

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION TYPE CERTIFICATE DATA SHEET E00075EN	TCDS NUMBER E00075EN DATE: April 25, 2019 Revision 1 ROLLS-ROYCE, Deutschland Ltd. & Co. KG MODELS: RB211-TRENT 970-84 RB211-TRENT 977-84 RB211-TRENT 970B-84 RB211-TRENT 977B-84 RB211-TRENT 972-84 RB211-TRENT 980-84 RB211-TRENT 972B-84
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Engines of models described herein conforming with this data sheet (which is part of Type Certificate Number E00075EN) 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, Deutschland Ltd. & Co. KG
 Eschenweg 11, 15827 Blankenfelde-Mahlow, Germany

TYPE CERTIFICATE (TC) RECORD: Rolls-Royce, plc transferred TC E00075EN to
 Rolls-Royce, Deutschland on February 21, 2019

I. MODELS	RB211-Trent 970-84	RB211-Trent 970B-84	RB211-Trent 972-84	RB211-Trent 972B-84	RB211-Trent 977-84	RB211-Trent 977B-84	RB211-Trent 980-84
TYPE	High by-pass turbofan axial flow, three-rotor. Single-stage low pressure fan with a swept fan blade (9.68 ft diameter) and OGVs to increase efficiency and reduce noise driven by a five-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. The LP and IP assemblies rotate independently in a counter-clockwise direction. The HP assembly rotates clockwise aft looking fwd (ALF). The engine control system utilizes an Electric Engine Control (EEC) which has an airframe interface for digital bus communications (AFDX).						
RATINGS (See NOTE 1) Maximum continuous Thrust, pounds net at sea level static	71,850	--	--	--	--	--	--
Takeoff (5 minutes, see NOTE 20) Thrust, pounds net at sea level static	75,152	78,304	76,752	80,213	80,781	83,835	84,098
Equivalent bare engine thrust, pounds (see NOTE 9)	76,155	79,337	77,766	81,271	81,846	84,940	85,202
	1. The 970-84, 972-84, 977-84 and 980-84 are flat rated to ISA + 15°C at all altitudes 2. The 970B-84, 972B-84 and 977B-84 are flat rated to ISA + 10°C at all altitudes						

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LEGEND: "--" INDICATES "SAME AS PRECEDING MODEL"
 "----" NOT APPLICABLE
 NOTE: SIGNIFICANT CHANGES ARE BLACK-LINED IN THE LEFT MARGIN

I. MODELS	RB211-Trent 970-84	RB211-Trent 970B-84	RB211-Trent 972-84	RB211-Trent 972B-84	RB211-Trent 977-84	RB211-Trent 977B-84	RB211-Trent 980-84
PRINCIPAL DIMENSIONS, inches							
Length	209	--	--	--	--	--	--
From tip of spinner minus rubber tip to Tail Bearing Housing							
Radius, around centerline includes VFG cooler, not including drains mast	77.5	--	--	--	--	--	--
CENTER OF GRAVITY, inches							
Aft from powerplant station 100	23.1	--	--	--	--	--	--
Below centerline	0.6	--	--	--	--	--	--
Starboard from engine centerline	-2.8	--	--	--	--	--	--
WEIGHT Dry Basic Engine (lbs) (not including fluids and Nacelle EBU)	13842	--	--	--	--	--	--
ENGINE PARTICULARS							
BUILD STANDARD	2244	2245	2274	2275	2247	2248	2249
RR Drawing Introduction Sheet (DIS)	Issue 3	--	--	--	--	--	--

FUELS

APPROVED FUELS

See relevant Engine Operating Instructions for approved fuels.

APPROVED OILS

See relevant Engine Operating Instructions for approved oils.

