

NATIONAL TRANSPORTATION SAFETY BOARD

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



June 13, 2013

MATERIALS LABORATORY FACTUAL REPORT

Report No. 13-042

A. ACCIDENT INFORMATION

Place : Oak Grove, Louisiana
Date : November 19, 2012
Vehicle : Quicksilver GT400
NTSB No. : CEN13LA063
Investigator : Craig Hatch
NTSB-CEN

B. COMPONENTS EXAMINED

Ignition switch

C. DETAILS OF THE EXAMINATION

The ignition switch, as shown in Figure 1, was submitted to the Materials Laboratory for examination. The ignition switch was submitted to determine if an internal failure in the switch was allowing current to flow back into the key when the key was inserted. During the engine test for the accident aircraft, an inspector stated that he had received a shock from the key when the key was inserted and turned within the ignition switch.

The ignition switch installed in the aircraft was an ACS Model No. A-510-2. The switch was the subject of a 1993 Airworthiness Directive (AD) that required ignition switches of this make and model to be inspected periodically to determine wear and corrosion and to lubricate the switch. According to the manufacturer of the switch, the switch was to be lubricated using Mobilgrease® 33, a grease with a lithium-complex thickener and a polyalphaolefin oil base.

The submitted ignition switch was tested for continuity prior to disassembly. There was evidence of some electrical continuity from the key through the rest of the switch, particularly when the key was turned.

The ignition switch was disassembled. Photographs of the internal contacts are shown in Figure 2. The interior of the switch including large areas of the contact surfaces were coated with a black, slightly oily residue. A sample of this residue was removed from the contact for examination. The residue sample was examined using a Fourier Transform Infrared (FTIR) micro-spectrometer with a germanium attenuated

total reflectance (ATR) accessory¹ in accordance to ASTM E1252-98 and ASTM E334-01². The spectrometer was used to collect and process infrared wavelength absorbance spectrum of the sample³. The resulting spectrum for the unknown residue had two significant peak patterns. A carbon-hydrogen bonding doublet peak was located between $\sim 3000\text{-}2800\text{ cm}^{-1}$ indicating the presence of an aliphatic hydrocarbon and a broad negative peak located between $\sim 2200\text{-}2000\text{ cm}^{-1}$ indicating of the presence of elemental carbon which absorbs infrared energy. The spectrum of the unknown residue was consistent with a lubricant containing a graphite thickener and a straight chained hydrocarbon base.

No other anomalies were found within the ignition switch.

Nancy B. McAtee
Chemist

¹ An IR spectrum is created when a molecule converts infrared radiation into molecular vibrations. There are two types of molecular vibrations: stretching and bending. These vibrational movements create bands in a spectrum that occur at specific wavelengths (cm^{-1}). Each wavelength is dependent on a number of factors including the mass of the atoms present, the force constants of the bonds present, and the geometry of the molecule present. Infrared spectra can help in identifying the chemical composition and/or bonding present in an unknown molecule. The spectrometer emits a broad band of infrared light through the specimen. Depending on the bonding present, the light will be absorbed, transmitted, or reflected at various wavelengths. From the spectrum produced, information about the bonding present is obtained from the location of group frequency peaks. Most spectra contain additional "fingerprint" peaks that are unique to a particular molecular structure. All molecules have a unique spectrum in IR.

² American Society for Testing Materials E1252-98: Standard Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis and American Society for Testing Materials E334-01: Standard Practice for General Techniques for Infrared Microanalysis.

³ The samples from this aircraft were analyzed using the reflective mode. In reflective mode, the infrared beam is passed through the sample and then reflected off of a reflective IR plate and passed back through the sample where it is detected and analyzed.



Figure 1. Overall photograph of ignition switch.



Figure 2. Photograph of residue on contact surface.