

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION TYPE CERTIFICATE DATA SHEET E39NE	TCDS NUMBER E39NE REVISION: 6 DATE: July 30, 2018 ROLLS-ROYCE plc MODELS: RB211 TRENT 768-60 RB211 TRENT 772-60 RB211 TRENT 772B-60
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Engines of models described herein conforming with this data sheet (which is part of Type Certificate Number E39NE) and other approved data on file with the Federal Aviation Administration, meet the minimum standards for use in certificated aircraft in accordance with pertinent aircraft data sheets and applicable portions of the Federal Aviation Regulations, provided they are installed, operated, and maintained as prescribed by the approved manufacturer's manuals and other approved instructions.

TYPE CERTIFICATE (TC) HOLDER: Rolls-Royce plc
 62 Buckingham Gate, London SW1E 6AT
 United Kingdom

I. MODELS	RB211 Trent 768-60	RB211 Trent 772-60	RB211 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)				
Maximum continuous Thrust pounds at sea level static	60410(2)	63560(4)	63560(4)	
Takeoff (5 minutes) Thrust pounds at sea level static	67500(1)	71100(3)	71100(5)(6)	
Equivalent bare engine thrust	68400	72000	72000	
	(1) Flat rated to ISA + 15°C for all altitudes. (2) ISA + 15°C up to 20,000 feet varying linearly to ISA + 10°C at 25,000 feet ISA + 10°C above 25,000 feet. (3) ISA + 15°C up to 8,000 feet varying linearly to ISA + 10°C at 10,000 feet ISA + 10°C above 10,000 feet. (4) ISA + 15°C up to 5,000 feet varying linearly to ISA + 10°C at 10,000 feet ISA + 10 °C above 10,000 feet. (5) ISA + 22°C up to 2,000 feet varying linearly to ISA + 15°C at 5,000 feet ISA + 15°C up to 8,000 feet varying linearly to ISA + 10°C at 10,000 feet ISA 10°C above 10,000 feet. (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%.			

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LEGEND: "--" INDICATES "SAME AS PRECEDING MODEL"

"---" NOT APPLICABLE

NOTE: SIGNIFICANT CHANGES IF ANY, ARE BLACK-LINED IN THE LEFT MARGIN.

I. MODELS	RB211 Trent 768-60	RB211 Trent 772-60	RB211 Trent 772B-60	
PRINCIPAL DIMENSIONS, inches				
Length				
From front fan case flange to rear of CNA	222	--	--	
Radius, maximum	54	--	--	
CENTER OF GRAVITY - complete powerplant	28.2	--	--	
Aft from powerplant station 100	1.4	--	--	
Below centerline	0.1	--	--	
Stbd. from engine centerline				
CENTER OF GRAVITY - basic engine				
Aft from powerplant station 100	25.4	--	--	
Below centerline	1.6	--	--	
Stbd. from engine centerline	0.2	--	--	
WEIGHT				
Dry Powerplant	14368	--	--	
Basic Engine	11023	--	--	
	Basic engine is the dry powerplant less nacelle, intake, cowl doors, CNA and thrust reverser.			
ENGINE PARTICULARS BUILD STND RR Drawing Introduction Sheet (DIS)	2150 Issue 4	2141 Issue 3	2179 Issue 1	

FUELS

APPROVED FUELS

See relevant Engine Operating Instructions for approved fuels.
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OILS

APPROVED OILS

OIL CONSUMPTION

OIL CAPACITY

Nominal total system capacity
 Nominal oil tank capacity
 Minimum useable oil (including effect of attitude)

See relevant Engine Operating Instructions for approved oils.
1.42 U.S. pints/hour overall inflight maximum for unrestricted operation.
93.9 U.S. pints --
49.2 U.S. pints --
32.5 U.S. pints --

COMPONENTS

ELECTRONIC FULL AUTHORITY FUEL CONTROL

Fuel control
 Fuel pump
 Fuel metering unit

IGNITION SYSTEM

Ignition system plugs
 Ignition system units

EQUIPMENT

RB211 Trent 768-60	RB211 Trent 772-60	RB211 Trent 772B-60
Lucas EEC 2000-03AB1	--	Lucas EEC 2000-06BE1
Argotech 721400	--	--
Lucas FMU 700 MK1	--	--
Champion CH34691	--	--
Simmonds 430081	--	--
For identification of equipment approved for use on these engines, refer to Chapter 1 of appropriate Rolls-Royce Drawing Introduction Sheet (DIS).		