OIL CAPACITY

Nominal total system capacity

35.5	--	--	--	--	--	--
Nominal oil tank capacity	22.2	--	--	--	--	--
Minimum usable oil (including effect of attitude)	12	--	--	--	--	--

Nominal oil tank capacity

Minimum usable oil (including effect of attitude)

	RB211-Trent 970-84	RB211-Trent 970B-84	RB211 Trent 972-84	RB211-Trent 972B-84	RB211-Trent 977-84	RB211-Trent 977B-84	RB211-Trent 980-84
COMPONENTS							
ELECTRONIC FULL AUTHORITY DIGITAL ENGINE CONTROL (FADEC)							
Hamilton Sunstrand EEC	1002600-1	--	--	--	--	--	--
Software standard	RRA380-402	--	--	--	--	--	--
Engine Monitoring Unit	271-123-034-034	--	--	--	--	--	--
Vibrometer	271-123-811-201	--	--	--	--	--	--
Software standard							
IGNITION SYSTEM							
Ignition system plugs							
Goodrich Rosemount (Champion)	CH34829	--	--	--	--	--	--
Ignition system units							
Goodrich Rosemount (Champion)	CH92077	--	--	--	--	--	--
EQUIPMENT	For identification of equipment approved for use on these engines, refer to Rolls-Royce installation manual DKC 237292.						

CERTIFICATION BASIS

FAR 33 effective February 1, 1965, as amended by FAR 33-1 through 33-20. Pursuant to FAR 21.29(a)(1)(ii), the Type Certificate was issued in validation of the Joint Aviation Authorities Certification Standards JAR-E Change 11 dated 1 November 2001, and EASA CS-E 800(c) issue 1 for large flocking bird ingestion which were found to provide a level of safety equivalent to that provided by FAR 33.76.

The FAA validated this product under U.S. Type Certificate Number E00075EN. Effective September 28, 2003, the European Aviation Safety Agency (EASA) began oversight of this product on behalf of the UK.

<u>MODEL</u>	<u>APPLICATION DATE</u>	<u>ISSUED DATE</u>
RB211 TRENT 970-84	October 1, 2002	December 4, 2006
RB211 TRENT 970B-84	October 1, 2002	December 4, 2006
RB211 TRENT 977-84	October 1, 2002	December 4, 2006
RB211 TRENT 980-84	October 1, 2002	December 4, 2006
RB211 TRENT 977B-84	May 6, 2003	December 4, 2006
RB211 TRENT 972-84	April 11, 2005	December 4, 2006
RB211 TRENT 972B-84	April 11, 2005	December 4, 2006

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 E00075EN, is in a condition for safe operation and has undergone a final operational check.

Reference FAR Section 21.500, which provides for the airworthiness acceptance of aircraft engines manufactured outside of the United States for which a U.S. type certificate has been issued.

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

NOTE 1. The engine thrust rating is for an engine on a test bed running at the same TET as an engine installed on an aircraft, operating to a rated thrust at kink point day temperature, at the point of rotation for take-off. The bare engine thrust is the take-off thrust plus the thrust that is lost through engine nacelle, by-pass duct and nozzle leakages and inefficiencies, recognizing that these components do not form part of the engine type design.

NOTE 2. MAXIMUM PERMISSIBLE ENGINE ROTOR SPEEDS (%)

100% HP = 12,200 rpm / 100% IP = 8,300 rpm / 100% LP = 2,900 rpm.

Takeoff (5 minutes, see NOTE 20)	
HP	97.8%
IP	97.8%
LP	96.1%

Maximum continuous (see note 22)	
HP	97.7%
IP	97.8%
LP	96.1%

NOTE: Stabilized operation in the speed range 64% to 72% NL or above 78% NL is not permitted during static operations with forward airspeed less than 45 knots. Passing through the speed range of 64% to 72% while increasing or decreasing thrust is permitted.

NOTE 3. MAXIMUM PERMISSIBLE TEMPERATURES

TURBINE GAS TEMPERATURE (TGT) - Trimmed (°C):

Starting (Momentary maximum during starts below 50% HP speed):	700
Maximum for Takeoff (5 minutes) (see NOTE 20)	900
Maximum continuous (unrestricted)	850
Maximum Overtemperature (20 seconds)	920 (See NOTE 21)
Maximum during relights in flight	850

NOTE: TGT is measured by thermocouples positioned at the 1st stage Nozzle Guide Vane of the LP Turbine.

