Type Acceptance Report

TAR 10/21B/28

ROLLS ROYCE BR700 Series

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Executive Summary

New Zealand Type Acceptance has been granted to the Rolls Royce Deutschland BR700 turbofan engine Series based on validation of EASA Type Certificate number E.018. There are no special requirements for import.

Applicability is limited to the Models and/or serial numbers detailed in Appendix 1, which are now eligible for installation on a NZ-registered aircraft. Additional variants or serial numbers approved under the foreign type certificate can become type accepted after supply of the applicable documentation, in accordance with the provisions of NZCAR §21.43(c).

1. Introduction

This report details the basis on which Type Acceptance Certificate No. 10/21B/28 was granted in the Standard Category in accordance with NZCAR Part 21 Subpart B.

Specifically the report aims to:

(a) Specify the foreign type certificate and associated airworthiness design standard used for type acceptance of the model(s) in New Zealand; and

(b) Identify any special conditions for import applicable to any model(s) covered by the Type Acceptance Certificate; and

(c) Identify any additional requirements which must be complied with prior to the issue of a NZ Airworthiness Certificate or for any subsequent operations.

2. ICAO Type Certificate Details

Manufacturer:	Rolls Royce Deutschland Ltd & Co KG
Type Certificate:	E.018
Issued by:	European Aviation Safety Agency
Models:	BR700-710A1-10
	BR700-710A2-20
	BR700-710C4-11
	BR700-725A1-12
Environmental Standard:	ICAO Annex 16, Volume II

3. Type Acceptance Details

The application for New Zealand type acceptance was from the manufacturer, Rolls Royce Deutschland, dated 20 May 2010. The BR700 is a FADEC-controlled twin-shaft axial flow turbofan engine of modular construction with thrusts in the 14,750-16,000 lb range.

Type Acceptance Certificate No.10/21B/28 was granted on 9 July 2010 to the Rolls Royce BR700-710 and -725 Series engines based on validation of EASA Type Certificate E.018. Specific applicability is limited to the coverage provided by the documentation supplied. There are no special requirements for import into New Zealand.

The BR700 is an all-new design of high-bypass ratio engine comprising a single 48-inch diameter wide-chord compressor fan, 10-stage HP compressor (with architecture scaled down from the V2500), annular combustor, and two-stage HP and LP turbines. The engine is fitted with a composite structural bypass duct. The first variant of the family was the version BR700-710A1-10 which was selected for the Gulfstream GV business jet. The BR700-710A2-20 is essentially the same engine with some installation differences for the Bombardier BDA700 Global Express or Global 5000 aircraft. The BR700-710C4-11 version was developed with a 4.3% thrust increase for the GV-SP. A major re-design resulted in the BR700-725A1-12 for the Gulfstream G650, which required higher thrust and reduced specific fuel consumption to meet range targets. The major changes introduced include new 50-inch swept-fan, HP compressor blisks and 3rd stage LP turbine.

As part of type acceptance of the engine a team of certification specialists from the CAA Aircraft Certification Unit visited Rolls Royce at Dahlewitz for a validation/familiarisation visit. (See RR Technical Report E-TR0615/10-ISS01 – Minutes of Meeting, dated 4 June 2010.) Prior to the visit the BR700-710C4-11 was given preliminary type acceptance to coincide with the first delivery of the G550 on the New Zealand Register.

4. NZCAR §21.43 Data Requirements

The type data requirements of NZCAR Part 21B Para §21.43 have been satisfied by supply of the following documents, or were already held by the CAA:

(1) ICAO Type certificate:

EASA Type Certificate Number E.018

EASA Type Certificate Data Sheet number E.018 at Issue 2 dated 23 June 2009
- Model BR700-710A1-10 approved 14 August 1996
- Model BR700-710A2-20 approved 28 January 1997
- Model BR700-710C4-11 approved 24 June 2002
- Model BR700-725A1-12 approved 23 June 2009

Note: The BR700-710 series was originally approved under LBA TC 6305

(2) Airworthiness design requirements:

(i) Airworthiness Design Standards:
The certification basis of the BR700-710A Series is JAR-E, Change 8, including Amendments E/91/1 and E/93/1. For the BR700-710C two sections at Change 10 were added (to replace the previous two special conditions). One exemption and one equivalent safety finding were granted, which have been reviewed and accepted by the CAA. For the BR700-725 the certification basis has been updated to CS-E, at initial issue dated 24 October 2003, plus E50 and E1030 of CS-E at Amendment 1 dated 10 December 2007. (See CRI-A1)

This is an acceptable certification basis in accordance with NZCAR Part 21B Para §21.41 and Advisory Circular 21-1, as JAR-E and its successor CS-E are accepted as equivalent to FAR Part 33, which is the basic standard for engines called up under Part 21 Appendix C. There are no non-compliances and no additional special conditions have been prescribed by the Director under §21.23.

