



MEMORANDUM FOR RECORD

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Date: 08/01/2024

Subject: Wreckage and Brakes Examinations

NTSB Case Number: ERA22LA275

On December 8, 2022, the wreckage of N432CD was examined at Florida Air Recovery, Jacksonville, Florida.

The follow information was garnered during the examination:

Fuselage

- Thermal damage to left side of fuselage from aft half of lower cowlings to aft of the baggage compartment door
- Left side of windscreen deformed
- Thermal damage to dashboard and instrument panel, center console and left front (pilot) crew seat

Wings

- Left side: Had extensive fire damage to lower wing skins and torque box structure.
- Right side: Fire damage limited to main landing gear strut fairings.

Landing Gear

- ☐ Left Main Landing Gear (MLG) & Wheel Assembly / Brakes
 - Left main landing gear (MLG) strut separated just above spindle.
 - The wheel assembly could not be rotated by hand on the spindle.
 - Flexible hose to caliper
 - Not observed or found in wreckage.
 - Swage portion of upper end of hose remained attached to fittings between flexible hose and the metal brake line.

- Fittings at connection point where upper end of flexible hose attaches to metal line on MLG strut were disassembled and no anomalies were noted on the mating surfaces or threads.
- Fittings could not be undone by hand but took very light pressure with hand tools to unscrew from one another.
- Brake Caliper.
 - Separated from wheel assembly.
 - Thermal damage present.
 - Multiple cracks present.
 - Brake pads not present or observed in the wreckage.
 - Bleeder valve not present or observed.
 - Hose fitting not present or observed.
 - A piece of metal was present near the edge of one piston that was similar in size and shape to the backing plate – it crumbled when an attempt to pick it up was made.
 - One piston was flush with the caliper and the other extended past the caliper about an eighth of an inch

Right MLG & Wheel Assembly / Brakes

- The strut was intact with the wheel assembly present.
- Evidence of thermal damage was present.
- The mid-strut fairing exhibited fire damage – most of the resin was consumed by fire.
- The upper wheels strut fairing exhibited fire damage.
- The tire exhibited fire damage and cracking.
- The flexible hose to the caliper
 - Was present and exhibited fire damage.
 - The b-nut at the top of the hose where it joined the metal brake line on the strut was removed by hand without the use of wrenches – no anomalies were noted on the mating surfaces of the fittings or the threads of the b-nut.
- Brake pads were present for all four positions.
- Brake Caliper
 - Discoloration was noted on top third of caliper.
 - Both pistons were flush with the caliper housing
 - The wheel assembly rotated freely when turned by hand.

Cockpit

- The brake line from the engine compartment reservoir was traced to the aft side of the firewall and no anomalies or leaks were noted when visually examined
- Parking brake was in the “OFF” position
- When the parking brake was actuated the actuation arm on the parking brake valve moved in conjunction with the parking brake control
- The master cylinders for each brake pedal were visually examined – no anomalies or leaks were noted at the hose fittings

- The plungers connected to the top of the master cylinders showed no signs of leaking or anomalies when visually examined

On March 15, 2023, the brake assemblies and brake discs were examined at Aircraft Wheels and Brakes LLC. Avon, Ohio.

The following information was garnered during the examination:

The brake assemblies were visually examined and were deemed unsafe for hydraulic pressure testing.

Both brake housings exhibited evidence of experiencing extreme heat. The paint was completely burned off and the brake housings appeared dark gray to chalky white in color. The brake housings were made from a magnesium alloy, the chalky white coloring appeared to be magnesium oxidation. The identifying brake assembly name plates were no longer present. The left brake assembly was determined to have been serviced with metallic linings, although no linings were present.

It was determined metallic linings had been used to service the brakes because the back plates and the pressure plate had lining pins installed. Linings pins are only used with metallic brake linings.

The left brake housing displayed extreme cracking, and the section of the brake housing containing the anchor bolts was completely broken off. As was noted during the wreckage examination, one piston could be seen partially extended.

The backplates and pistons were still present in the left brake assembly.

The left brake disc was examined. The brake disc exhibited signs of extreme heat based on the absence of paint and the dark non-metallic coloring. The brake disc was made of steel alloy and was plastic media blasted to clean it for better identification.

The left brake disc was manufactured by Rapco, part number RA164-01501, PMA equivalent to Aircraft Wheel and Brake disc 164-01501. This brake disc part number was not designed to be paired with metallic linings; it was designed for use with organic linings. Wheels and brakes designed and manufactured by Aircraft Wheel and Brake LLC are FAA TSO qualified together as paired assemblies. Wheel assembly 40-75P was FAA TSO qualified with the 30-52 brake assembly.