FUEL (°C): (See NOTE 15)

Minimum fuel temp in flight:	-54 (or the freeze point, whichever is higher)
Minimum fuel temp for ground starting:	-20 (for the Hydro Mechanical Unit and LP fuel filter)
Maximum fuel temp	
(i) On ground to top of climb:	55
(ii) At top of descent:	50

OIL (°C)

Combined scavenge	
Minimum for starting	-10
Minimum for opening up	60
Maximum for unrestricted use	196

NOTE 4. PRESSURE LIMITS:

FUEL Pressure (psi):

Minimum Fuel Pressure (psi)
Minimum absolute inlet pressure (measured at the pylon interface): 5

NOTE 4 (Cont.) FUEL pressure:(continued):

Maximum pressure at the engine inlet (measured at the pylon interface)

(i) Continuous	40
(ii) Transient	100
(iii) Static	50

OIL pressure (psi):

Minimum Oil pressure (psi):

(i) Ground idle to 70% HP rpm	25
(ii) Above 95% HP rpm	50

Maximum Allowable Oil Consumption (l/hr): 0.46

NOTE 5. MAXIMUM PERMISSIBLE COMPRESSOR AIR BLEEDS

The maximum allowable air delivery for aircraft services, excluding powerplant anti-icing is given below. This air is automatically scheduled from the engine IP stage 8 at take-off, cruise and climb and HP stage 6 compressor bleed ports at descent and idle ground conditions. At holding conditions (from 5,000 ft to 30,000 ft), switchover from IP8 to HP6 Stage bleed occurs.

- At normal operating conditions (4 bleeds and 2 aircraft air-conditioning packs), air is bled from the IP off-take whenever IP port pressure is greater than 30.0 psi. For IP off-take pressures lower than this value, air is bled from the HP off-take.
- At abnormal operating conditions (2 bleeds and 1 aircraft air-conditioning pack), air is bled from the IP off-take as long as the IP port pressure is greater than 33.5 psi (34.5 psi in icing conditions); otherwise, air is bled from the HP off-take.

Maximum HP6 bleed (% W26): This bleed decreases linearly between the values listed below for the 1020°C turbine entry temperature (TET) and switchover points.

- | | |
|------------------------------------|--------------|
| 1. Normal Operation | |
| i. Low idle and up to 1020°C TET | 12.1 to 11.8 |
| ii. 1020 °C to 1218 °C | 11.8 to 5.3 |
| 2. Abnormal (One engine operation) | |
| i. Low idle and up to 1103°C TET | 13.5 to 13.1 |
| ii. 1103 °C to 1173 °C | 13.1 to 13.1 |
| ii. 1173 °C to 1258 °C | 13.1 to 13.1 |

Maximum IP8 bleed (% W24): This bleed (IP8) decreases linearly between the values listed below for the maximum continuous and maximum takeoff points.

- | | |
|------------------------------------|------------|
| 1. Normal Operation | |
| i. 1218 °C to 1393 °C | 5.9 to 3.8 |
| ii. 1393 °C to 1488 °C | 3.8 to 1.7 |
| iii. 1488 °C to Max take-off | 1.7 to 1.8 |
| 2. Abnormal (One engine operation) | |
| i. 1258 °C to 1504 °C | 6.3 to 3.3 |
| ii. 1504 °C to Max take-off | 3.3 to 3.1 |

AIR DELIVERY FOR POWERPLANT ANTI-ICING

Maximum HP3 bleed (% W26):

This bleed decreases linearly between the values listed below. The nacelle thermal anti-icing flow demand (HP3) is modulated via a regulating valve to provide a constant flow function at the engine/ nacelle.

- | | |
|------------------------------------|------------|
| 1. Normal Operation | |
| i. Low idle to 888°C | 1.6 to 1.5 |
| ii. 888 °C to 1293 °C | 1.5 to 1.4 |
| iii. 1293 °C to 1548 °C | 1.4 to 1.2 |
| iv. 1548 °C to Max take-off | 1.2 to 1.1 |
| 2. Abnormal (One engine operation) | |
| i. Low idle to 888 °C | 1.8 to 1.8 |
| ii. . 888 °C to 1293 °C | 1.8 to 1.3 |
| iii. 1293 °C to 1548 °C | 1.3 to 0.8 |
| iv. 1548 °C to Max take-off | 0.8 to 0.8 |

Precooler flow (%W120) varies linearly between the points listed.

