Civil Aviation Authority
United Kingdom

TYPE-CERTIFICATE DATA SHEET

UK.TC.E.00059

for

RB211 Trent 900 series engines

Type Certificate Holder

Rolls-Royce Deutschland Ltd & Co KG

Eschenweg 11

Dahlewitz

15827 Blankenfelde-Mahlow

Germany

Model(s):	RB211 Trent 970-84 RB211 Trent 970B-84 RB211 Trent 972-84 RB211 Trent 972B-84 RB211 Trent 972E-84 RB211 Trent 977-84 RB211 Trent 977B-84 RB211 Trent 980-84
Issue:	1
Date of issue:	11 January 2023

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Section 1 General (All Models)

I. General

This Type-Certificate Data Sheet (TCDS) is the concise definition of the type-certificated product accepted and or approved by the CAA in the UK for the affected types and models.

This TCDS includes:

1. Details of the type design that affect the TCDS that have been approved or accepted by the CAA in the UK from 01 January 2021.

2. Details of the type design that affected the TCDS and were approved or accepted by EASA before 01 January 2021, and were incorporated into EASA TCDS EASA.E.012 at Issue 10 dated 22 November 2019 and are therefore accepted by the UK under Article 15 of Annex 30 of the UK-EU Trade and Cooperation Agreement.

Section 2 RB211 Trent 900

I. General

1. Type / Variant or Model

RB211 Trent 970-84, 970B-84, 972-84, 972B-84, 972E-84, 977-84, 977B-84, 980-84. These models are approved for use on multi-engined civil aircraft classified in the Transport Category (Passenger) at the ratings and within the operating limitations specified below, subject to compliance with the powerplant installation requirements appropriate to approved installations. Within this TCDS, the term 'RB211' is voluntarily omitted from the model names for simplification.

2. Type Certificate Holder

Rolls-Royce Deutschland Ltd & Co KG

Eschenweg 11

Dahlewitz

15827 Blankenfelde-Mahlow Germany

DOA ref.: EASA.21J.065

formerly (until 20 February 2019):

Rolls-Royce plc

62 Buckingham Gate

London

SW1E 6AT

United Kingdom

Former DOA ref.: EASA.21J.035

3. Manufacturer

Rolls-Royce plc

4. Date of Application at EASA (Certificating Authority)

Model	Application Date
Trent 970-84	03 April 2002
Trent 970B-84	03 April 2002
Trent 977-84	03 April 2002
Trent 980-84	03 April 2002
Trent 977B-84	18 March 2003
Trent 972-84	11 April 2005
Trent 972B-84	11 April 2005
Trent 972E-84	10 August 2015

5. Type Certification date at EASA (Certificating Authority)

Model	EASA Certification Date
Trent 970-84	29 October 2004
Trent 970B-84	29 October 2004
Trent 977-84	29 October 2004
Trent 980-84	29 October 2004
Trent 977B-84	29 October 2004
Trent 972-84	11 August 2005
Trent 972B-84	11 August 2005
Trent 972E-84	28 April 2017

II. Certification Basis

1. Reference Date for determining the applicable airworthiness requirements

03 April 2002

2. State of Design Airworthiness Authority Type Certification Data Sheet Number

EASA.E.012

3. State of Design Airworthiness Authority Certification Basis

Refer to TCDS EASA.E.012.

4. UK CAA Certification Basis

4.1 Airworthiness Standards

Model	Airworthiness Standards
Trent 970-84	JAR-E, Amendment 11, dated 1 November 2001. CS-E 800 (c) of CS-E Initial Issue, dated 24 October 2003, for Large Flocking Bird Ingestion. CS-E 580 (b) of CS-E Initial Issue, dated 24 October 2003, for Failure of External Air Ducts.
Trent 970B-84	
Trent 977-84	
Trent 980-84	
Trent 977B-84	
Trent 972-84	
Trent 972B-84	
Trent 972E-84	JAR-E, Amendment 11, dated 1 November 2001. CS-E 800 (c) of CS-E Initial Issue, dated 24 October 2003, for Large Flocking Bird Ingestion.

