COMANDO DA AERONÁUTICA
DEPARTAMENTO DE PESQUISAS E DESENVOLVIMENTO
CENTRO TÉCNICO AEROESPACIAL

TYPE CERTIFICATE DATA SHEET Nº EM-2001T01

Type Certificate Holder:

ROLLS-ROYCE plc
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ENGLAND

EM-2001T01
Sheet 01

ROLLS-ROYCE

RB 211 TRENT 768-60
RB 211 TRENT 772-60
RB 211 TRENT 772B-60

May 2001

Engines of models described herein conforming with this data sheet, which is part of Type Certificate No.2001T01, meet the minimum standards for use in certificated aircraft in accordance with pertinent aircraft data sheets and applicable portions of the Brazilian Aeronautical Regulations provided they are installed, operated, and maintained as prescribed by the approved manufacturer's manuals and other instructions.

MODELS RB 211 Trent 768-60, RB 211 Trent 772-60 and RB 211 Trent 772B-60.

TYPE High by-pass turbofan (by-pass ratio of 5.17:1 for the 768-60 and 5.05:1 for the 772-60 and 772B-60), axial flow, three-shaft. Single-stage low pressure fan driven by four stage turbine. Eight stage intermediate pressure compressor driven by single stage turbine. Six-stage high pressure compressor driven by single stage turbine. Annular combustion chamber.

RATINGS (See Note 1)

	Trent 768-60	Trent 772-60	Trent 772B-60
Takeoff thrust(5 minutes) kN (lbf)			
Net at sea level static	300.3 (67 500) (1)	316.3 (71 100) (3)	316.3 (71 100) (5)(6)
Equivalent bare engine	304.3 (68 400)	320.3 (72 000)	320.3 (72 000)

RATINGS (See Note 1) (Cont.)	Maximum continuous thrust kN (lbf)			
	Net at sea level static	268.7 (60 410) (2)	282.7 (63 560) (4)	282.7 (63 560) (4)

(1) Flat rated to ISA + 15 °C for all altitudes.
(2) ISA + 15 °C up to 6 096m (20 000 ft) varying linearly to ISA +10 °C at 7 620m (25 000 ft) and ISA + 10 °C above 7 620m (25 000 ft).
(3) ISA + 15 °C up to 2 438m (8 000 ft) varying linearly to ISA + 10 °C at 3 048m (10 000 ft) and ISA + 10 °C above 3 048m (10 000 ft).
(4) ISA + 15 °C up to 1 524m (5 000 ft) varying linearly to ISA + 10 °C at 3 048m (10 000 ft) and ISA + 10 °C above 3 048m (10 000 ft).
(5) ISA + 22 °C up to 610m (2 000 ft) varying linearly to ISA + 15 °C at 1 524m (5 000 ft), ISA + 15 °C up to 2 438m (8 000 ft) varying linearly to ISA + 10 °C at 3 048m (10 000 ft) and ISA 10 °C above 3 048m (10 000 ft).
(6) The Trent 772B-60 has the same ratings as the 772-60 except between 2 000 ft and 8 000 ft altitude or when the ambient temperature is greater than ISA +15 °C, where the 772B-60 produces increased thrust at take-off ratings. The magnitude of this increase varies with altitude and ambient temperature and is limited to a maximum of 5.4%.

		Trent 768-60	Trent 772-60	Trent 772B-60
DIMENSIONS	Length from front fan case flange to rear of CNA, cm (in)	5 63.9 (222)	--	--
	Radius, maximum, cm (in)	137.2 (54)	--	--
CENTER OF GRAVITY – (complete powerplant)	Aft from powerplant station 100, cm (in)	64.5 (25.4)	--	--
	Below centerline, cm (in)	3.3 (1.3)	--	--
	Stbd. from engine centerline, cm (in)	0.76 (0.3)	--	--
CENTER OF GRAVITY – (basic engine)	Aft from powerplant station 100, cm (in)	71.1 (28.0)	--	--
	Below centerline, cm (in)	3.3 (1.3)	--	--
	Stbd. from engine centerline, cm (in)	0.25 (0.1)	--	--