(ii) Special Conditions:
BR700-710A:
Ingestion of Hail – No hail stone ingestion test was carried out but instead it was shown by analysis and analogy to the medium bird ingestion test that ingestion of hailstones would not result in a hazardous condition. (See CRI-T2)

Ingestion of Rain – A test was carried out using a spray grid to show that ingestion of water equivalent to 4% inlet mass flow at both low-idle and maximum take-off thrust conditions would not result in unacceptable characteristics. (See CRI-T1)

(iii) Equivalent Level of Safety Findings:
BR700-710A/C:
JAR-E840(a)(2) Rotor Integrity – A 5% margin overspeed demonstration resulting from LP shaft failure was accepted in lieu of the regulation 10% on the basis that the probability of failure was reduced because the shaft system was classified and certificated as “critical” per JAR-E110(c) and JAR-E515. (See CRI-T3)

(iv) Deviations:
BR700-710A/C:
Exemption: JAR-E890(a) Engine Calibration in Reverse Thrust – This was granted against the requirement that a performance calibration curve be developed over the range of reverse thrust conditions on the grounds that the regulation has not been used before, thrust reverser deterioration during the 150-hour endurance test can be determined by post-test inspection, and thrust reverser performance is not included in Type Certificate documents. (See CRI-T4)

(v) Airworthiness Limitations:
See the Time Limits Manuals T-710-1BR, T-710-2BR, T-710-4BR, T-725-7BR

(3) Aircraft Noise and Engine Emission Standards:

(i) Environmental Standard:
The BR700 Series has been type certificated under the environmental protection requirements of ICAO Annex 16, Volume II (Second Edition July 1993).

(ii) Compliance Listing:
See the specific BR710A/C engine variant – CRI-A2 Compliance Sheet (JAR)

Rolls Royce Technical Report No. O-TR1422/09-Iss01 – BR725 Engine Emissions, Compliance with ICAO Annex 16 Vol.II

(4) Certification Compliance Listing:

BR700-710A1-10 Means of Compliance List – dated 9 August 1996

BR700-710A2-10 Means of Compliance List – dated 15 January 1997

BR700-710C4-11 Compliance Checklist Engine – JAR-E – dated 14 May 2002

BR725A1-12 Type Investigation Programme 01040439 Part 1 Appendix 1 – Means of Compliance Checklist, Issue 05 – E-TR1220/07 dated 16 June 2009

(5) Flight Manual: Not Applicable

(6) Operating Data for Engine:

(i) Maintenance Manual:
M-710-1BR, M-710-2BR, M-710-4BR, M-725-7BR

(ii) Current service Information:
Service Bulletins

(iii) Illustrated Parts Catalogue:
S-710-1BR, S-710-2BR, S-710-4BR and S-725-7BR

(7) Agreement from manufacturer to supply updates of data in (5), and (6):

Rolls Royce has provided access to the www.aeromanager.com website

(8) Other information:

Installation Manual:
E-TR206/95, E-TR364/95, E-TR240/01(FR), O-TR1458/08

Operating Instructions:
OI-710-1BR, OI-710-2BR, OI-710-4BR, OI-725-7BR

Engine Manual:
E-710-1BR, E-710-2BR, E-710-4BR, E-725-7BR

Attachments

The following documents form attachments to this report:

Copy of EASA Type Certificate Data Sheet Number E.018

Sign off

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David Gill	Checked – Ron Doggett
Team Leader Airworthiness	Airworthiness Engineer

Appendix 1

List of Type Accepted Variants:

Model:	*Applicant:*	*CAA Work Request:*	*Date Granted:*
BR700-710A1-10	Rolls Royce Deutschland	10/21B/28	9 July 2010
BR700-710A2-20	Rolls Royce Deutschland	10/21B/28	9 July 2010
BR700-710C4-11	Rolls Royce Deutschland	10/21B/28	28 May 2010
BR700-725A1-12	Rolls Royce Deutschland	10/21B/28	9 July 2010