

European Aviation Safety Agency

EASA

TYPE-CERTIFICATE DATA SHEET

Number : E.018

Issue : 03

Date : 27 April, 2011

Type : Rolls-Royce Deutschland Ltd & Co KG
BR700-710 engines

Models

BR700-710A1-10

BR700-710A2-20

BR700-710C4-11

BR700-725A1-12

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I. General

1. Type/Models:

Type: BR700-710

Models:

BR700-710A1-10	BR700-710A2-20	BR700-710C4-11	BR700-725A1-12
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These Models are approved for use on multi-engined civil aircraft at the ratings and within the operating limitations specified below, subject to compliance with the powerplant installation requirements appropriate to approved installations.

2. Type Certificate Holder:

Rolls-Royce Deutschland Ltd & Co KG
(formerly Rolls-Royce Deutschland GmbH, formerly BMW Rolls-Royce GmbH)
Eschenweg 11, Dahlewitz
15827 Blankenfelde-Mahlow
Germany

EASA Design Organisation Approval No: EASA.21J.065

3. Manufacturer:

Rolls-Royce Deutschland Ltd & Co KG
(formerly Rolls-Royce Deutschland GmbH, formerly BMW Rolls-Royce GmbH)

4. Certification Application Date:

BR700-710A1-10	BR700-710A2-20	BR700-710C4-11	BR700-725A1-12
16 February 1993	23 March 1994	15 January 2001	6 March 2006

5. Certification Reference Date:

31 August 1993

6. EASA Certification Date:

BR700-710A1-10 (refer to note 6)	BR700-710A2-20 (refer to note 6)	BR700-710C4-11 (refer to note 6)	BR700-725A1-12
14 August 1996	28 January 1997	24 June 2002	23 June 2009

II. Certification Basis

1. BR700-710A1-10, BR700-710A2-20, BR700-710C4-11:

BR700-710A1-10	BR700-710A2-20	BR700-710C4-11
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Airworthiness and Environmental Protection Requirements:

<ul style="list-style-type: none">• JAR-E, Change 8• Amendment E/91/1, effective 27.05.1991• Amendment E/93/1, effective 17.05.1993• Emissions and Fuel Venting: ICAO Annex 16, Volume II (Second Edition July 1993) Plus:	
<ul style="list-style-type: none">• none	<ul style="list-style-type: none">• JAR-E, Change 10, E790 Ingestion of Rain and Hail• JAR-E, Change 10, E40(f) Ratings

Special Conditions:

<ul style="list-style-type: none">• Ingestion of Hail• Ingestion of Rain	<ul style="list-style-type: none">• none
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Deviations:

<ul style="list-style-type: none">• JAR-E890(a) Engine Calibration in Reverse Thrust – Exemption
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Equivalent Safety Findings:

<ul style="list-style-type: none">• JAR-E840(a)(2) Rotor Integrity
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1.1 BR700-725A1-12:

Certification Specifications: CS-E, Initial Issue dated 24 October 2003
E50 and E1030 of CS-E, Amendment 1 dated 10 December 2007

Environmental Protection Requirements: ICAO Annex 16, Volume II (Second Edition July 1993),
Amendment 5 dated 24 November 2005

Special Conditions: none

Deviations: none

Equivalent Safety Findings: none

III. Technical Characteristics

1. Type Design Definition:

The Engine Type Designs are defined in the following Drawing Introduction Sheets (DIS):

BR700-710A1-10	BR700-710A2-20	BR700-710C4-11	BR700-725A1-12
DIS 10002 ISSUE 03 or later approved issues	DIS 10005 ISSUE 02 or later approved issues	DIS 10012 ISSUE 01 or later approved issues	DIS 10016 Issue 1 Revision D or later approved issues

Changes to the Engine Type Design are introduced by approved Modification Bulletins.

2. Description:

BR700-710A1-10	BR700-710A2-20	BR700-710C4-11	BR700-725A1-12
<p>Two spool axial flow engine consisting of a single stage fan, a ten stage axial flow high pressure compressor, an annular combustion chamber, a two stage axial flow high pressure turbine, a two/three* stage axial flow low pressure turbine, an accessory gearbox, a thrust reverser** and a Full Authority Digital Engine Control (FADEC).</p>			

* The BR700-710A1-10, BR700-710A2-20 and BR700-710C4-11 feature a two stage axial flow low pressure turbine, while the BR700-725A1-12 features a three stage axial flow low pressure turbine.