--Same as preceding # Does not apply

WEIGHT (DRY)	Dry powerplant, kg (lb)	6 517 (14 368)	--	--
	Basic engine, kg (lb)	5 000 (11 023)	--	--
	Basic engine is the dry powerplant less nacelle, intake, cowl doors, CNA and thrust reverser.			
ENGINE PARTICULARS BUILD STND	RR Drawing Introduction Sheet (DIS)	2 150 (Issue 4)	2 141 (Issue 3)	2 179 (Issue 2)
FUEL	See relevant Engine Operating Instructions for approved fuels.			
ELECTRONIC FULL AUTHORITY FUEL CONTROL	Fuel control	Lucas EEC 2000-03AB1	--	--
	Fuel pump	Argotech 721400	--	--
	Fuel metering unit	Lucas FMU 700 MK1	--	--
OIL, LUBRICATION	Approved oils	See relevant Engine Operating Instructions for approved oils.		
	Oil consumption	1.42 U.S. pints/hour overall in-flight maximum for unrestricted operation.		
OIL CAPACITY	Nominal total system capacity, U.S. pints	93.9	--	--
	Nominal oil tank capacity, U.S. pints	50.7	--	--
	Minimum useable oil (including effect of attitude), U.S. pints	38.1	--	--
		Trent 768-60	Trent 772-60	Trent 772B-60
TEMPERATURE LIMITS		See Note 3	--	--
PRESSURE LIMITS		See Note 4	--	--
AIR BLEED		See Note 5	--	--
IGNITION	Ignition system plug	Champion CH34691	--	--
	Ignition system units	Simmonds 430081	--	--

-- Same as preceding # Does not apply

IMPORT REQUIREMENTS Each engine imported separately and/or spare parts must be accompanied by an export airworthiness approval issued by CAA (or a third country authority, in case of used engine imported from such country) attesting that the particular engine and/or parts were submitted to the governmental quality control before delivery and are in conformity with the CTA approved type design.

CERTIFICATION BASIS The Certification Basis for the engine are those indicated in the RBHA 33 which endorses the FAR 33 effective February 1, 1965, as amended by FAR 33-1 through 33-15 plus special conditions and equivalent safety findings established by the following JAA CRIs and CTA FCAR's:

– CRI 7 – Ingestion of Rain– Special Condition;
– CRI 11 – Ingestion of Hail – Special Conditions;
– CRI 15 – Speed limitations at Maximum Continuous Rating – Equivalent Safety Finding;
– FCAR HPR-01 – Compressor and Turbine Rotor Integrity Maximum Speed Tests; and
– FCAR HPR-02 – Turbine Overtemperature Tests.

	Application	Issued TC
Trent 768-60	09 March 2001	09 May 2001
Trent 772-60	09 March 2001	09 May 2001
Trent 772B-60	09 March 2001	09 May 2001

NOTES

NOTE 1 The engine ratings are based on static test stand operation under the following A & B conditions:

A.

(1) Compressor inlet air at 15 °C (59 °F) and 29.92 in Hg.
(2) No aircraft accessory loads or optional air extraction.
(3) 100% air intake recovery corrected from the datum air intake system defined by drawing ATF12161 or approved alternatives.
(4) Engine exhaust system defined by Common Nozzle Assembly (CNA) FK16544 and Jet Pipe FK 16545 and Tail Plug FK 16507.
(5) Turbine gas temperature and rotor speed limitations are not exceeded.

NOTE 1 (Cont.) B. Equivalent Bare Engine Thrust

The Equivalent bare engine thrust: derived from the approved Net Take-off Thrust by excluding the losses attributable to the cold convergent divergent nozzle, by-pass duct flow and leakage and the afterbody.

NOTE 2 Maximum Permissible Engine Rotor Speeds (%)

100% HP = 10 611 rpm
100% IP = 7 000 rpm
100% LP = 3 300 rpm

Maximum takeoff (5 minutes) (See Note 18)

HP (*)	100.0
IP	103.3
LP (*)	99.0

Maximum continuous

See (**) below.

