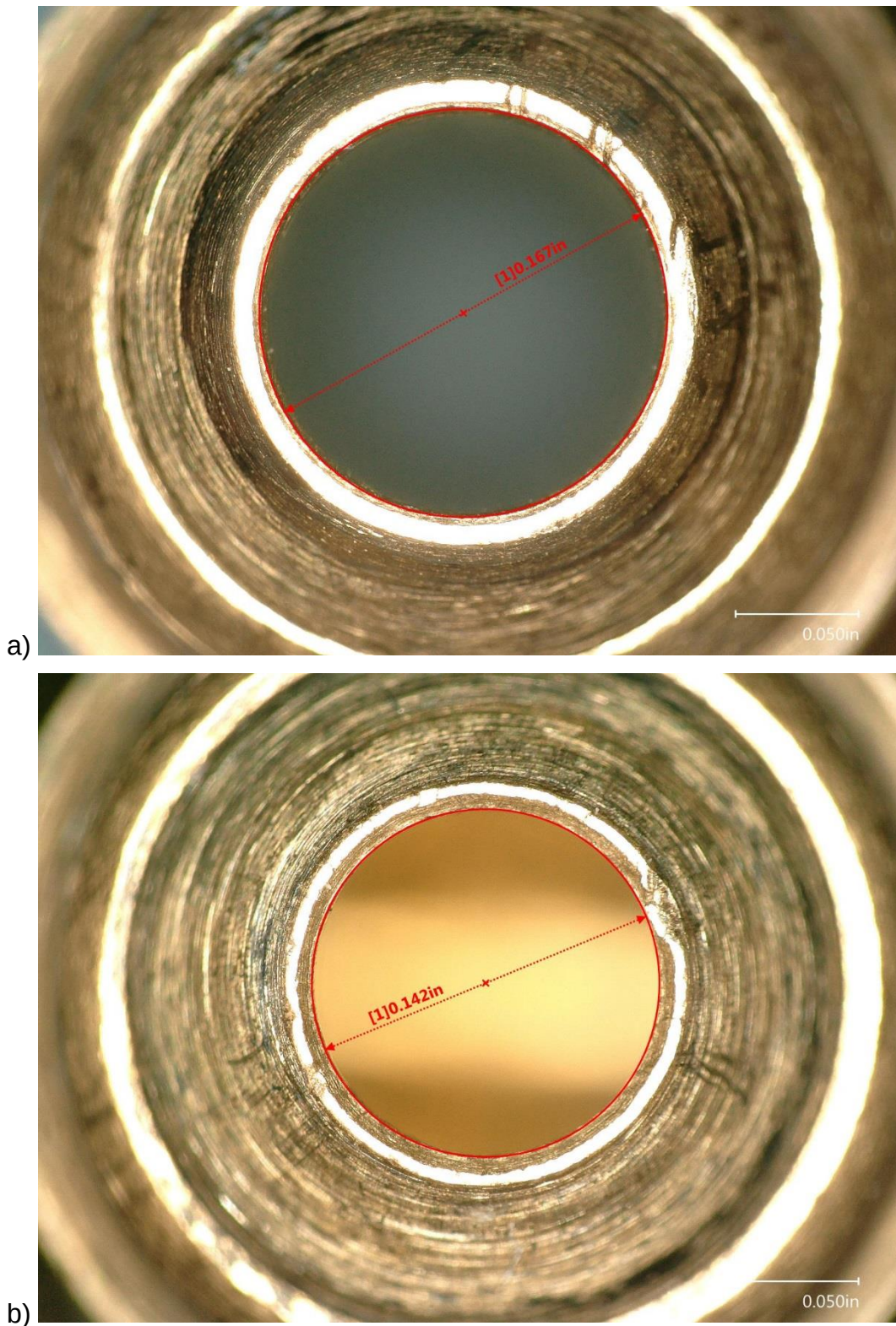


Figure 3: a) End view image of the external flare at the end of the run. The diameter of the hole at the end was approximately 0.167 inch. The nominal hole diameter was 0.172 inch; b) end view image of the external flare at the end of the branch. The diameter of the hole at the end was approximately 0.142 inch. The nominal hole diameter was 0.172 inch.

