



SUBJECT: AGING OF CIRCUIT BREAKERS

ATA CHAPTER: 20-00

AIRCRAFT TYPE: A300, A300-600, A310, A318, A319, A320, A321, A330, A340, A340-500/600

APPLICABILITY: ALL

REFERENCES:

- OIT AI/SE-E 999.0071/02 dated 24 July 2002
- FAA Report DOT/FAA/AR-01/118 dated November 2002
- SIL 20-013
- Electrical Standard Practices Manual (ESPM) – Chapter 20

1. **PURPOSE:**

The above referenced OIT provided a description of the background of Aging Transport Systems Rulemaking Advisory Committee (ATSRAC) and FAA Enhanced Airworthiness Program for Airplane Systems (EAPAS).

As a complement to the referenced OIT concerning the results of the ATSRAC Tasks, this SIL is intended to provide additional information on the FAA Aging Electrical Systems Research Program and particularly on the Aging Circuit Breaker study.

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2. **BACKGROUND**

The EAPAS is an overall program that outlines the recommendations of the ATSRAC but is also intended to focus on all aircraft systems, including mechanical systems. The current focus of this program revolves around aging wiring systems and provides strategies for how the FAA and industry will work to improve the airworthiness of wire systems through near-term and long-term actions, with the intent to disseminate the outcomes throughout the industry.

The EAPAS also includes an extensive Aging Electrical System Research Program. This program is intended to conduct research into aging wiring systems to determine mechanisms that drive the aging process, develop tools to better inspect and maintain wiring, and develop technologies that mitigate the hazards associated with wiring failure.

3. **DESCRIPTION**

As part of the Aging Electrical System Research Program, the FAA sponsored a test program to evaluate the performance of circuit breakers removed from some retired large transport aircraft (B727 and DC-10 aircraft) and issued in November 2002 a report ref. DOT/FAA/AR-01/118 to disseminate the results of this study.

The purpose of this test was to provide data needed to determine to what extent circuit breakers removed from retired aircraft have degraded from their original performance specification parameters. The test program encompassed visual and X-Ray examination, voltage drop test, current overload test, insulation resistance test and failure analysis.

Results indicated that circuit breakers installed on aircraft with extended service life would continue to protect the electrical wire provided that adequate attention is placed on the need to control circuit breaker aging characteristics throughout their life. The report makes several recommendations aiming at improving the reliability of circuit breakers, and reducing maintenance related problems, including:

- Cycle circuit breakers periodically with no power,
- Need for instructions to protect the back of circuit breaker panels during routine maintenance,
- Need for instructions on cleaning the back of circuit breaker panels,
- Need to inspect circuit breaker panels for loose, broken or misapplied wire termination hardware,
- Need to inspect circuit breakers for overheating and arcing,
- Need for instructions to use the correct wire termination hardware,

The FAA is now considering the results of this test program and more particularly the benefits of thermal circuit breaker cycling.

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4. AIRBUS ACTION

Even if the circuit breakers used during the test program were not removed from Airbus aircraft, Airbus have reviewed the results and recommendations for potential application on their aircraft.

As far as circuit breaker inspections are concerned (for loose, broken, incorrect or misapplied termination hardware, overheating and electrical arcing), Airbus has already initiated the process of developing an Enhanced Zonal Analysis Procedure (EZAP) for all their aircraft types (ref. SIL 20-013). EZAP is a logic process to be applied to all zones containing wiring that allows determination of a need for tasks to minimize the presence of combustible material (cleaning tasks); and the need for either standalone General Visual Inspections or dedicated Detailed Inspections of specific wiring installations.

The new tasks generated by application of the procedure will be added in the Maintenance Review Board (MRB) report and the Maintenance Planning Document (MPD) will be updated to reflect MRB Report revision.

Airbus will ensure that application of EZAP will consider circuit breaker panels to permit visual inspection of circuit breakers.

As far as cycling of circuit breakers is concerned, and based on the lower and higher current overload results, it can be concluded that cycling the breaker on and off will improve the voltage drop rated current and circuit breaker's current overload characteristics.

Airbus is therefore in agreement with this recommendation and then recommends that operators perform an initial manual cycling of all thermal circuit breakers on and off at least one time under no power within an initial 24-month period and thereafter at intervals not to exceed 36 months.

This repetitive task will be included in the next MPD revision (not later than end of 2005), with the SIL referenced as the source document. Pending the issue of that revision, operators may use the following allocated MPD task numbers in their approved maintenance programmes:

- A300: 240000-0503-2
- A300-600: 240000-03-1
- A310: 240000-04-1
- A318/A319/A320/A321: 240000-17-1
- A330/A340: 240000-01-1

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