4.2 Special Conditions (SC)

Model	Special Conditions (SC)
Trent 970-84	JAR-E 50 Programmable Logic Devices
Trent 970B-84	
Trent 977-84	
Trent 980-84	
Trent 977B-84	
Trent 972-84	
Trent 972B-84	
Trent 972E-84	

4.3 Equivalent Safety Findings (ESF)

Model	Equivalent Safety Findings
Trent 970-84	JAR-E 740 150 Hour Endurance Test JAR-E 740 (f) Non declaration or display of Maximum Continuous Speed Limitation JAR-E 800 (c) Medium Bird Ingestion – Fan rig test JAR-E 800 (c)(iii) Medium Bird Ingestion – Flock encounter
Trent 970B-84	
Trent 977-84	
Trent 980-84	
Trent 977B-84	
Trent 972-84	
Trent 972B-84	
Trent 972E-84	

4.4 Deviations

Model	Deviations
Trent 970-84	JAR-E 890 (a) Engine Calibration in Reverse Thrust
Trent 970B-84	
Trent 977-84	
Trent 980-84	
Trent 977B-84	
Trent 972-84	
Trent 972B-84	
Trent 972E-84	

4.5 Environmental Protection

Model	Environmental Protection Requirements
Trent 970B-84	CS-34 Amendment 2, dated 12 January 2016. ICAO Annex 16, Volume II, Amendment 8 as applicable from 01 January 2015 in accordance with Commission Reg. (EU) No. 2016/4 dated 25 January 2016. For NOx, the standards in accordance with Part III, Chapter 2, § 2.3.2 d) (CAEP/6) apply.
Trent 972B-84	
Trent 977-84	
Trent 977B-84	
Trent 980-84	
Trent 970-84	CS-34 Amendment 4 as implemented by ED Decision 2021/011/R (applicable 25 July 2021), ICAO Annex 16 Volume II, Amendment 10 applicable 1 January 2021 as implemented into EU legislation 27 April 2021. NOx standard in accordance with ICAO Annex 16 Volume II, Part III, Chapter 2, § 2.3.2 e) (CAEP/8). Maximum nvPM mass concentration levels in compliance with Part III, Chapter 4, paragraph 4.2.2.1. nvPM mass and number emissions in compliance with Part III, Chapter 4, paragraph 4.2.2.2 a) 1) and 4.2.2.2 b) 1) (CAEP/11 In- Production standard). Compliance has also been demonstrated with the nvPM standard from ICAO Annex 16 Volume II, Amendment 10, Part III, Chapter 4, paragraph 4.2.2.2 a) 2) and 4.2.2.2 b) 2) (CAEP/11 New-Type standard).
Trent 972-84	
Trent 972E-84	

III. Technical Characteristics

1. Type Design Definition

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

Model	Part Number
Trent 970-84	DIS 2244 Issue 4
Trent 970B-84	DIS 2245 Issue 4
Trent 977-84	DIS 2247 Issue 4
Trent 980-84	DIS 2249 Issue 4
Trent 977B-84	DIS 2248 Issue 4
Trent 972-84	DIS 2274 Issue 4
Trent 972B-84	DIS 2275 Issue 4
Trent 972E-84	DIS 2390 Issue 1

2. Description

The Trent 900 engine is a three shaft high bypass ratio, axial flow, turbofan with Low Pressure, Intermediate Pressure and High Pressure Compressors driven by separate turbines through coaxial shafts. The LP Compressor fan diameter is 2.95m with a swept fan blade and OGV's to increase efficiency and reduce noise. The combustion system consists of a single annular combustor. The LP and IP assemblies rotate independently in an anti-clockwise direction, the HP assembly rotates clockwise, when viewed from the rear of the engine. The Compressor and Turbine have the following features:

Compressor	Turbine
LP – Single stage	LP – 5 stage
IP – 8 stage	IP – single stage
HP – 6 stage	HP – single stage

The engine control system utilises an EEC (Electronic Engine Controller) which has an airframe interface for digital bus communications (AFDX).

