European Union Aviation Safety Agency

TYPE-CERTIFICATE DATA SHEET

EASA.E.042

For Engine
RB211 Trent 700 series engines

Type Certificate Holder
Rolls-Royce Deutschland Ltd & Co KG
Eschenweg 11
Dahlewitz
15827 Blankenfelde-Mahlow
Germany

For Models:

RB211 Trent 768-60
RB211 Trent 772-60
RB211 Trent 772B-60
RB211 Trent 772C-60

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I. General

1. Type / Models

RB211 Trent 700 / RB211 Trent 768-60, RB211 Trent 772-60, RB211 Trent 772B-60, RB211 Trent 772C-60

2. Type Certificate Holder

Rolls-Royce Deutschland Ltd & Co KG
Eschenweg 11
Dahlewitz
15827 Blankenfelde-Mahlow
Germany

DOA ref.: EASA.21J.065

3. Manufacturer

Rolls-Royce plc

4. Date of Application

30 June 1991	30 June 1991	26 August 1997	06 May 2005
RB211 Trent 768-60	RB211 Trent 772-60	RB211 Trent 772B-60	RB211 Trent 772C-60

5. EASA Type Certification Date

RB211 Trent 768-60: 24 January 1994
RB211 Trent 772-60: 18 March 1994
RB211 Trent 772B-60: 11 September 1997
RB211 Trent 772C-60: 06 March 2006
(See note 11)

II. Certification Basis

1. Certification Reference Date

30 June 1991

2. EASA Certification Basis

2.1. Airworthiness Standards

JAR-E, change 8, dated 4 May 1990
Orange Paper E/91/1, effective 27 May 1991

2.2. Special Conditions (SC)

SC1 Ingestion of Rain (E790)
SC2 Ingestion of Hail (E790)

2.3. Equivalent Safety Findings (ESF)

JAR-E 740(f): Non-Declaration or Display of Maximum Continuous Speed Limitations
JAR-E 800(c): Number of Medium Birds (NPA-E-12 ref Orange Paper E/93/1)

2.4. Deviations

JAR-E 570(a)(3): Scavenge pump inlet strainers – Exemption
JAR-E 890(a): Engine Calibration in Reverse Thrust – Exemption

2.5. Environmental Protection

RB211 Trent 768-60, RB211 Trent 772-60, RB211 Trent 772B-60, RB211 Trent 772C-60	CS-34 amendment 3 Engine emissions: ICAO Annex 16 Volume II, fourth edition, July 2017, including Amendment 9, applicable 01/01/2018, as implemented into EU legislation 11/09/2018. For NOx, the standards in accordance with Part III, Chapter 2, § 2.3.2 e) (CAEP/8) apply. For maximum nvPM mass concentration, the standards of Part III, Chapter 4, § 4.2.2 (CAEP/10) apply.

III. Technical Characteristics

1. Type Design Definition

The build standards are defined in the following Drawing Introduction Sheet (DIS) or later approved issues:

Trent 768-60: DIS 2150 Issue 3
Trent 772-60: DIS 2141 Issue 2
Trent 772B-60: DIS 2179 Issue 1
Trent 772C-60: DIS 2276 Issue 2

2. Description

Three shaft, high bypass ratio, axial flow, turbofan engine with Low Pressure (LP), Intermediate Pressure (IP) and High Pressure (HP) compressors driven by separate turbines through coaxial shafts. The LP compressor consists of 26-off wide chord fan blades. The combustion system consist of a single annular combustor, with 24-off fuel spray nozzles. The LP, IP and HP assemblies rotate independently, and in an anti-clockwise direction when viewed from the rear of the engine. The compressor and turbine have the following features:

	Compressor	Turbine
LP	single stage (fan)	4 stages
IP	8 stages	single stage
HP	6 stages	single stage

The engine control system utilises an Electronic Engine Controller (EEC) which has an airframe interface for digital communications (ARINC).
The engine Drawing Introduction Sheet (DIS) includes the Thrust Reverser Unit (TRU). All engines are approved for reverse thrust operation.

3. Equipment

The engine DIS includes the starter motor.
Refer to the appropriate engine DIS for details of equipment included in the engine type design and for details of equipment supplied by the aircraft Type Certificate (TC) holder.

