



AEROSPACE RECOMMENDED PRACTICE

ARP1619™**REV. B**

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Superseding ARP1619A

(R) Replacement and Modified Brakes and Wheels

RATIONALE

This document is substantially revised to incorporate changes in regulatory and other guidance material and to enhance, update and restructure some of the content.

FOREWORD

Aircraft wheel and brake manufacturers, in addition to meeting airworthiness requirements issued by civil regulatory agencies or other cognizant authorities, are required to meet applicable airframe designer/manufacturer safety, performance, and aircraft compatibility specifications to qualify their equipment for installation as original equipment on newly-manufactured aircraft. To demonstrate equivalent safety, performance, and aircraft compatibility of modified/replacement brakes and/or wheels, it is important that those components be tested to the same requirements as applicable at the time of aircraft qualification (Type Certification for civil aircraft) or appropriately updated requirements based on intended use. Laboratory test results and aircraft test results, if deemed necessary, comparing current component performance with that of the replacement/modified component, should be used as the criteria for performance of the modified/replacement brake and/or wheel.

Although this document provides the typical characteristics and parameters that affect performance of wheels and brakes on the aircraft, it may not encompass all such characteristics and parameters that would guarantee equivalent on-aircraft safety, performance, and aircraft compatibility with equipment previously approved for use on aircraft. Particular information that would provide a greater assurance of meeting all safety, performance, and aircraft compatibility requirements are typically obtainable only from proprietary sources such as the OEM airframer. Although it is not a regulatory requirement to consult the airframe manufacturer prior to developing replacement or modified brakes and/or wheels, it is recommended to do so, yet the aircraft level airworthiness requirements must still be met regardless of whether aircraft manufacturer input can be obtained.

1. SCOPE

This SAE Aerospace Recommended Practice (ARP) defines recommended planning and substantiation procedures and associated reviewing and approval processes to confirm that proposed changes do not compromise the demonstrated safety of the originally certified aircraft, and performance and aircraft compatibility are appropriately addressed in aircraft documentation. Successful demonstration also requires that failure modes be identified and mitigation provided for each.

These procedures apply to modifications made by the original component or assembly supplier as well as approval of an alternate supplier.

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Documents
Document Sharing Hub

1.1 Purpose

This document sets forth planning and substantiation procedures and associated reviewing and approval processes for modified or replacement aircraft brake and wheel assemblies.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 U.S. Government Publications

Copies of these documents are available online at <http://quicksearch.dla.mil>.

FAA Advisory Circular No. AC21-40A, Guide for Obtaining a Supplemental Type Certificate

FAA Advisory Circular No. AC21.101-1B Establishing the Certification Basis of Changed Aeronautical Products

FAA Advisory Circular No. AC25-7C, Flight Test Guide for Certification of Transport Category Airlines

FAA Advisory Circular No. AC25-22, Certification of Transport Airplane Mechanical Systems

FAA Advisory Circular AC25.735-1, Brakes and Braking Systems Certification Tests and Analysis

FAA Advisory Circular AC25.1309-1A, System Design and Analysis

FAA Order 8110.42C, Parts Manufacturer Approval Procedures

FAA Order 8110.48, How to Establish the Certification Basis for Changed Aeronautical Products

FAA Order 8150.1C, Technical Standard Order Program

TSO-C135a Transport Airplane Wheels and Wheel and Brake Assemblies

TSO-C26d Aircraft Wheels, Brakes and Wheel/Brakes Assemblies for Part 23, 27, and 29 Aircraft

14 Code of Federal Regulations, Part 21, including Subparts E, K and O, and Parts 23, 25, 27, 29, 45.

2.1.2 EASA Regulations

Available from European Aviation Safety Agency, Ottoplatz, 1, D-50679 Cologne, Germany, Tel: +49 221 8999 000, www.easa.europa.eu.

AMC & GM Part 21

Commission Regulation (EU) No 748/2012: (Part 21) Airworthiness & Environmental Certification Implementing Rules

Certification Specifications CS-23, CS-25, CS-27, CS-29, CS-ETSO

2.1.3 Other Publications

The FAA and Industry Guide to Product Certification, September, 2004. Prepared by the AIA, GAMA and FAA the FAA Aircraft Certification Service, http://www.faa.gov/aircraft/air_cert/design_approvals/media/CPL_guide.pdf

2.2 Glossary

ARP: Aerospace Recommended Practice

AFM: Aircraft Flight Manual

AFMS: Aircraft Flight Manual (supplement)

Applicant: The person or Company that will carry out the management of development and approval of the modified/replacement brakes and/or wheels

Approving Authority: Governing Regulatory Agency or Other Cognizant Authority responsible for approving changed products.

