

NATIONAL TRANSPORTATION SAFETY BOARD

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



February 20, 2020

MATERIALS LABORATORY ADDENDUM REPORT

Report No. 19-049B

1. ACCIDENT INFORMATION

Place : Prescott, Arizona
Date : August 29, 2018
Vehicle : Cessna P210N, N6500W
NTSB No. : WPR18FA245
Investigator : Zoë Keliher, AS-WPR

2. COMPONENTS EXAMINED

Remnants of exhaust system heat exchanger

3. DETAILS OF THE EXAMINATION

This report complements the Materials Laboratory Factual Report (19-049), which described the exhaust system components from a Cessna P210N that impacted terrain in Prescott, AZ on August 29, 2018. This report details the heat exchanger from the exhaust system of the accident airplane.

Figure 1 shows the heat exchanger and adjacent components, as received. The heat exchanger assembly remnants had been removed from the overall exhaust system of the airplane prior to receipt at the NTSB Materials Laboratory. As shown in Figure 2, the assembly had experienced severe deformation, charring, and distortion consistent with a post-crash fire. The primary duct material for the inlet and outlet ducts was missing in multiple locations, leaving only the metallic reinforcing wire. The remaining duct material crumbled upon touch or movement.

The heat shield had been deformed outward and then back inward toward the heat exchanger. Visual indications of soot and charring were present on the outer surfaces of the heat exchanger and heat shield.

The ducts and heat shield were removed to better examine the heat exchanger. Figures 3 and 4a show the heat exchanger in this condition from multiple angles.

According to supplied documentation, this airplane was equipped with a cabin pressurization system. The system allowed the user to have cool or heated pressurized air forced into the cabin. If selected for heated air, the ram air passing through the heat

exchanger was heated by ram air which passed over the left exhaust manifold of the engine. This condition could be set by the pilot pulling the cabin heat control outward.

The heat exchanger was a plate-fin air-to-air type. The heated ram air from the engine manifold was designed to pass through the exchanger on the side depicted in Figure 4a, where inlet and outlet ports are located. The compressor discharge air for cabin pressurization was designed to pass through the larger sides, shown in Figures 3a and 3c. In the heated air selection, the compressor air would be warmed, by the heated ram air from the left manifold.

The fire damage had destroyed the markings on the plate, shown in Figure 3d. Searches of replacement parts for a Cessna P210N typically listed a Janitrol air-to-air heat exchanger, with specification number C166051. These listed parts were consistent with the dimensions and features of this accident heat exchanger.

Typically, a pressure test can be performed to determine if the shrouds between the two sides of a heat exchanger are compromised, allowing an undesired gas path. However, in this case, the heat exchanger had been damaged from the accident impact forces, as highlighted in Figures 3a and 3c as well as Figure 2. There were multiple locations on the ram air sides of fins and shrouds having separated from each other and the primary plates. This damage was consistent with overstress fracture from the accident impact.

Therefore, the heat exchanger was sent to an external laboratory for internal non-destructive examination by computed tomography (CT) scanning. The details of this examination are cataloged in the *NTSB Specialist's Factual Report* for accident WPR18FA245.

The exhaust outlet/inlet cover was sectioned from the body of the heat exchanger. The exposed interior is shown in Figure 4b (compare with Figure 4a). The inlet side, which experienced higher temperature gasses exhibited a black coloring. The outlet side exhibited yellowish coloring. Compounds adhered to each side were examined using energy dispersive x-ray spectroscopy (EDS) for chemical composition. The compositions were consistent with each other, containing primarily iron oxides and silicon dioxide. There were detectable (less than 5 weight percent) levels of cadmium, sulfur, and chlorine on the inlet (black) side. Detectable levels of magnesium and potassium were noted on the outlet side (yellow).

Erik M Mueller
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Figure 1 – View of the heat exchanger and surrounding housing and tube, as received.



Figure 2 – Side view of the heat exchanger, showing the extent of damage to the assembly, as received.

