

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



ERA24FA160

MATERIALS LABORATORY

Factual Report 24-026

April 17, 2024

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A. ACCIDENT INFORMATION

Location: Mulberry, Florida
Date: April 2, 2024
Vehicle: Arthur B Canning Merlin Lite, N622PC
Investigator: Joshua Young, AS-ERA

B. COMPONENTS EXAMINED

Cylinder and piston assemblies from a Polini Thor 303 DS engine

C. EXAMINATION PARTICIPANTS

Specialist Matthew R. Fox, Ph.D.
NTSB
Washington, DC

D. DETAILS OF THE EXAMINATION

An overall view of the submitted components is shown in figure 1. The piston had a hole in the middle of the crown as shown, and the surrounding areas had light gray deposits covering portions of the crown surface. The remaining area of the piston crown and interior surfaces of the cylinder head appeared to be free of heavy combustion deposits. Machining marks and partial vibro-peen markings were visible on the piston crown.

The piston crown had features consistent with pre-ignition damage. As noted in the references listed in the footnote below, pre-ignition occurs when an ignition source such as an overheated spark plug tip, glowing hot carbon or lead deposits in the combustion chamber, or a burned exhaust valve prematurely ignites the fuel/air mixture in the cylinder during the combustion cycle. Additional possible causes for pre-ignition include use of unsuitable fuel with an octane rating that is too low or that has been contaminated with diesel, excessive leaning that results in higher combustion temperatures, or inadequate ventilation or general overheating of the engine.¹

The barrel and the head were further examined using an optical stereo microscope. No evidence of cracks were observed. Additionally, no evidence of

¹ *Detonation and Pre-Ignition*, <https://www.savvyaviation.com/detonation-and-pre-ignition/>. Savvy Aviation, March 6, 2024.

Piston Damage - Recognising and Rectifying, https://www.ms-motorservice.com/MediaAssets/1642019_ks_50003973-02_web.pdf, Motorservice International, Neuenstadt, Germany, accessed April 17, 2024.

exhaust gas leakage on exterior surfaces, air intake passageways, or on the seal areas between the head and the barrel was observed.

Submitted by:

Matthew R. Fox, Ph.D.
Chief Technical Advisor - Materials

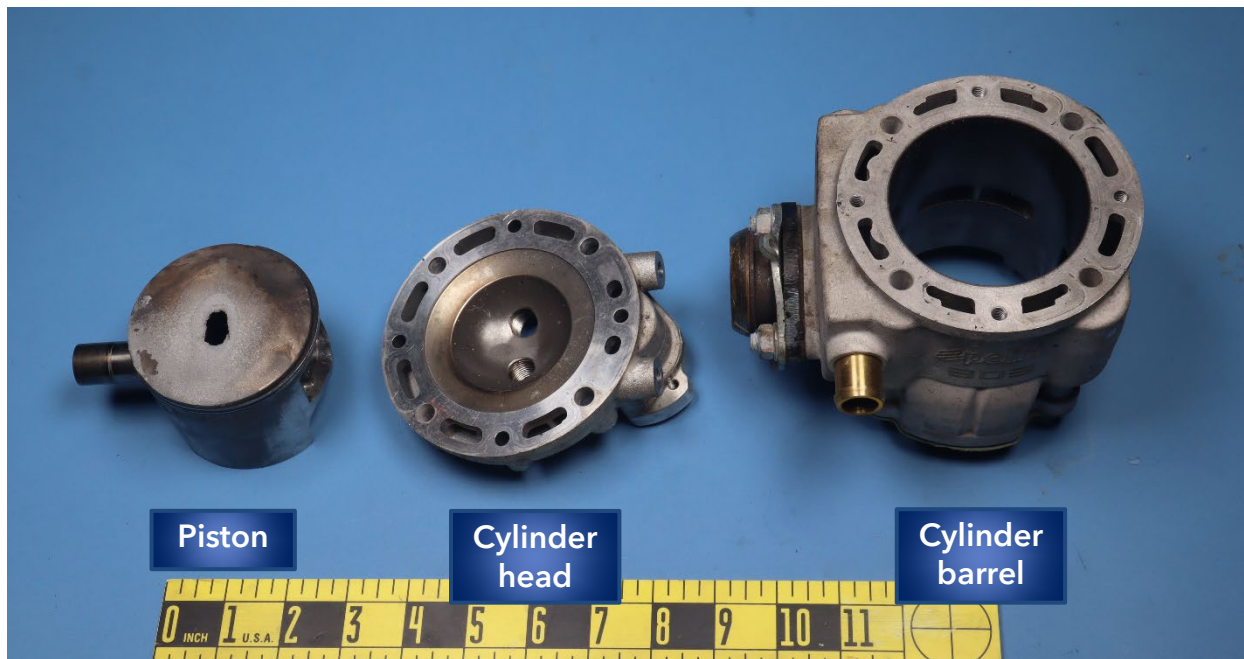


Figure 1. Overall view of the submitted components as received (upper image) and a closer view of the piston assembly showing a hole in the middle of the crown (lower image).