3. Equipment

For details of equipment included in the type design definition: refer to Installation Manual. For details of equipment supplied by the Airframe TC holder: refer to Installation Manual.

At engine certification, the engine has been approved for use with Aircelle Thrust Reverser Unit (TRU) at the inboard engine positions (part numbers 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.

4. Dimensions

Dimensions – Milimeters (Inches)	
Overall Length	5477.5 (215.65)
Maximum Diameter	3944 (155.28)

Length – tip of spinner minus rubber tip to Tail Bearing Housing Plug Mount Flange.

Diameter – around centre line, including VFG Cooler, not including drains mast.

5. Dry Weight

Dry Engine Weight – kg (lb)	6246 (13769)

Not including fluids and Nacelle EBU.

6. Ratings

The ISA sea-level static thrust ratings are:

	Rating Thrust			
Models	**Take-off (net) (5 minutes) kN (lbf)**	**Equivalent Bare Engine Take-off kN (lbf)**	**Maximum Continuous (net) kN (lbf)**	**Equivalent Bare Engine Maximum Continuous kN (lbf)**
Trent 970-84	334.29 (75152)	338.75 (76155)	319.60 (71850)	323.91 (72818)
Trent 972-84	341.41 (76752)	345.95 (77766)	319.60 (71850)	323.91 (72818)
Trent 970B-84	348.31 (78304)	352.91 (79337)	319.60 (71850)	323.91 (72818)
Trent 972B-84	356.81 (80213)	361.51 (81271)	319.60 (71850)	323.91 (72818)
Trent 977-84	359.33 (80781)	364.07 (81846)	319.60 (71850)	323.91 (72818)
Trent 977B-84	372.92 (83835)	377.83 (84940)	319.60 (71850)	323.91 (72818)
Trent 980-84	374.09 (84098)	379.00 (85202)	319.60 (71850)	323.91 (72818)
Trent 972E-84	341.41 (76752)	345.95 (77766)	319.60 (71850)	323.91 (72818)

Refer to Notes 4 & 5.

7. Control System

The engine is equipped with a Full Authority Digital Engine Control (FADEC) system. The engine is also equipped with an Engine Monitoring Unit (EMU).

	FADEC		**EMU**	
Models	**EEC Software Standard**	**EEC P/N**	**EMU Software Standard**	**EMU P/N**
Trent 970-84	RRY24-0106-380A or later approved standard	1002600-3 or later approved standard	271-123-800-411 or later approved standard	271-123-035-036 or later approved standard
Trent 970B-84				
Trent 977-84				
Trent 980-84				
Trent 977B-84				
Trent 972-84				
Trent 972B-84				
Trent 972E-84	RRY22-0122-380A or later approved standard			

Refer to the Installation Manual and Operating Instructions for further information.

Refer to Notes 2, 3 & 8.

8. Fluids (Fuel, Oil Coolant, Additives)

8.1. Fuel and Additives

Refer to the Operating Instructions for information on approved fuel and additive specifications for the Trent 900.

8.2. Oil

Refer to the Operating Instructions for information on approved oil specifications for the Trent 900.

9. Aircraft Accessory Drives

The loads, weights and power extraction of the accessory gearbox aircraft power off takes (two hydraulic pumps and one variable frequency generator) are described in the Installation Manual.

10. Maximum Permissible Air Bleed Extraction

Environmental Control System Bleed and Wing Anti-Icing Flow ('Customer Bleed') is bled from IP8 off take at take-off, cruise and climb, and from HP6 at descent and idle ground conditions. At holding conditions (from 1524 m to 9144 m) (5000ft to 30000ft), switch-over from IP8 to HP6 off take takes place.