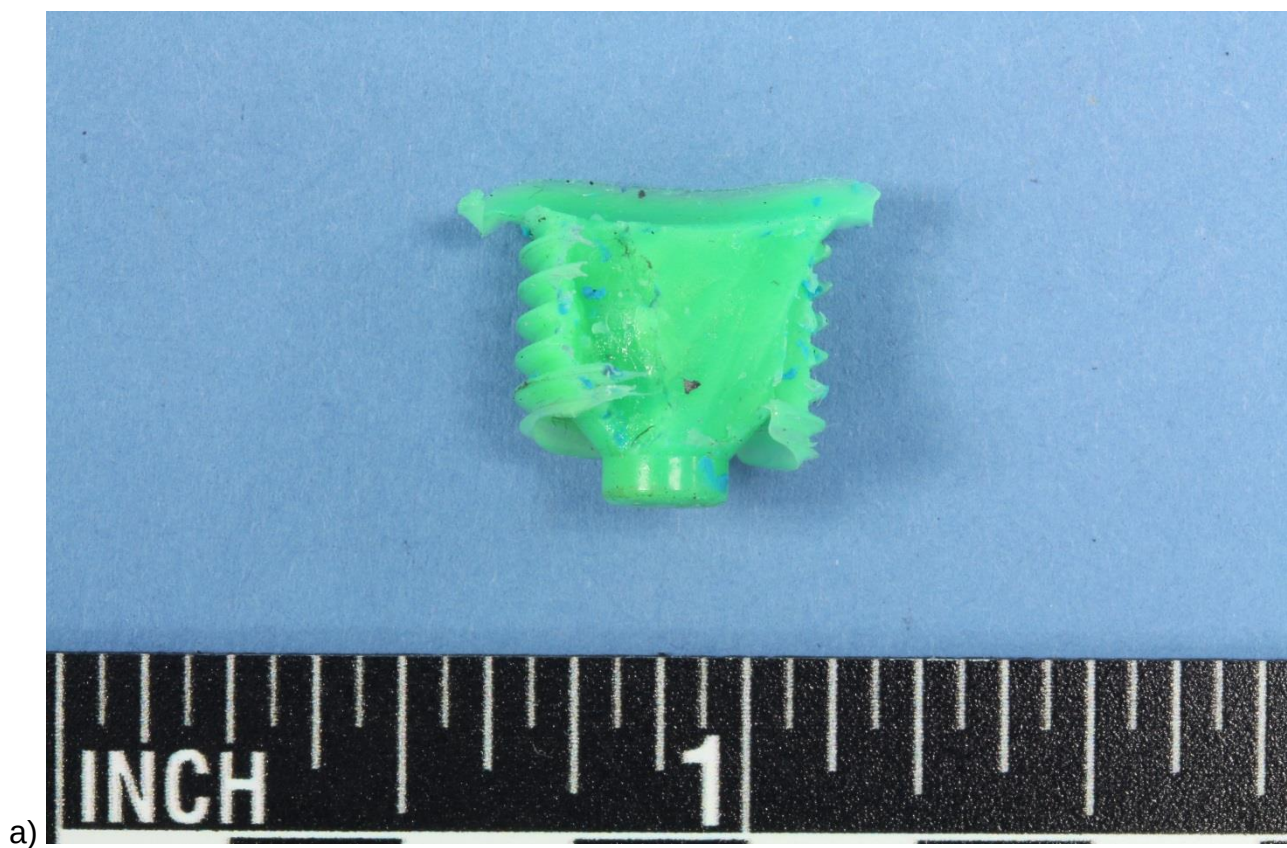


Figure 4: Silicone rubber mold of the cap's internal threads.