CERTIFICATION BASIS 14 CFR 21.29 and 14 CFR part 33 effective February 1, 1965, amendments 33-1 through 33-15. Pursuant to 14 CFR 21.29(a)(1)(ii), the Type Certificate was issued in validation of the British Civil Aviation Authority Certification Standards JAR-E change 8 plus OP E/91/1 which was found to provide a level of safety equivalent to that provided by 14 CFR part 33, amendment 33-15.

<u>MODEL</u>	<u>APPLICATION DATE</u>	<u>ISSUED/REVISED</u>
	<u>SURRENDERED</u>	
RB211 TRENT 768-60	FEB 12 1992	NOV 1, 1994
RB211 TRENT 772-60	FEB 12 1992	NOV 1, 1994
RB211 TRENT 772B-60	MAR 2, 1998	OCT 9, 1998

The aviation authority for the United Kingdom, the UK Civil Aviation Authority (CAA), originally type certificated this engine. The FAA validated this product under U.S. Type Certificate Number E39NE. Effective September 28, 2003, the European Aviation Safety Agency (EASA) began oversight of this product on behalf of the UK.

The following models comply with 14 CFR part 34, amendment 5a, effective October 23, 2013. See NOTE 11 for detailed summary of the certification basis for fuel venting and exhaust emissions: RB211 TRENT 768-60; RB211 TRENT 772-60; and RB211 TRENT 772B-60.

IMPORT REQUIREMENTS

To be considered eligible for installation on U.S. registered aircraft, each new engine to be exported to the United States with UK CAA or EASA airworthiness approval shall have a Joint Aviation Authorities (JAA) or EASA Form 1, Authorized Release Certificate. The JAA or EASA Form 1 should state that the engine conforms to the type design approved under the U.S. Type Certificate E39NE, is in a condition for safe operation and has undergone a final operational check.

Additional guidance is contained in FAA Advisory Circular 21-23, "Airworthiness Certification of Civil Aircraft, Engines, Propellers, and Related Products Imported into the United States."

NOTES

Notes 1 through 20, which follow.

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 59°F and 29.92" 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, Jet Pipe FK 16545, and Tail Plug FK 16507.
 - (5) Turbine gas temperature and rotor speed limitations are not exceeded.
- B. Equivalent Bare Engine Thrust (LBF)
The equivalent bare thrust (lbf) is rated thrust excluding the losses of propulsion fan duct and thrust reverser and jet pipe washed by the fan stream.

NOTE 2. MAXIMUM PERMISSIBLE ENGINE ROTOR SPEEDS (%)

100% HP = 10,611 RPM
 100% IP = 7,000 RPM
 100% LP = 3,900 RPM

Maximum takeoff (5 minutes) (See NOTES 18, 19 and 20)

HP	100.0
IP	103.3
LP	99.0

Maximum overspeed (20 seconds)

HP	100.0
IP	103.3
LP	99.0

Maximum reverse thrust (30 seconds)

LP	80.8
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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 (inflight 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
Overtemperature (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	50
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 $450^{\circ}\text{C} \pm 2.5^{\circ}\text{C}$ 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 switchoverpoint (1.26 EPR) 5.8

Maximum IP8 bleed (5 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

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 1450K TET and max. continuous points)

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

NOTE 6. SHAFT POWER EXTRACTION LIMITATIONS

Accessory drive provisions (continuous power as listed may be extracted under all engine operating conditions)						
MODELS	DRIVE	ROTATION (AS VIEWED) FROM GEARBOX)	SPEED RATIO TO HP ROTOR SPEED	TORQUE (lb - in)		OVERHANG (IN - LB)
				CONTINUOUS	MAXIMUM IN- STANTANEOUS	
ALL MODELS	STARTER	CW	1.00057	SEE BELOW	SEE BELOW	290
	IDG	CW	0.855	2956	5000	1300
	HYDRAU					
	LIC	CW	0.4002	1500	1730	183
	PUMPS	CW	0.3919	1500	1730	183
	Rear pump					
	Front pump					
		CW = CLOCKWISE CCW = COUNTERCLOCKWISE				