The maximum allowable Customer Bleed and nacelle thermal anti-icing flow is given in the tables below.

Bleed flows vary linearly between the points listed.

Customer Bleed Off-takes for Normal Operation.

TET (T41) °K	Customer Bleed (HP6) %W26	Customer Bleed (IP8) %W24
Low Idle to 1251	12.5 to 12	n/a
1251 to 1545	12 to 5.5	n/a
1545 to 1672	n/a	5.11 to 4.1
1672 to 1787	n/a	4.1 to 1.95
1787 to Max Take-off	n/a	1.95

At normal operating conditions (4 bleeds and 2 aircraft air-conditioning packs), air is bled from IP off take whenever IP port pressure is greater than 206.8 kPa. For IP off take pressures lower than this value, air is bled from HP.

Customer Bleed Off-takes for Abnormal Operation.

TET (T41) °K	Customer Bleed (HP6) %W26	Customer Bleed (IP8) %W24
Low Idle to 1272	14.9 to 14.35	n/a
1272 to 1406	14.35 to 13.25	n/a
1406 to 1662	13.25 to 6.6	n/a
1662 to 1803	n/a	6.35 to 2.6
1803 to Max Take-off	n/a	2.6

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 231 kPa (237.9 kPa in icing conditions); otherwise, air is bled from the HP off take.

The nacelle thermal anti-icing flow demand (HP3) is modulated via a regulating valve to provide a constant flow function at the engine/nacelle.

Nacelle Thermal Anti-Icing Bleed Off-takes for Normal and Abnormal Operations.

TET (T41) °K	Nacelle Thermal Anti-Ice Bleed (HP3) %W26
Low Idle to 1160	1.19
1160 to 1565	1.19 linearly decreasing to 1.07
1565 to 1820	1.07 linearly decreasing to 0.50
1820 to Max Take-off	0.50

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 Operations.

TET (T41) °K	Pre-cooler Flow (LPC) %W120
Idle to 1373	0.62
1373 to 1600	0.62 to 0.27
1600 to 1870	0.27

Note: W120 is Fan inlet flow

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 Installation Manual for details of the Operating Envelope, including the air inlet distortion at the engine inlet.

At take-off ratings, the Trent 970-84, 972-84, 972E-84, 977-84 and 980-84 are flat rated to ISA +15°C at all altitudes.

At take-off ratings, the Trent 970B-84, 972B-84 and 977B-84 are flat rated to ISA +10°C at all altitudes.

1.2. Turbine Gas Temperature (TGT) - Trimmed

Maximum TGT (°C)	
Below 50% HP speed, maximum during ground starts	700
Maximum during in-flight relights	850
Maximum for take-off (5 min. limit) – refer to Note 5	900
Maximum Continuous (unrestricted duration)	850
Maximum over-temperature (20-second limit) – refer to Note 14	920

Refer to Notes 5, 6 and 16.

1.3. Fuel Temperature

Fuel Temperature (°C)		
Minimum In flight		minus 54
Maximum		
(i)	On ground to top of climb	55
(ii)	At the top of descent	50

Refer to Note 7.

Refer to the Installation Manual for additional information.

1.4. Oil Temperature

Combined Oil Scavenge Temperature (°C)		
Minimum for engine starting		
(i)	With Special Starting procedure	minus 40
(ii)	With no Special Starting procedure	minus 30
Minimum for acceleration to take off power		40
Maximum for unrestricted use		196

Note: In temperature les than minus 30°C but not less than minus 40°C, the Special Starting procedure as defined in the Operating Instructions must be followed..