** The BR700-725A1-12 is designed for use with a Thrust Reverser, but it is not part of the engine Type Design.

3. Equipment:

Approved equipment is listed in the following RRD Reports:

BR700-710A1-10	BR700-710A2-20	BR700-710C4-11	BR700-725A1-12
E-TR150/95-(FR), ISSUE 03 'Engine Equipment Classification' or later approved issues	E-TR427/96-(FR), ISSUE 01 'Engine Equipment Classification' or later approved issues	E-TR466/01-(FR), ISSUE 02 'Engine Equipment Classification' or later approved issues	See Installation Manual O-TR1458/08

For details of equipment included in the type design definition: refer to the appropriate engine DIS.

4. Dimensions:

	BR700-710A1-10	BR700-710A2-20	BR700-710C4-11	BR700-725A1-12
Overall Length	4669 mm	4669 mm	4660 mm	3297 mm (tip of spinner to rear of exhaust cone)
Maximum Diameter (radius)	1820 mm	1820 mm	1785 mm	950 mm (radius from center line measured at the lowest point of AGB)

5. Dry Weight:

	BR700-710A1-10	BR700-710A2-20	BR700-710C4-11	BR700-725A1-12
Dry engine weight	1851,2 kg	1891,0 kg	1818,4 kg	1635,2 kg

Dry weight includes thrust reverser and dressings for the BR700-710A1-10, BR700-710A2-20 and BR700-710C4-11 and dressings for the BR700-725A1-12, but excludes all fluids and all buyer furnished equipment and in the case of the BR700-725A1-12 also the thrust reverser.

6. Ratings:

	BR700-710A1-10	BR700-710A2-20	BR700-710C4-11	BR700-725A1-12
Take off	65,6 kN	65,6 kN	68,4 kN	71,6 kN
Maximum Continuous	64,3 kN	64,3 kN	64,3 kN	66,6 kN

See Note 5.

7. Control System:

The engine is equipped with a Full Authority Digital Engine Control (FADEC) system.

	BR700-710A1-10	BR700-710A2-20	BR700-710C4-11	BR700-725A1-12
EEC P/N	1501KDC01-817 or later approved standards	1520KDC01-605 or later approved standards	1505KDC01-002 or later approved standards	G3000ECU03AC or later approved standards

8. Fluids

Approved fuels, additives and oils are listed in the Operating Instructions

9. Aircraft Accessory Drives:

BR700-710A1-10 (with two hydraulic pumps installed)	Direction of Rotation ¹	Transmission Ratio	Shear Torque [Nm]	Weight [kg]	Static Overhang Moment [Nm]	Maximum Torque Extraction [Nm]
Gear Line 6 Pad (Hydr. Pump 1)	counter-clockwise	0.270	418	8.91	8.1	69
Gear Line 8 Pad (Hydr. Pump 2)	counter-clockwise	0.275	418	8.91	8.1	68
Gear Line 11 Pad (Generator)	clockwise	0.520	412.5	32.61	56.5	106

BR700-710A1-10 & BR700-710C4-11	Direction of Rotation ¹	Transmission Ratio	Shear Torque [Nm]	Weight [kg]	Static Overhang Moment [Nm]	Maximum Torque Extraction [Nm]
Gear Line 8 Pad (Hydraulic Pump)	counter-clockwise	0.275	418	8.91	8.1	86
Gear Line 11 Pad (Generator)	clockwise	0.520	412.5	32.61	56.5	106

BR700-710A2-20	Direction of Rotation ¹	Transmission Ratio	Shear Torque [Nm]	Weight [kg]	Static Overhang Moment [Nm]	Maximum Torque Extraction [Nm]
Gear Line 6 Pad (Hydraulic Pump)	counter-clockwise	0.335	305.1	6.57	6.1	39
Gear Line 8 Pad (Generator No. 2)	counter-clockwise	1.080	283	20.0 ²	32.5	50
Gear Line 11 Pad (Generator No. 1)	clockwise	1.083	283	20.0 ²	32.5	50

BR700-725A1-12	Direction of Rotation ¹	Transmission Ratio	Shear Torque [Nm]	Weight [kg]	Static Overhang Moment [Nm]	Contin. Torque Extraction [Nm]
Hydr. Pump	clockwise	0.261	406,75	14,55 ²	16,37	120
IDG	clockwise	0,522	412,5	32,61 ²	56,5	100
ATS	clockwise	0,988	847	9,99 ²	6,76	415

10. Maximum Permissible Air Bleed Extraction:

BR700-710A1-10, BR700-710A2-20, BR700-710C4-11 :

EPR=P50/P20.

The amounts of bleed extraction from stages 5 and 8, respectively, are related to the core entry mass flow, W26. The amounts of fan bleed extraction are related to the fan entry mass flow, W1A.

Stage 8 bleed extractions are cleared for operation up to and including Maximum Continuous rating.