4. Dimensions (mm)

Overall length, from tip of spinner minus rubber tip to rear of CNA: 5639
Maximum radius, from centre line, not including drains mast: 1372

5. Weight (kg)

Dry engine weight, not including fluids and nacelle EBU: 6160

6. Ratings

	Thrust - kN (lbf)			
	Tent 768-60	Trent 772-60	Trent 772B-60	Trent 772C-60
Take-Off Thrust (net) (5 minutes)	300.3 (67500)	316.3 (71100)	316.3 (71100)	316.3 (71100)
Equivalent Bare Engine Take-Off Thrust	304.3 (68400)	320.3 (72000)	320.3 (72000)	320.3 (72000)
Maximum Continuous Thrust (net)	268.7 (60410)	282.7 (63560)	282.7 (63560)	282.7 (63560)

(See notes 1, 2, 12, 13)

7. Control System

The engine is equipped with a Full Authority Digital Engine Control (FADEC) system.
EEC System, part number- EEC2000-04AS1 or later approved standard.
Software Standard:
RB211 Trent 768-60 and 772-60: EEC A6.2 (*)
RB211 Trent 772B-60: EEC A9.0 (*)
RB211 Trent 772C-60: EEC A12.5 (*)
(*) or later approved standard
(See notes 3, 4)

8. Fluids (Fuel, Oil, Coolant, Additives)

Fuel and Additives: Refer to the applicable engine “Operating Instructions” document F-Trent-A330, APPENDIX.
Oil: Refer to the “Civil Large Engines – Engine Oils Manual” document EOM-CIVIL-1RR.

9. Aircraft Accessory Drives

The engine’s accessory gearbox may be fitted with up to two hydraulic pumps and one Integrated Drive Generator to provide electrical and hydraulic power to the aircraft. These units are formally part of the airframe, and certified under JAR-25 regulations.

10. Maximum Permissible Air Bleed Extraction

10.1 Environmental control system bleed

Environmental control system bleed ('Customer Bleed') is bled from IP8 off take at take-off, cruise and climb, and from HP6 at descent and idle ground conditions. Switch-over from IP8 to HP6 off take takes place automatically, dependent upon engine and atmospheric conditions. The maximum allowable Customer Bleed is given in the tables below. Bleed flows vary linearly between the points listed.

Customer Bleed Off takes for normal operation:

Condition	CUSTOMER BLEED (HP6) %W26	CUSTOMER BLEED (IP8) %W24
Low Idle	11.6%	n/a
Switchover point (nominal 1.26 EPR)	5.2%	4.5%
Maximum Continuous	n/a	3.1%
Above Max Continuous	n/a	2.4%

W24 is IP compressor inlet airflow and W26 is HP compressor inlet airflow.

Customer Bleed Off takes for abnormal operation:

Condition	CUSTOMER BLEED (HP6) %W26	CUSTOMER BLEED (IP8) %W24
Low Idle	12.7%	n/a
Switchover point (nominal 1.26 EPR)	5.8%	5.3%
Maximum Continuous	n/a	4.0%
Above Max Continuous	n/a	2.9%

W24 is IP compressor inlet airflow and W26 is HP compressor inlet airflow.

10.2 Nacelle thermal anti-icing bleed

Nacelle thermal anti-icing bleed is bled from HP3 offtake at all conditions. The nacelle thermal anti-icing flow demand is modulated via a regulating valve to provide a flow function to the engine / nacelle. The maximum allowable nacelle thermal anti-icing flow is given in the tables below. Bleed flows vary linearly between the points listed.

Nacelle Thermal Anti-Icing Bleed Off takes for normal and abnormal operation:

TET (T41) K	NACELLE THERMAL ANTI-ICE BLEED (HP3) %W26
Low Idle to 1450	0.75%
Maximum Continuous	0.69%
Above Maximum Continuous	0.44%

W26 is HP compressor inlet airflow.

10.3 Fan bleed

Fan bleed is taken off the fan outlet to cool the air in the cabin bleed system pre-cooler. The maximum allowable pre-cooler flows are given in the table below. Bleed flows vary linearly between the points listed.

Pre-cooler flow for normal and abnormal operation

Condition	PRE-COOLER BLEED (LPC) %W120
Low Idle	1.23%
Maximum Continuous	1.23%
Above Maximum Continuous	0.96%

W120 is fan inlet airflow.