2. Pressure Limits

2.1. Fuel Pressure

Fuel Pressure - measured at the pylon interface – kPa (psi)		
Minimum absolute inlet pressure		34 (5)
Maximum pressure at inlet		
(i)	Continuous	276 (40)
(ii)	Transiently	690 (100)
(iii)	Static	345 (50)

2.2. Oil Pressure

Minimum oil pressure:

Oil Pressure– kPa (psi)		
Minimum oil ptrddutr		
(i)	Ground idle to 70% HP rpm	172 (25)
(ii)	Above 95% HP rpm	344 (50)

3. Maximum / Minimum Permissible Rotor Speeds.

Maximum Permissible Rotor Speeds (rpm)	**HP**	**IP**	**LP**
Reference speeds, 100% rpm	12200	8300	2900
Maximum for Take-off (5 minute limit)- Refer to Note 5	97.8%	98.7%	97.2%
Maximum Over-speed (20-second limit) – Refer to Note 14	-	99.5%	-
Maximum Continuous Refer to Note 11	97.7%	97.8%	97.2%

For all engine models with their respective minimum approved software (defined in Section III.7) or later approved standard installed, the Control System prevents stabilised operation of the engine in the range of 64% to 72% LP shaft speed (N1) (Keep Out Zone) and above 78% LP shaft speed (N1) (Modified Engine Take-Off Thrust Setting) during ground operations, in primary and rated reversionary forward thrust control modes.

This function is designed against inadvertent operation by the following measures: -

- Protection is active only on the ground,
- Protection is enabled only below 60 knots,
- Protection is de-activated for flight once stabilised power is achieved, and is activated again only when TRA is retarded below Climb (i.e. Autothrust dis-engaged).

The Modified Engine Take-Off Thrust Setting logic is active below 32.5 knots. The Keep Out Zone logic is active below 60 knots.

Passing through the 64% to 72% LP shaft speed range while increasing or decreasing thrust is not prevented..

4. Installation Assumptions

Refer to Installation Manual for details.

5. Time Limited Dispatch

The engine has been approved for Time Limited Dispatch. The maximum rectification period for each dispatchable state is specified in the Installation Manual..

V. Operating and Service Instructions

Document	**Document Reference**
Installation Manual including Engine Control System Dispatch Limits.	DKC237292
Operating Instructions	OI-Trent-A380
Engine Manual	E-Trent -A380
Maintenance Manual	M-Trent-A380
Time Limites Manual	T-Trent-A380
Service Bulletins	RB211- as required

Refer to Note 10.

VI. Notes

1. Not used.
2. The software of the Engine Electronic Control is designated Level “A” as defined by EUROCAE ED-12B/RTCA DO178B.
3. The software of the Engine Monitoring Unit is in part designated Level “C” and part level “E” as defined by EUROCAE ED-12B/RTCA DO178B.
4. The Equivalent Bare Engine Take-off and Maximum Continuous thrust quoted above is 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.
5. 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.
6. Turbine Gas Temperature (TGT) is measured by thermocouples positioned at the 1st stage Nozzle Guide Vanes of the LP Turbine.
7. 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 it is assumed that there is negligible differences in temperature between the tank and the engine inlet.
8. HIRF, EMI/Lightning : Refer to Installation Manual for details.
9. Not used.
10. The engine components subjected to a limited service life are specified in the Airworthiness Limitations Section of the Time Limits Manual.
11. The Maximum Continuous Speed limitations defined in this Data Sheet are not displayed as limitations on the A380 flight desk. In accordance with the Equivalent Safety Finding against JAR-E740 (f), non display of these limitations is acceptable.
12. The acceleration from 15% to 95% rated take off power is 5,6 seconds.
13. Not used.
14. The Trent 900 is approved for a maximum exhaust gas over-temperature of 920 Degrees Centigrade (Trimmed), and for a maximum IP over-speed of 99.5%, for inadvertent use for periods of up to 20 seconds without requiring maintenance action. The cause of the over-temperature or over-speed must be investigated and corrected.
15. Not used.
16. TGT trimming. The EEC software contains a “trimming” function. This takes the measured TGT value, reduced it by a pre-determined amount, and sends this trimmed TGT value to the cockpit display.