Maximum overspeed (20 seconds)

HP	100.0
IP	103.3
LP	99.0

Maximum reverse thrust (30 seconds)

LP	80.8

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

(**) The maximum rotor speeds demonstrated for use at maximum continuous conditions are HP 99.1%, IP 100.8%, LP 98.2% as quoted in Rolls-Royce report PTR 43 010 Issue 2. These speeds are not required to be quoted as operating limitations.

NOTE 3 Maximum Permissible Temperatures

Turbine Gas Temperature (TGT) °C

Starting

Below 50% N3 (ground starting)	700 (Momentary max. during start or relight)
Below 50% N3 (in flight starting)	850
Above 50% N3	850
Takeoff (5 minutes)	900 (May be used up to 10 minutes in the event of one engine failure)
Maximum continuous (unrestricted)	850
Over temperature (20 seconds)	920

Fuel

Maximum temperature at outlet from HP fuel pump (° C)

Unrestricted	120
Max. during transient overshoots on reducing rpm (15 min. limit)	140

Oil

Combined scavenge temperature (°C)

Minimum for starting	-40
Minimum for opening up	20
Maximum for unrestricted use	190

NOTE 4 Fuel And Oil Pressure Limits

Fuel

Minimum fuel pressure

Between sea level and 41 000 feet, not less than 5 psig plus true fuel vapor pressure, measured at inlet to engine LP fuel pump.

Oil

Minimum acceptance for flight

Ground idle to 70% HP rpm	35 psig
Above 95% HP rpm	60 psig

Minimum to complete flight

Ground idle and 70% HP rpm	24 psig
Above 95% HP rpm	50 psig

NOTE 5 Maximum Permissible Compressor Air Bleeds

Air delivery for aircraft services, excluding powerplant anti-icing. The air is automatically scheduled from the engine IP stage 8 and HP stage 6 compressor bleed ports via two valves in the aircraft ducting which select the appropriate supply in response to signals sensing HP compressor delivery pressure (P30), IP compressor delivery pressure (P25) and altitude together with a synthesized HP compressor delivery temperature (T30Syn).

With valve controller ABG SEMCA DRG 6764A010000 the switchover from the HP to the IP compressor delivery port occurs at engine power settings where the following conditions are met:

(a) T30Syn is greater than 450 °C + 2.5 °C and P30 is greater than 75 psi + 2.5 ambient pressure, or
(b) Altitude is greater than 26 000 ft + 250 and P30 is greater than 85 psi + 2.5 ambient pressure, or
(c) P25 is greater than 40 psi + 4.0 ambient pressure.

Maximum HP6 bleed, (% of gas generator compressor flow); This bleed decreases linearly between the values listed below for the low idle and switchover points.

1. Normal operation:
   - i. Low Idle 11.6
   - ii. At switchover point (1.26 EPR) 5.2
2. Abnormal (one engine inoperative):
   - i. Low Idle 12.7
   - ii. At switchover point (1.26 EPR) 5.8

Maximum IP8 bleed (% of gas generator compressor flow); This bleed (IP8) decreases linearly between the values listed below for the switchover and maximum continuous points)

1. Normal operation:
   - i. At switchover point 4.5
   - ii. Max. continuous 3.1
   - iii. Above max. continuous 2.4
2. Abnormal (one engine inoperative):
   - i. At switchover point 5.3
   - ii. Max. continuous 4.0
   - iii. Above max. continuous 2.9

NOTE 5 (Cont.) Maximum LP bleed (% of fan flow)

1. Normal & Abnormal (one engine inoperative):
   - i. From low idle to max. continuous 1.23
   - ii. Above max. continuous 0.96

Maximum HP3 bleed for powerplant anti-icing (% of HPC inlet flow); This bleed decreases linearly between the values listed below for the 1450 °K TET and max. continuous points)