IV. Operating Limitations

1. Temperature Limits

1.1 Climatic Operating Envelope

The engine may be used in ambient temperatures up to ISA+40°C. Refer to the applicable engine Installation Manual for details of the Operating Envelope, including the air inlet distortion at the engine inlet.

1.2 Turbine Gas Temperature – Trimmed (°C)

Below 50% HP speed, maximum during starts on the ground: 700
Maximum during relights in flight: 850
Maximum for take-off (5 min. limit): 900
Maximum Continuous (unrestricted duration): 850
Maximum over-temperature (See note 5): 920
(See note 6)

1.3 Fuel Temperature (°C)

Minimum fuel temperature in flight: minus54 (or the fuel freeze point, whichever is higher)
Minimum fuel temperature for ground starting: minus54
Maximum fuel temperature: 55
(See note 7)

1.4 Oil temperature (°C)

Combined oil scavenge temperature limits:
Minimum for engine starting: minus40
Minimum for acceleration to power: 50
Maximum for unrestricted use: 190

2. Rotational Speed Limits (rpm)

	LP Rotor (N1)	IP Rotor (N2)	HP Rotor (N3)
Reference speeds, 100% rpm	3900	7000	10611
Maximum for Take-off (5 minute limit, see notes 2, 8, 9)	99.0%	103.3%	100.0%
Maximum Overspeed (20-second limit, see notes 8, 9)	99.0%	103.3%	100.0%
Maximum Continuous (See notes 10, 9)	98.2%	100.8%	99.1%

Stabilised operation in the speed range 51% to 74% N1 is not permitted during static operations. Passing through this speed range while increasing or decreasing thrust is permitted.

3. Pressure Limits

3.1 Fuel pressure (kPa)

Minimum absolute inlet pressure (measured at engine inlet): 34.5 + Fuel Vapour Pressure
Maximum pressure at inlet (measured at the pylon interface):

(i) Continuous: 414
(ii) Transiently: 483
(iii) Static: 1276

3.2 Oil pressure (kPa)

Minimum oil pressure:

(i) Ground idle to 70% HP rpm: 165
(ii) Above 95% HP rpm: 345

4. Time Limited Dispatch

The engine has been approved for Time Limited Dispatch. The maximum justifiable rectification period for each dispatchable state is specified in the Installation Manual; no extension to such rectification period is allowed.

V. Operating and Service Instructions

Manuals	All Trent 700 engine models
Installation Manual	EL2837
Operating Instructions	F-Trent-A330

Instructions for Continued Airworthiness (ICA)	All Trent 700 engine models
Engine Manual	E-Trent-A330
Time Limits Manual	T-Trent-1RR
Maintenance Manual	M-Trent-A330
Civil Large Engines – Engine Oils Manual	EOM-CIVIL-1RR
Service Bulletins	RB211—as published by TC holder

VI. Notes

1. The Equivalent Bare Engine Take-off Thrust quoted in the Ratings table is derived from the approved Net Take-off Thrust by excluding the losses attributable to the inlet, cold nozzle, hot nozzle, by-pass duct flow and leakage and the after body. No bleed or power offtakes are assumed.

2. The take-off rating and the associated operating limitations may be used for up to 10 minutes in the event of an engine failure, but their use is otherwise limited to no more than 5 minutes.

3. The software of the EEC is designated Level “1” according to DO-178A/ED-12A.

4. EMI / Lightning: Refer to applicable “Installation Manual” document for details.

5. The Trent 700 is approved for a maximum exhaust gas over-temperature of 920 °C for inadvertent use for periods of up to 20 seconds without requiring maintenance action. The cause of the over-temperature must be investigated and corrected.

6. Turbine Gas Temperature is measured by thermocouples positioned at the 1st stage Nozzle Guide Vane of the LP Turbine.

7. The fuel temperature limits are quoted for conditions at the engine inlet.

8. Post Modification 73-C780, the Maximum Take-Off speeds for LP and HP shafts are increased to 99.5% and 100.7%. The speed signals transmitted to the aircraft, however, are trimmed in order to maintain the same cockpit indicated Maximum Take-Off speeds as the pre-modification standard (i.e. 99.0% and 100.0% respectively.)

9. Post Modification 73-E502, the Maximum Take-Off speeds for the HP shaft is increased to 101.7%. The speed signals transmitted to the aircraft, however, are trimmed in order to maintain the same cockpit indicated Maximum Take-Off speeds as the pre-modification standard (i.e 100.0%). The Maximum Continuous HP Shaft speed is also raised from 99.1% to 100.1%.