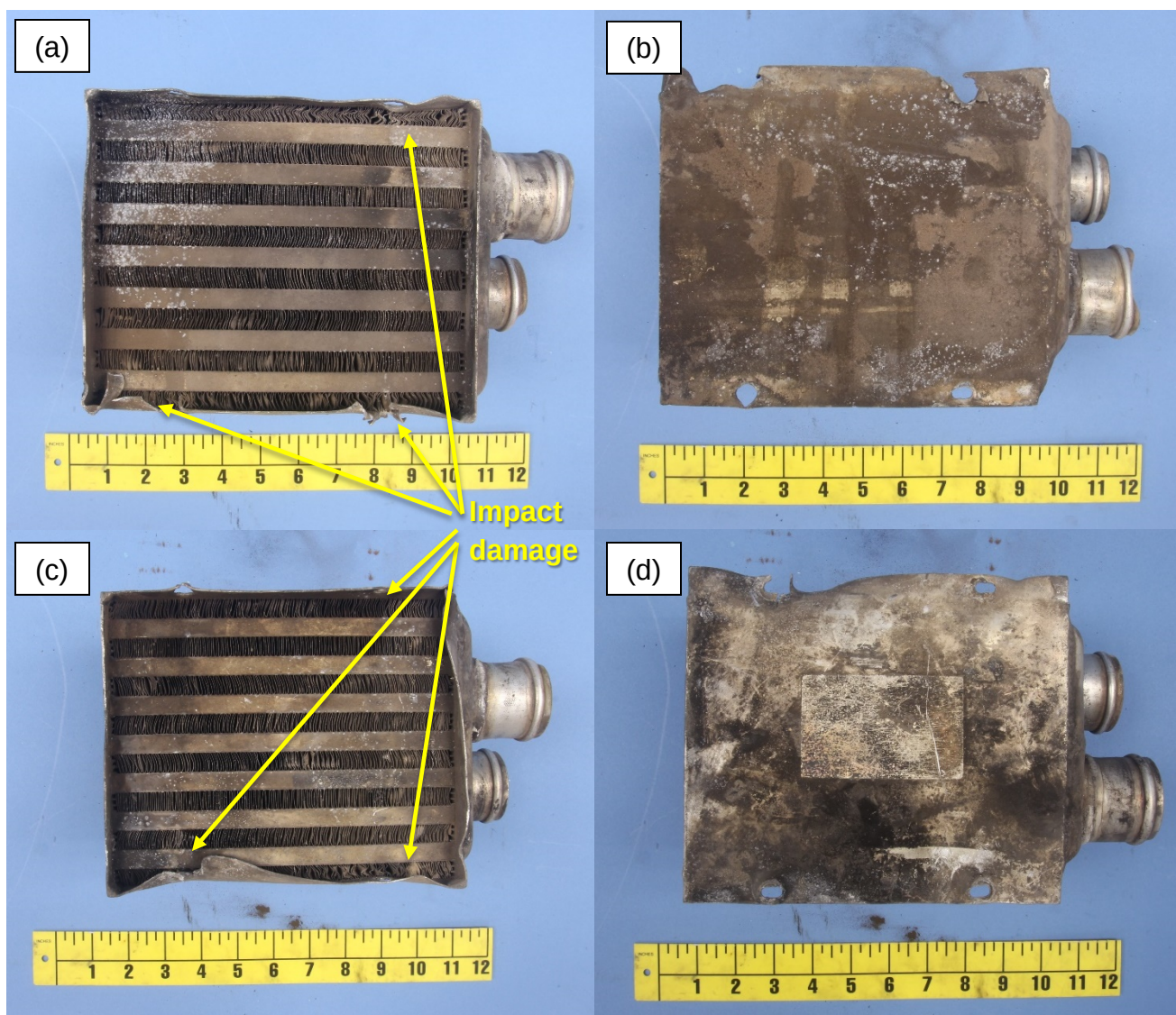


Figure 3 – View of the heat exchanger after removal of the damaged brackets and tubes, from (a) the ram air side, (b) the unmarked cover, (c) the opposite ram air side, and (d) the marked cover side where the markings had been obliterated.

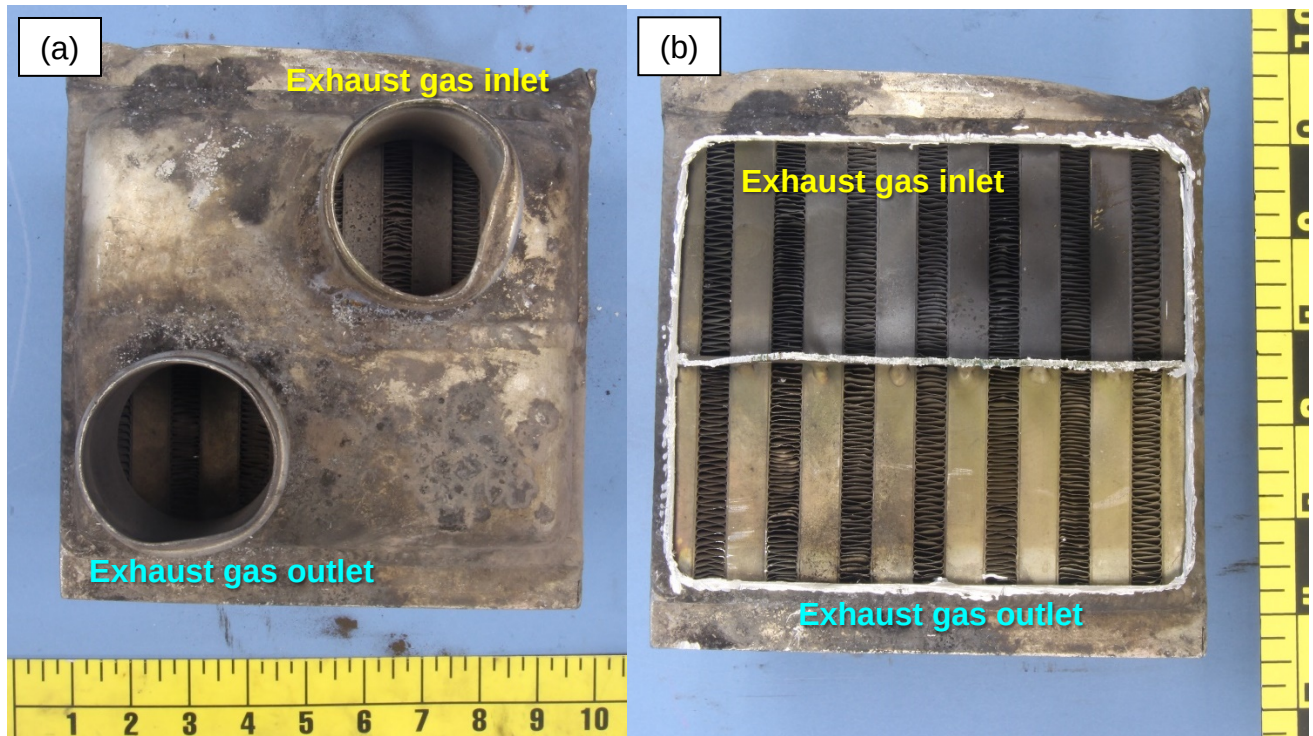


Figure 4 – View of the inlet and outlet ports of the heat exchanger (a) after removal of the damaged ducts and shield covering, and (b) after sectioning of the port housing.