TGT Trim	Maximum Takeoff (5 min. limit, see Note 5)		Maximum Continuous (unrestricted duration)		Maximum Overtemperature (refer to Note 14)		Introduced by	Essential / Comple-mentary Hardware
	Trimmed (°C) (1)	Un- trimmed (°C) (2)	Trimmed (°C) (1)	Un-trimmed (°C) (2)	Trimmed (°C) (1)	Un-trimmed (°C) (2)		
Profile 5	900	956	850	939	920	957	Minimum Service Standard	Not required
Profile 7	900	964	850	939	920	977	SB 72-G204	none
Profile 8 (3)	900	955	850	930	920	966	SB 73-G884	SB 72-G308
Profile 9 (3)	900	967	850	942	920	979	SB 73-G999	SB 72-G308
Profile 10 (4)	900	983	850	963	920	991	SB 73-H556	SB 72-G178, 72-G308, 72-G370, 72-G506, 72-G569

(1) Trimmed TGT is displayed in the cockpit.

(2) Untrimmed TGT is the temperature measured on the engine (see Note 6).

(3) Profile 8 and 9 are applicable to the Trent 970-84 and Trent 972-84 only.

(4) Profile 10 can be installed on the Trent 970-84 and 972-84 only, by way of the Service Bulletins and hardware requirements listed in the table. Profile 10 is also installed on the Trent 972E-84 as the Minimum Service Standard.

Section 3 Administration

I. Acronyms and Abbreviations

Acronym / Abbreviation	Definition
AFDX	Avionics Full-Duplex Switched Ethernet
CS-E	Certification Specifications for Engines
EASA	European Union Aviation Safety Agency
EBU	Engine Build-up Unit
EEC	Electronic Engine Controller
ESF	Equivalent Safety Finding
EMU	Engine Monitoring Unit
FADEC	Full Authority Digital Engine Control
HP	High Pressure
ICAO	International Civil Aviation Organisation
IP	Intermediate Pressure
LP	Low Pressure
SC	Special Condition
TCDS	Type Certificate Data Sheet
TRA	Thrust Resolver Angle
W24	IP Core Engine Air Mass Flow
W26	HP Core Engine Air Mass Flow
CAA	Civil Aviation Authority

II. Type Certificate Holder Record

TCH Record	Period
Rolls-Royce plc 62 Buckingham Gate Westminster London SW1E 6AT United Kingdom Design Organisation Approval No.: EASA.21J.035	From 29 October 2004 to 20 February 2019
Rolls-Royce Deutschland Ltd & Co KG Eschenweg 11 Dahlewitz 15827 Blankenfelde-Mahlow Germany Design Organisation Approval No.: EASA.21J.065	From 21 February 2019

III. Amendment Record

TCDS Issue No.	TCDS Issue Date	Changes	TC Issue and Date
1	11 Jan 2023	- Section 1 is added to provide explanatory notes about the details of the type design that affect the TCDS, that have been approved or accepted by the CAA in the UK from 01 January 2021 and that the design changes accepted by EASA before 01 January 2021 were incorporated into EASA TCDS EASA.E.012 at Issue 10 dated 22 November 2019 were therefore accepted by the UK under Article 15 of Annex 30 of the UK-EU Trade and Cooperation Agreement. - Section 2 (II) (1), (2), (3), and (4) added to provide information about certifying authority and certification basis applied by the certificating authority. - Section 2 (II) (4.5) updated with regards to the certification basis for environmental protection, in accordance with EASA Major Change certificate 10080323 dated 10 October 2022. - Two typographical corrections in agreement with the TC holder have been made as compared to the EASA TCDS E.012 Issue 11 as below: o (1) Within table for Pre-Cooler flow for normal and abnormal operation by correcting HP3 to LPC. o (2) Table 2.1 Fuel pressure item (iii) corrected from Transiently to Static	Issue 1 11 Jan 2023

– END –