Max starter torque varies with air temperature as follows:

Air temperature (°C)	Max torque (lb - in)
10	7440
-20	8640
-40	10800

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 14 CFR 33.4 and 14 CFR 33.5 requirements are:

MODEL RB211-	OPERATING INSTRUCTIONS	MAINTENANCE MANUAL	INSTALLATION MANUAL	ENGINE MANUAL
TRENT 768-60	F-TRENT-A330	M-TRENT-A330	EL 2837	E-TRENT-IRR
TRENT 772-60	F-TRENT-A330	M-TRENT-A330	EL 2837	E-TRENT-IRR
TRENT 772B-60	F-TRENT-A330	M-TRENT-A330	EL 2837	E-TRENT-IRR

Each of the documents listed below must state that it is approved by the European Aviation Safety Agency (EASA) or, for approvals made before September 28, 2003 by the United Kingdom Civil Aviation Authority. Any such documents including those approved under a delegated authority, are accepted by the FAA and are considered FAA approved.

- Service bulletins,
- Structural repair manuals,
- Vendor manuals,
- Aircraft flight manuals, and
- Overhaul and maintenance manuals.
- Technical Variances

These approvals pertain to the type design only.

NOTE 11. The following emissions standards promulgated in 14 CFR part 34, amendment 5a, effective October 23, 2013, and 40 CFR part 87, effective October 31, 2012, have been complied with for: RB211 TRENT 768-60; RB211 TRENT 772-60; and RB211 TRENT 772B-60.

Fuel Venting Emission Standards: 14 CFR §§ 34.10(a) and 34.11; in addition, 40 CFR §§ 87.10(a) and 87.11.

Smoke Number (SN) Emission Standards: 14 CFR 34.21(e)(2); in addition, 40 CFR 87.23(c)(1).

Carbon Monoxide (CO) Emission Standards: 14 CFR 34.21(d)(1)(ii); in addition, 40 CFR 87.23(c)(1).

Hydrocarbons (HC) Emission Standards: 14 CFR 34.21(d)(1)(i); in addition, 40 CFR 87.23(c)(1).

Oxides of Nitrogen (NO_x) Emission Standards: 14 CFR 34.23(b)(1); in addition, 40 CFR 87.23(c)(3).

In addition to the FAA's finding of compliance based on the certification requirements defined in this TCDS, the engine manufacturer has declared that the ICAO emissions standards identified in Annex 16, Volume II, Third Edition, Part III, Chapter 2, Section 2.2.2 for SN, Section 2.3.2 for CO and HC, Section 2.3.2.e for NO_x (also known as CAEP/8), and Part II Chapter 2 for fuel venting have also been demonstrated.

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 are fitted with an independent IP and LP spool overspeed governor. Dispatch with this item unserviceable is not permitted.

NOTE 15. These engines satisfy the certification basis as defined in this Data Sheet when operating with the FADEC in reversionary control mode.

NOTE 16. 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 2,000 feet and 8,000 feet.

NOTE 17. The RB211 Trent 700 series engines have been approved to operate with certain faults present in the control system, based on satisfaction of 14 CFR part 33 requirements and appropriate 14 CFR part 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 in adapting these fault categories to the aircraft maintenance and display systems; however, the maximum operating intervals are restricted as shown above.

NOTE 18. 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.

NOTE 19. Post modification 73-C780, the maximum Take-off speeds 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 indicated Maximum Take-off speeds as the pre-modification standard, i.e., 99.0% and 100.0%.

NOTE 20. Post modification 73-E502 for the data entry plug for the selection of increased HP redline speed, the maximum take-off speed for the HP shaft is increased to 101.7%. However the speed signal transmitted to the aircraft is trimmed to maintain the same cockpit indication as the pre mod standard i.e. 100.0%.

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