1. Normal & Abnormal (one engine inoperative):
   - i. From low idle to 1450 °K TET 0.75
   - ii. Max. Continuous 0.69
   - iii. Above max. continuous 0.44

NOTE 6 Shaft Power Extraction Limitations

Models	*Drive*	*Rotation (as viewed from gearbox)*	*Speed Ratio to HP Rotor Speed*	*Torque (lb.in)*		*Overhang (in.lb)*
				Continuous	*Maximum Instantaneous*	
All models	Starter	cw	1.00057	See below	See below	290
	IDG	cw	0.855	2 956	5 000	1 300
	Hydraulic Pumps					
	Rear pump	cw	0.4002	1 500	1 730	183
	Front pump	cw	0.3919	1 500	1 730	183

cw – clockwise

Maximum starter torque varies with air temperature as follows:

Air temperature (° C)	Max torque (lb.in)
10	7 440
-20	8 640
-40	10 800

NOTE 7 Power settings, power check, and control of the engine output is to be based on Rolls-Royce (RR) engine charts included in RR Operating Instructions referring to engine pressure ratio (EPR). Pressure probes are included in the engine for this purpose.

NOTE 8 Life limited parts are identified in the Engine Manual.

NOTE 9 This engine approval includes bare engine plus thrust reverser, engine mounting feet and links, core engine cowlings, and engine accessories, coolers, filters, harness, and instrumentation transmitters as defined in the appropriate RR DIS. Hydraulic pumps and IDG are aircraft supply.

NOTE 10 RB211 series manuals under CAA requirements accepted as equivalent to FAR 33.4 and FAR 33.5 requirements are:

Model RB211-	*Operating Instruction*	*Maintenance Manual*	*Installation Manual*	*Engine Manual*
Trent 768-60 Trent 772-60 Trent 772B-60	F-Trent-A330	M-Trent-A330	EL 2837	E-Trent-1RR

Service bulletins, structural repair manuals, vendor manuals, aircraft flight manuals, and overhaul and maintenance manuals which contain a statement that the document is CAA-approved are accepted by the CTA and are considered CTA-approved. These approvals pertain to the type design only.

NOTE 11 These engines meet the smoke and gaseous emission requirements of RBHA/FAR 34.

NOTE 12 The engine is fitted with a Digital Electronic Engine Fuel Control system in which the software meets the "critical" standard of RTCA DO-178A/ED12A.

NOTE 13 In icing conditions, the engine may be operated satisfactorily at LP rotor speeds (N1) down to low idle. Minimum corresponding N1 at low idle for these engines is 21.4 percent.

NOTE 14 These engines satisfy the certification base as defined in this Data Sheet when operating with the FADEC in reversionary control mode.

NOTE 15 VARIANTS

RB211 Trent 768-60	Basic model.
RB211 Trent 772-60	Same as basic model except for increased thrust rating.
RB211 Trent 772B-60	Same as 772-60 model except for increased takeoff thrust ratings at altitude between 610m (2 000 ft) and 2 438m (8 000 ft).

NOTE 16 The RB211 Trent 700 series engines have been approved to operate with certain faults present in the control system, based on satisfaction of FAR 33 requirements and appropriate FAR 25 control system reliability requirements.

The following criteria exist as dispatch and maintenance requirements for the engine control system:

Fault Class 1 Level A:	No dispatch allowed
Fault Class 1 Level B:	Dispatchable; maximum operating interval for Fault Class 1 level B fault(s) is 150 operating hours
Fault Class 2:	Dispatchable; maximum operating interval for Fault Class 2 fault(s) is 500 operating hours

Fault levels Class 1 and 2 constitute Rolls-Royce nomenclature. The airframe manufacturers may use different nomenclature is adapting these fault categories to the aircraft maintenance and display systems; however, the maximum operating intervals are restricted as shown above.
The information given above is contained in the Rolls-Royce report DNS 21 680.

NOTE 17 The take-off rating and its associated operating limitations may be used for up to 10 minutes in the event of engine out contingency, but their use is otherwise limited to no more than 5 minutes.

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