¹ Looking normal to pad along shaft.

² Dry.

BR700-710A1-10	Normal Flow [%]			Maximum Flow [%]		
	Stage 5	Stage 8	Fan	Stage 5	Stage 8	Fan
Power Range						
Idle to 1.06 EPR	X	7.8	X	3.0	12.1	0.6
1.06 to 1.3 EPR	4.4	4.2	0.2	8.3	7.9	1.6
Above 1.3 EPR	4.3	X	0.4	8.5	8.0	1.8

BR700-710A2-20	Normal Flow [%]			Maximum Flow [%]		
	Stage 5	Stage 8	Fan	Stage 5	Stage 8	Fan
Power Range						
Idle to 1.06 EPR	X	7.8	0,4	3.0	12.1	0.6
1.06 to 1.3 EPR	4.4	4.2	0.4	8.3	7.9	0.9
Above 1.3 EPR	4.3	X	0.4	8.5	8.0	1.1

BR700-710C4-11	Normal Flow [%]			Maximum Flow [%]		
	Stage 5	Stage 8	Fan	Stage 5	Stage 8	Fan
Power Range						
Idle to 1.06 EPR	X	7.7	X	3.0	12.0	0.6
1.06 to 1.3 EPR	4.3	4.1	0.2	8.2	7.8	1.6
Above 1.3 EPR	4.2	X	0.4	8.3	7.8	1.8

BR700-725A-12:

$$NHRT2 = \frac{\text{Mechanical HP Speed [rpm]}}{\sqrt{\text{Engine Inlet Temperature [K]}}} = \frac{NH}{\sqrt{T2}}$$

- Stage 5 and stage 8 HP compressor customer bleed is expressed as a percentage of HP compressor entry mass flow W26.
- Fan bleed flow is expressed as percentage of the fan tip entry mass flow W12.

HP Bleed Stage 5			
Nominal		Maximum	
NHRT2	% W26	NHRT2	% W26
Idle - 675	6.5	Idle - 700	7.7
675 - 850	10.1	700 - 875	10.1
850 - MTO	6.5	875 - MTO	8.6

HP Bleed Stage 8			
Nominal		Maximum	
NHRT2	% W26	NHRT2	% W26
Idle - 790	13.6	Idle - 800	14.2
790 - MTO	9.3	800 - MTO	10.0

LP(Fan) Bleed			
Nominal		Maximum	
NHRT2	% W12	NHRT2	% W12
Idle - 700	1.4	Idle - 720	1.5
700 - 775	1.7	720 - MTO	1.9
775 - MTO	1.7		

IV. Operating Limitations:

1. Temperature Limits

Gas Temperatures TGT (trimmed):

	BR700-710A1-10	BR700-710A2-20	BR700-710C4-11	BR700-725A1-12
Maximum prior to starting on ground	150 °C			150°C
Starting on ground	700 °C			700°C
Starting in flight	850 °C			850°C
Take-off ³	900 °C			900°C
Maximum Continuous	860 °C			885°C
Maximum Overtemperature(20sec.)	905 °C			920°C (see Note 7)

Fuel Temperatures:

	BR700-710A1-10	BR700-710A2-20	BR700-710C4-11	BR700-725A1-12**
LP Pump Inlet, maximum	54 °C			
LP Pump Inlet, 51000ft				47°C
Min. fuel temp.				-40 within the Take-Off envelope/ -45 outside the Take-Off envelope

** The max. engine fuel inlet temperatures at altitude below 51000ft are derived by linear interpolation between the values given for sea level and 51000ft.

Oil Temperatures:

	BR700-710A1-10	BR700-710A2-20	BR700-710C4-11	BR700-725A1-12
Minimum for starting	-30 °C	-40 °C ⁴	-30 °C	-40°C
Minimum for acceleration to Take-off	20 °C			
Maximum	160 °C			

2. Permissible Rotational Speeds

Low Pressure Turbine N1:

	BR700-710A1-10 ⁵	BR700-710A2-20 ⁵	BR700-710C4-11 ⁵	BR700-725A1-12 ⁷
Maximum Take-off	101.1 %	102.1 %	101.1 %	102,8 %
Maximum Continuous	101.0 %	102.1 %	101.0 %	102,8 %
Maximum Overspeed (20 sec.)	101.5 %	102.5 %	101.5 %	104,3 %
Reverse Thrust (maximum 30 sec.)	70.0 %			78,1%

³ Limited to 5 minutes and to maximum 10 minutes after one engine having failed.

⁴ For temperatures below -30 °C see OI-710-2BR Operating Instructions.