CFR: Code of Federal Regulations

Other Cognizant Authority: An authority responsible for approving changes to products that is not an OEM and is not a Governing Regulatory Agency such as the FAA, EASA, and equivalent agencies.

CS: EASA Certification Specification

DOA: EASA Design Organization Approval

DER: Designated Engineering Representative

EASA: European Aviation Safety Agency

ETSO: European Technical Standard Order: A minimum performance standard; which does not constitute installation approval

FAA: Federal Aviation Administration

Governing Regulatory Agency: A government entity charged with approving aircraft type designs and changes to type designs such as the FAA, EASA, and equivalent agencies.

ODA: FAA Organization Designation Authorization

OEM: Original Equipment Manufacturer (civil)

PMA: Parts Manufacturer Approval, (FAA): An FAA approval available for replacement parts. For some cases, this approval permits installation without an associated STC but may constitute only a production approval when an STC is also required. (Note: PMA is an approval made by the FAA alone. EASA do not grant PMA-type approvals, however, those granted by the FAA are recognised by EASA automatically via ED decision 2007/003/C, providing the part is not a "critical part".)

P/N: Part Number

STC: Supplemental Type Certificate. (FAA and EASA): This approval is a design approval and as such includes installation approval. PMA or TSO is generally used in conjunction with an STC as the means of production approval for producers other than the original equipment supplier. This approval type is generally used for complete replacement of the original wheel and brake by a new model wheel and/or brake, or for friction material replacement in an existing brake. (Ref. 14 CFR § 21.113, "Requirement of supplemental type certificate").

TSO: Technical Standard Order: A minimum performance standard; which does not constitute installation approval.

2.3 Definitions

2.3.1 Major Change

- 2.3.1.1 At the aircraft level, the term “Major Change” is intended to be synonymous with the Federal Aviation Administration (FAA) and European Aviation Safety Agency (EASA) term “major change”. For the FAA equivalent, see 14 CFR § 21.93, “Classification of changes in type design,” or for the EASA equivalent, see Part 21 point 21.A.91.
- 2.3.1.2 At the wheel and brake level, “Major Changes” are synonymous with major changes as defined for TSO articles in 14 CFR § 21.619, “Design changes” or ETSO articles in Part 21 point 21.A.611, “Design changes.” For articles produced under FAA PMA, “Major Changes” are synonymous with “major changes” as defined under 14 CFR § 21.319, “Design changes”. Of course, these changes need to also be considered at the aircraft level as described above.
- 2.3.1.3 Those modifications potentially affecting the aircraft safety, performance, and aircraft compatibility areas may be considered major. Experience and guidance material indicate that changes to heat sink component parts, structural parts (including the wheel), and friction elements are likely to be considered major when done by the original supplier or a third party. In all cases, changes to processing of friction materials, including raw materials and oxidation protection systems, should be discussed with the Approving Authority prior to starting a project.

2.3.2 Minor Changes

- 2.3.2.1 At the aircraft level, the term “Minor Change” is intended to be synonymous with the FAA term “minor change”. For FAA equivalent, see 14 CFR § 21.93 “Classification of changes in type design”. For the EASA equivalent, see PART 21 point 21.A.91 “Classification of changes in type design”.
- 2.3.2.2 At the wheel and brake level, “Minor Changes” are synonymous with “Minor changes” as defined for TSO articles in 14 CFR § 21.619, “Design changes” or ETSO articles in Part 21 point 21.A.611, “Design changes.” For articles produced under FAA PMA, “Minor Changes” are synonymous with “minor changes” as defined under 14 CFR § 21.319, “Design changes”. Of course, these changes need to also be considered at the aircraft level as described above.
- 2.3.2.3 Changes not specifically addressed in 2.3.1 and subparagraphs may be considered minor. This determination should have the review of the FAA, EASA, an ODA Unit Member, a DOA delegated signatory, or an FAA Designated Engineering Representative (DER) or other Governing Regulatory Agency delegate or Other Cognizant Authority as appropriate.

3. PROCEDURE

3.1 Planning

- 3.1.1 It is important to develop a plan that addresses how the changed aircraft will continue to meet all airworthiness requirements after the wheels and/or brakes are modified or replaced. Regulatory agencies such as EASA and the FAA require a Certification Plan that defines the means of showing compliance to all of the applicable airworthiness requirements. Each regulatory agency has requirements for developing and approving such plans, and these methods should be followed to ensure a successful project. When the modification or replacement is for an aircraft that is not regulated by a Governing Regulatory Agency such as EASA or the FAA, a plan similar to a regulatory Certification Plan should be developed and approved in a manner acceptable to the approving agency (Other Cognizant Authority). For the purposes of this document, the term Certification Plan will be used for all types of plans used to show compliance to airworthiness regulations or other applicable requirements.