



SUBJ: Landing gear: Catalytic Oxidation of Aircraft Carbon Brakes due to
Runway De-icing (RDI) Fluids

SAIB: NM-08-27R1

Date: December 31, 2008

This is information only. Recommendations aren't mandatory.

Introduction

This Special Airworthiness Information Bulletin (SAIB) advises registered owners and operators of **Transport Category Airplanes equipped with carbon brakes and operated into and out of airports where runway de-icing (RDI) fluids are used** that the use of carbon brakes in aircraft since the 1980s and the concurrent switch to more environmental friendly organic salt RDI fluids have led to a concern that is possibly safety related, and that corrective actions may impose additional cost.

The current FAA-recommended SAE AMS (Aerospace Material Specification) runway deicer specifications were developed with the endorsement of the SAE G12 aviation industry representatives, which included both domestic and foreign airlines, airframe manufacturers, and regulators. For better protection of aircraft material and equipment, the FAA will modify the SAE AMS specifications once the affected parties formalize new testing protocol that has been formally endorsed by the SAE G12, Aircraft Ground De/Anti-icing Committee.

Background

The FAA issued SAIB NM-08-27 on June 6, 2008. Since the issuance of that SAIB, members of the SAE G-12F Catalytic Oxidation of Carbon Brakes working group have determined that the issue of thermal oxidation is a separate technical issue with carbon brakes and is not a direct result from the carbon material being exposed to the alkali metal runway deicers. Consequently, the working group requested removal of the reference to “thermal oxidation,” as it appeared in a “Note” in SAIB NM-08-27, since thermal oxidation of the carbon is a different category of oxidation. The use of the term “thermal oxidation” and the accompanying information in the “Note” may result in confusion for operators of carbon-brake-equipped airplanes.

In addition, we have become aware of two other necessary changes to SAIB NM-08-27:

- The Recommendations paragraph caused some confusion with respect to the recommended inspection interval. Since wheel replacement normally is not “scheduled,” the timing of the recommended inspection requires clarification.
- The words “heat sink” and “heat pack,” as they appear in SAIB NM-08-27, need to be replaced with the words “brake rotors and stators” throughout the SAIB.

We agree that the changes described above are necessary, and have incorporated them into this revised SAIB. The content of SAIB NM-08-27, dated June 6, 2008, including these changes, is restated below:

During the course of the last 18 months, aircraft manufacturers have informed airworthiness authorities, including the FAA, that RDI fluids containing organic salts (mainly potassium formate and acetate, but other alkalis as well) are sprayed by the wheels, mainly during aircraft take-off and landing runs. The fluid remains on the underside of the aircraft and can be collected as ice and slush on the landing gear. The worst condition is the spray between wheels, which drives the RDI fluid directly into the brakes and, particularly, coats the (carbon) brake rotors and stators, which are also

used as the pressure plates to provide braking. During landing gear retraction, the ice and slush on the gear (now in a horizontal position) melt into the brake units where they further absorb into the carbon discs. The presence of the alkalis creates a catalytic condition, which lowers the temperature at which oxidation occurs. This softens the carbon, causing it to flake and crumble over time, reducing the life and long-term efficiency of the brakes themselves.

As a result, there is a danger of possible brake failure during high-speed aborted take-off or dragged brake during normal take-off (and subsequent overheat, once airborne) or excessive vibration during any ground operation. It should be noted here that the center of the brake unit cannot be easily inspected, and this is where its stator couplings are indexed to the torque tube, mechanically linked to the axle, thus transmitting the braking torque to the wheels. If the stator couplings fail, the brake effectiveness will be diminished.

The FAA is evaluating the aforementioned information with regard to potential continued airworthiness concerns on U.S.-registered aircraft (e.g., the loss of braking during emergency situations, a rejected take-off operation is potentially catastrophic). At this time, the airworthiness concern is not an unsafe condition that would warrant airworthiness directive (AD) action under Title 14 of the Code of Federal Aviation Regulations (14 CFR) part 39.

Compliance with the U.S. Environmental Protection Agency (EPA) Regulations (Clean Water Act/stormwater management) has led airport operators to use environmental friendly RDI fluids such as potassium acetate/formate. The resulting interaction of these fluids with aircraft equipment [electronics and carbon brakes] is detrimental and costly for the airlines. The FAA Airport Operational Regulations allow use of the aforementioned fluids to maintain runway safety. Depending on latest developments and advice from industry, a revision to Brake and Wheel minimum performance standard (e.g., TSO-C135) could be considered, if necessary.

In June 2006, the SAE G12 Fluids Committee established an SAE-G12-F working group to address the specific issue of “Catalytic Oxidation of Carbon Brakes” with members from Boeing, Airbus, brake vendors, runway deicer fluid vendors, several airlines, airport authorities, and airworthiness authorities (FAA, Transport Canada, EASA). The working group has been meeting twice a year since November 2006 and has been using a monthly telecon for updates.

In the meantime, the FAA:

- Informs operators of transport category airplanes by way of this Special Airworthiness Information Bulletin to raise awareness of these issues;
- Will continue to monitor the situations and associated developments; and
- Will evaluate the need to issue mandatory continuing airworthiness actions (i.e., airworthiness directives) if airport measures alone are found unable to mitigate the risk.

Recommendations

For owners/operators of transport category airplanes equipped with carbon brakes and operated into and out of airports where runway de-icing (RDI) fluids are used, we recommend you do the following. During each landing gear wheel removal:

- Carry out a detailed visual inspection for oxidation of the carbon brake rotors and stators per the applicable Aircraft Maintenance Manual Section or, if not available,
- Inspect the carbon brake rotors and stators for obvious damage, e.g., carbon chips and debris, or frayed, crushed, flaked, soft, fractured carbon or missing carbon elements.

Dependent on actual findings and wheel removal intervals, more frequent inspections may be appropriate to prevent intermediate brake failures.

Reference publication: EASA Safety Information Notice No. 2008-19, issued March 13, 2008, which can be found at: http://www.easa.eu.int/ws_prod/c/c_sin.php.

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