The Engineering Resource For Advancing Mobility
400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE RECOMMENDED PRACTICE

ARP 1619

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Revised

REPLACEMENT AND MODIFIED BRAKES AND WHEELS

1. PURPOSE: To identify recommended substantiation procedures for modified and/or replacement wheel and brake assemblies.

2. SCOPE: This Aerospace Recommended Practice (ARP) identifies "type" and "degree" of change to brake, wheel, or component thereof, and recommends substantiation procedures to confirm that performance capability of an existing aircraft using the replacement or modified brake and wheel equipment is not less than that when originally certified for commercial or military aircraft applications.

3. CLASSIFICATION OF BRAKE AND WHEEL CHANGE:

3.1 Type Change:

3.1.1 A modified brake and/or wheel assembly is classified as a configuration change of parts or subassemblies of an existing wheel and/or brake assembly, certified and/or approved for a specific aircraft, to improve service life, and/or aircraft performance, or correct in-service problems. Changes to brakes and wheels are either insignificant--Paragraph 3.2.1 or significant--Paragraph 3.2.2. Performance substantiation of affected assemblies and component parts are as defined in Paragraph 4, "Substantiation Procedure."

A modified assembly not manufactured or approved under the original certification (FAA, etc.) constitutes a replacement assembly and must be performance substantiated as a significant change. Both the modified assembly as well as the changed parts and/or subassemblies, in this case, must be permanently reidentified differently from those items of the original manufacturer.

3.1.2 Replacement brake and/or wheel assemblies are considered as new to the aircraft on which they are intended to be installed. Replacement assemblies must be substantiated as a significant change (Paragraph 3.2.2).

3.2 Degree of Change:

3.2.1 An insignificant change to a brake and/or wheel assembly is defined as a configuration change that does not affect aircraft ground performance and component or assembly interchangeability. It is introduced into the original certified wheel-brake assemblies and on the original airframe.

3.2.2 A significant change to a brake and/or wheel assembly is defined as a configuration or material change that could influence brake energy absorption capability, brake torque capability, brake and/or wheel life, wheel load carrying capability and thermal sensing pressure release as established by wheel beadseat temperature limits.

Examples of significant changes:

(a) Structure material changes and friction material composition changes of heat sink elements.

(b) Reduction of new heat sink mass.

(c) Change in total brake actuation load or area.

(d) Changes in friction radius and/or in total number and/or area of friction faces or elements.

(e) Fuse plug relocation in wheel and/or change in release temperature.

(f) Changes that would adversely affect temperature-time profile of wheel and/or fuse plug.

(g) Relocation of "over pressure release" or "inflation valve."

(h) Reduction in wheel or brake structure which could adversely affect wheel strength or fatigue life.

(i) Reduction in wheel tie-bolt diameter or material strength of bolt and nut.

(j) Change in wheel bearing size that would adversely affect the wheel or bearing load capacity.

4. SUBSTANTIATION PROCEDURES: Configuration change should be substantiated by conducting the necessary analytical investigations and/or laboratory testing and/or aircraft testing to ensure that the change can be made without impairing aircraft braking or rolling performance. Recommended substantiation procedures for modified and replacement component parts and assemblies are based on the degree of change.

4. (Continued):

Modified Assemblies - Insignificant Change

MINIMUM SUBSTANTIATION - Analytical investigation and/or laboratory testing to meet such of those relevant parts of the following paragraphs of this ARP as are agreed upon with the certifying authority.

MAXIMUM SUBSTANTIATION - Laboratory testing to meet the relevant parts of the following referenced paragraphs of this ARP.

4.1.1 Reference applicable issue of TSO-C26.
4.1.2 Reference airframe specification for wheel/brake design criteria.

Modified Assemblies - Significant Change

MINIMUM SUBSTANTIATION - Analytical investigation supplemented by laboratory testing to meet the relevant parts of the following paragraphs of this ARP.

4.1.1 Reference applicable issue of TSO-C26.
4.1.2 Reference airframe specification for wheel/brake design criteria.
4.1.3 Relevant to thermal-sensing wheel fuse plug release and temperature-time profile.
4.1.4 Relevant to airframe/wheel-brake compatibility.
4.1.5 Relevant to aircraft performance demonstrated.

MAXIMUM SUBSTANTIATION - Aircraft testing to meet Paragraph 4.2 of this ARP.

Replacement Assembly - Significant Change

MINIMUM SUBSTANTIATION - Should consist of analytical investigation, laboratory testing to all relevant requirements of 4.1, and aircraft testing to all relevant requirements of 4.2.

4.1 Laboratory Substantiation Requirements:

4.1.1 Conformance with relevant parts of the applicable issue of TSO-C26 and the applicable revision for Commercial Aircraft Applications at the time of original component qualification.

4.1.2 Conformance to Airframe Manufacturer's Wheel and Brake Specification and other Airframe Applicable Requirements.

4.1.3 Conformation of Thermal-Sensing Wheel Fuse Plug release and Temperature-Time Profiles.

Modified brakes or wheels with redesigned or relocated fuse plugs should be tested in a laboratory as follows:

(a) Two RTO's (Rejected Takeoff), one with original equipment and one with modified equipment at maximum aircraft KE, without outside cooling. Compare data for temperature-time profile of beadseat and fuse plug, including time of wheel fuse plug release.

(b) Maximum energy input without wheel fuse plug release and no outside cooling. Use aircraft averaged data for stop KE, plus taxi KE, plus an additional 5%. Run two stops on original wheel-brake and two stops on modified wheel-brake. Data must be comparable for KE absorption, stop time, deceleration rates, and distance.

4.1.4 Demonstrate compatibility and interchangeability of the original certified brake assemblies with the modified or replacement wheel-brake assemblies on the same gear and/or aircraft.

4.1.5 Laboratory performance demonstration of the modified or replacement assemblies to simulate conditions.

The dynamic tests are to be run to actual aircraft performance data supplied by the Airframe Manufacturer. The conditions selected will conform to the four points of Figure 1., so the μ versus KE curve may be compared with the curve produced by the original brake certification.