⁵ 100% N1 equals 7431 min⁻¹

⁷ 100% N1 equals 7000 min⁻¹

High Pressure Turbine N2⁶:

	BR700-710A1-10	BR700-710A2-20	BR700-710C4-11	BR700-725A1-12
Maximum Take-off	99.6%			100.0 %
Maximum Continuous	98.9%			98.7 %
Maximum Overspeed (20 sec.)	99.8%			101.3 %

3. Pressure Limits

Fuel Pressures:

	BR700-710A1-10	BR700-710A2-20	BR700-710C4-11	BR700-725A1-12
Minimum at LP Pump Inlet	34.5 kPa			

Differential Oil Pressures:

Lower limit for flight in the range	BR700-710A1-10	BR700-710A2-20	BR700-710C4-11	BR700-725A1-12
Idle to 72.3% N2	241.2 kPa			
72.3% N2 to 90% N2	Straight line interpolation from 241.2 kPa to 310.3 kPa			
Above 90% N2	310.3 kPa			

Minimum to complete flight in the range	BR700-710A1-10	BR700-710A2-20	BR700-710C4-11	BR700-725A1-12
Idle to 72.3% N2	172.3 kPa			
72.3% N2 to 90% N2	Straight line interpolation from 172.3 kPa to 241.2 kPa			
Above 90% N2	241.2 kPa			

4. Installation Assumptions:

Refer to Installation Manuals for details.

5. Dispatch Limitations (Time Limited Dispatch):

Information on engine operation with FADEC system dispatch limitations is contained in the respective Time Limits Manuals.

V. Operating and Service Instructions:

	BR700-710A1-10	BR700-710A2-20	BR700-710C4-11	BR700-725A1-12
Installation Manual	E-TR206/95 Issue 6 or later approved issues	E-TR364/95 Issue 1 or later approved issues	E-TR240/01(FR) ISS02 or later approved issues	O-TR1458/08 Issue 2 or later approved issues
Operating Instructions	OI-710-1BR	OI-710-2BR	OI-710-4BR	OI-725-7BR

⁶ 100% N2 equals 15898 min⁻¹

Maintenance Manual	M-710-1BR	M-710-2BR	M-710-4BR	M-725-7BR
Engine Manual	E-710-1BR	E-710-2BR	E-710-4BR	E-725-7BR
Time Limits Manual	T-710-1BR	T-710-2BR	T-710-4BR	T-725-7BR
Service Bulletins	As issued by Rolls-Royce Deutschland Ltd & Co KG.			

For BR700-710C4-11 Engines with Modification 72-101466 incorporated E-TR0283/06 Issue01 or later approved issue and the Service Bulletin SB-BR700-72-101466 apply additionally.

VI. Notes

1. The engines are equipped with a thrust reverser:

	BR700-710A1-10	BR700-710A2-20	BR700-710C4-11	BR700-725A1-12
Left hand engine	P/N04G0001-039 or later approved standards	P/N07G0001-005 or later approved standards	P/N25G0001-001 or later approved standards	P/N RD00103001-1 or later approved standards
Right hand engine	P/N04G0001-041 or later approved standards	P/N07G0001-007 or later approved standards	P/N25G0001-003 or later approved standards	P/N RD00103001-2 or later approved standards
Operation of these thrust reversers is approved for ground use only.				
Power back is <u>prohibited</u> .				

2. Life limited critical parts are included in the respective Time Limits Manuals.
3. The EEC software has been developed and verified in accordance with RTCA/DO-178B respectively ED-12B, Level A
4. Information on lightning protection and electromagnetic compatibility is contained in the Installation Manuals.
5. The ratings shown under III.6. are achieved at sea level and ISA standard day conditions using a defined test bed configuration for the air intake and exhaust system with all optional bleeds closed and the aircraft service equipment drives unloaded, at a lower fuel heating value of 43179 kJ/kg [22721 CHU/kg]. The take-off rating and associated operating limitations may be used for up to 10 minutes in the event of an engine failure or shut down.
6. Models BR700-710A1-10, BR700-710A2-20, BR700-710C4-11 were previously covered under LBA Engine Type Certificate 6305 and Type Certificate Data Sheets 6305 (BR700-710A1-10 at Issue 7, BR700-710A2-20 at Issue 6, BR700-710C4-11 at Issue 1) prior to being superseded by the EASA Type Certificate and Type Certificate Data Sheet.
7. The BR700-725A1-12 engine is approved for a maximum exhaust gas over temperature of 920°C for inadvertent use for periods up to 20 seconds without requiring maintenance action. The cause of the over temperature must be investigated and recorded.
8. The BR700-725A1-12 engine is approved for ground operation in freezing fog conditions down to minus 10°C.