10. The Maximum Continuous Speed limitations defined in this Data Sheet are not displayed as limitations on the A330 flight deck. Non display of these limitations was agreed during the Certification programme.

11. Models RB211 Trent 768-60, RB211 Trent 772-60 and RB211 Trent 772B-60 were previously certified under CAA-UK Engine Type Certificate 092/2 and Type Certificate Data Sheet 1050 prior to being superseded by the EASA Type Certificate and Type Certificate Data Sheet.

12. The RB211 Trent 772B-60 has the same ratings as the RB211 Trent 772-60 except between 610 m (2000 ft) and 2440 m (8000 ft) altitude or when the ambient temperature is greater than ISA+15°C, where the 772B-60 produces increased thrust at take-off rating. The magnitude of this increase varies with altitude and ambient temperature and is limited to a maximum of 5.4%.

13. The RB211 Trent 772C-60 has the same ratings as the RB211 Trent 772B-60 except at altitudes above 2440 m (8000 ft) where the 772C can provide more thrust in both Take-Off and Continuous conditions. The extent of this thrust increase is dependent upon altitude, temperature and Mach number, but is limited to a maximum of 8.5%. From 3048 m (10000 ft) to 4877 m (16000 ft) there is a Take-Off thrust increase of 3% for day temperatures of ISA+28°C and above, this reduces to 0% at ISA+8°C and below. At altitudes greater than 3962 m (13000 ft) and Mach numbers greater than 0.4 a further thrust increase results from maximum continuous thrust exceeding maximum Take-Off thrust, this increases the maximum Take-Off thrust below ISA+15°C by a maximum of 5.0% relative to the Trent 772B-60 at 4877 m (16000 ft), 0.5 Mn. Max Continuous thrust is increased by up to 8.5% relative to the Trent 772B-60 rating for altitudes between 4572 m (15000 ft) and 7620 m (25000 ft) for Mach numbers between 0.3 and 0.6 and temperatures from ISA to ISA+30°C.

14. The EASA approved Airworthiness Limitations Section of the Instructions for Continued Airworthiness is published in the applicable “Time Limits Manual”.

SECTION: ADMINISTRATIVE

I. Acronyms and Abbreviations

ARINC	Aeronautical Radio, Incorporated
CNA	Common Nozzle Assembly
DIS	Drawing Introduction Sheet
EASA	European Union Aviation Safety Agency
EBU	Engine Build Unit
EEC	Engine Electronic Controller
EMI	Electro Magnetic Interference
FADEC	Full Authority Digital Engine Control
HP	High Pressure
ICAO	International Civil Aviation Organisation
IP	Intermediate Pressure
LP	Low Pressure
rpm	Revolutions per Minute
SC	Special Conditions
TCDS	Type Certificate Data Sheet
TET	Turbine Entry Temperature

II. Type Certificate Holder Record

Rolls-Royce plc 62 Buckingham Gate Westminster London SW1E 6AT United Kingdom Design Organisation Approval No.: EASA.21J.035	From 24 Jan. 1994 to 20 Feb. 2019
Rolls-Royce Deutschland Ltd & Co KG Eschenweg 11 Dahlewitz 15827 Blankenfelde-Mahlow Germany Design Organisation Approval No.: EASA.21J.065	From 21 Feb. 2019

III. Change Record

TCDS Issue	Date	Changes	TC issue date
Issue 01	06 March 2006	Initial Issue	Initial Issue, 06 March 2006
Issue 02	29 November 2013	Addition of Airworthiness Standards, radius dimensions, dispatch limitations	06 March 2006
Issue 03	14 October 2014	Addition of Airworthiness Standards	06 March 2006
Issue 04	18 April 2018	Revision of minimum oil temperature for acceleration to power according to Major Change Approval 10065099 and Change of TC Holder's address.	Amended, 18 April 2018
Issue 05	21 February 2019	Transfer of TC from Rolls-Royce plc to Rolls-Royce Deutschland Ltd & Co KG.	Transferred, 21 February 2019
Issue 06	20 December 2019	Record of compliance with CAEP/10 emissions requirements (certificate 10071616). Introduction of Engine Oils Manual. Removal of a non-certified oil consumption limitation. Addition of note 14. Other changes are editorial to match the current TCDS template.	21 February 2019

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