FAA TSO assembly components cannot be switched or substituted. Original OEM equipment for the Cirrus SR22 supplied by Aircraft Wheel and Brake LLC (formerly Parker) up to serial number 1740 is the 30-52 brake assembly which utilizes organic linings and the 40-75P wheel assembly. The 40-75P wheel assembly comes standard with brake disc 164- 01501. Serial number 1740 and on were fitted with the 30-233B brake assembly which utilizes metallic linings and the 40-406-wheel assembly. A Cirrus service bulletin, SB2X-32-13, along with Aircraft

Wheel and Brake, LLC (Parker) service bulletin, SB7085, exist allowing an upgrade from the 30-52 brake assembly to the 30-233B brake assembly.

Performing the brake upgrade also required that the wheel be upgraded per the service bulletin. The wheel assembly upgrade to part number 40-406 included the appropriate brake disc, 164-02504, that was qualified with the 30-233B brake assembly. The 164-02504 brake disc was .108" thicker than the RA164-01501 that was utilized.

The brake disc acts as a heat sink to the brake assembly. The mass of the brake disc is calculated to establish kinetic energy capacity of the brake assembly. The minimum allowed thickness of the 164-02504 brake disc that is paired with metallic linings is .445". The 164-02504 brake disc minimum thickness is being referenced because it is the appropriate disc that is paired with the metallic linings in the brake assembly.

The left brake disc flange thickness was measured in three places on the rubbed surface.

Measurements were recorded as follows:

- Location 1: .3215"
- Location 2: .3264"
- Location 3: .3209"

The measurements recorded were .118" to .124" below the minimum wear limit of the 164-02504 brake disc that is paired with metallic linings.

There were no brake linings available to be examined with the left brake assembly.

The right brake disc and right brake assembly were also examined. The right brake assembly included metallic brake linings, a short supply hose and a shim that fits between the brake housing and the back plates.

The right brake disc was plastic media blasted for identification purposes and was found to be a Parker 164-01501 disc.

The 164-01501 brake disc was designed for use with organic linings.

The right brake disc was measured in three locations, similar to how the left disc was measured.

Measurements were recorded as follows:

- Location 1: .3381
- Location 2: .3401
- Location 3: .3427

The measurements recorded were .102” to .107” below the minimum wear limit (.445”) of the 164-02504 brake disc which is typically paired with metallic linings.

The right brake metallic linings were measured and found to be consistent with new lining thicknesses.

The linings were then cleaned with a scotch brite material to reveal their part identification. The right brake linings were all marked APS66-06200 which are PMA metallic linings equivalent to Aircraft Wheel and Brake, LLC part number 066-06200 metallic linings.

The shim that was present with the right brake assembly was not an OEM shim. It was made from aluminum. The OEM shim that is part of the 30-233B metallic lining brake assembly was made from an insulative material and helps prevent heat build-up in the brake housing. The shim present with the right brake was material tested and found to be 6061 aluminum alloy. The aluminum shim was measured to be thinner than the OEM shim, it measured .0208”. The correct 068-01100 shim that is part of the 30-233B brake assembly measures .036”. Note: the 30-52 organic lining brake assembly does not include a shim.

After the visual examination, the left and right brake assemblies were disassembled. The back plates were removed from the left brake assembly. The pistons from each brake assembly were removed. To accomplish the piston removal, the back side of the brake housings were opened mechanically to gain access to push out the pistons. Once the pistons were removed, O-ring material was visible. The full O-ring was not present in either assembly. The portions of the O-ring that remained had taken a set due to the extreme heat. The O-ring material removed from the left brake assembly was very hard and flaky. For lack of a better comparison, it resembled small pieces of charcoal and was reduced to black powder if it was compressed.

The O-ring material removed from the right brake assembly contained a larger percentage of the full O-ring. It was also slightly more pliable than the left brake O-ring material indicating it may have experienced slightly less heat.

The pistons found in both the left and right brake assemblies were designed for organic linings. This was determined because pistons designed for use with metallic linings had a recessed cut out to accommodate a piston insulator. The piston insulator is a key component used in a metallic lining brake assemblies to help prevent heat transfer from the pressure plate into the brake housing and brake fluid.

The 092-08600 piston subassembly was part of the 30-233B metallic lining brake assembly.