- I. Normal and Abnormal Operation
 - i. Idle to 1101 °C 0.62
 - ii 1101 °C to 1328 °C 0.62 to 0.27
 - iii. 1328 °C to 1598 °C 0.27

NOTE 6. SHAFT POWER EXTRACTION LIMITATIONS

Accessory drive provisions (continuous power as listed may be extracted under all engine operating conditions)						
MODELS	DRIVE	ROTATION	SPEED RATIO TO HP ROTOR SPEED	TORQUE (pound - inches)		OVERHANG (in.-lbs)
				CONTINUOUS	MAXIMUM INSTANTANEOUS	
ALL MODELS	HYDRAULIC PUMPS	CCW	0.33		8497	403
	VFG	CCW	1.81		8860	1172
		CW = CLOCKWISE CCW = COUNTERCLOCKWISE				

NOTE 7. Reserved

NOTE 8. Life-limited parts are identified in Time Limits Manual (See NOTE 10).

NOTE 9. The Equivalent Bare Engine Take-off and Maximum Continuous thrust quoted above are derived from the approved Net Take-off and Net Maximum Continuous thrust by excluding the losses attributable to the inlet, cold convergent nozzle, hot nozzle, by-pass duct flow leakage and the after body. No bleed or power off takes are assumed.

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

RB211-TRENT 900 SERIES	OPERATING INSTRUCTIONS	MAINTENANCE MANUAL	INSTALLATION MANUAL	ENGINE MANUAL	TIME LIMITS MANUAL
ALL MODELS	OI-Trent-A380	M-Trent-A380	DKC-237292	E-Trent-A380	T-Trent-9RR

Each of the documents listed above must state that it is approved by the European Aviation Safety Agency (EASA). 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. These engines meet the smoke and gaseous emission requirements of FAR 34.

NOTE 12. The software of the Engine Electronic Control is designated Level “A” as defined by RTCA DO-178B/ED12B.

NOTE 13. The software of the Engine Monitoring Unit is designated Level “C” as defined by RTCA DO-178B/ED12B.

NOTE 14. EMI/ Lightning (Refer to the Installation Manual for details.)

- NOTE 15.** The fuel temperature is taken as that in the wing tank. The minimum and maximum fuel temperature and pressure are not measured on the engine and therefore, not provided to the flight deck. However, the wing tank temperature is available on the flight deck and is assumed that there is negligible difference in temperature between the tank and the engine inlet.
- NOTE 16.** The acceleration from 15% to 95% of the Trent 980 rated take-off power is 5.6 seconds.
- NOTE 17.** VARIANTS
- | | |
|---------------------|--|
| RB211-Trent 970-84 | Basic model. |
| RB211-Trent 970B-84 | Same as basic model except for increased thrust ratings. |
| RB211 Trent 972-84 | Same as basic model except for increased thrust ratings |
| RB211-Trent 972B-84 | Same as basic model except for increased thrust ratings |
| RB211-Trent 977-84 | Same as basic model except for increased thrust ratings |
| RB211-Trent 977B-84 | Same as basic model except for increased thrust ratings |
| RB211-Trent 980-84 | Same as basic model except for increased thrust ratings |
- NOTE 18.** The engine models (RB211 Trent 970-84, 970B-84, 972-84, 972B-84, 977-84, 977B-84 and 980-84) have not been approved for Time Limited Dispatch.
- NOTE 19.** These engines are approved for use with Aircelle Thrust Reverser Unit (TRU) at the inboard engine positions (Part number ASE 0010-XX-0 for the left hand installation and ASE 0050-XX-0 for the right hand installation) and for a fixed fan duct (FFD) in the outboard engine positions (Part numbers ASE 5010-XX-0 for the left hand installation and ASE 5050-XX-0 for the right hand installation), The TRU and FFD do not form part of the engine type design and must be certified as part of the aircraft type design.
- NOTE 20.** 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 not more than 5 minutes.
- NOTE 21.** The engine models (RB211 Trent 970-84, 970B-84, 972-84, 972B-84, 977-84, 977B-84 and 980-84) are approved for a maximum exhaust gas overtemperature of 920°C for inadvertent use for periods of up to 20 seconds without requiring maintenance action. The cause of the overtemperature must be investigated and corrected.
- NOTE 22.** No overhaul is authorized until the EM and MM are approved and delivered.
- NOTE 23.** The maximum Continuous Speed limitations defined in this Data Sheet are not displayed as limitations on the A380 flight deck. In accordance with the equivalent safety finding against JAR-E740(f), non display of these limitations is acceptable.

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