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I. General

1. Type/Variants: RB211 Trent 553-61, 556-61, 556B-61, 560-61, 553A2-61, 556A2-61, 556B2-61, 560A2-61

These variants 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.

2. Type Certificate Holder:

Rolls-Royce plc
PO Box 31
Derby DE24 8BJ
United Kingdom

DOA ref.: EASA.21J.035

3. Manufacturer:

Rolls-Royce plc

4. Certification Application Date:

09 February 1998	12 January 2000	21 April 2002
RB211 Trent 553-61, 556-61, 560-61	RB211 Trent 556B-61	RB211 Trent 553A2-61, 556A2-61, 556B2-61, 560A2-61

5. Certification Reference Date: 09 February 1998

6. EASA Certification Date: 15 December 2000 for RB211 Trent 553-61, 556-61, 556B-61 and 560-61 (refer to note 1)

18 February 2003 for RB211 Trent 553A2-61, 556A2-61, 556B2-61 and 560B2-61 (refer to note 2)

II. Certification Basis

1. Airworthiness Standards and Environmental Requirements:

- JAR-E, change 9 plus Orange Papers E/96/1 and E/97/1
- Emissions and Fuel Venting: ICAO Annex 16 Volume II (second edition 1993)

2. Special Conditions:

- JAR-E 790 Ingestion of Rain & Hail
- JAR-E 800 Medium & Large Bird Ingestion
- JAR-E 530 (f) Electronic Engine Control (EEC) Fire and Overheat Protection

3. Deviations:

- JAR-E 890(a) Engine Calibration in Reverse Thrust

4. Equivalent Safety Findings:

- JAR-E 640(b)1 Static Pressure Tests
- JAR-E 740 150-Hour Endurance Test
- JAR-E 740(f) Non-Declaration or Display of Maximum Continuous Speed as an Operating Limitation (refer to Note 3)

III. Technical Characteristics

1. Type Design Definition:

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

DIS 2207 Issue 4 for Trent 553-61
DIS 2208 Issue 4 for Trent 556-61
DIS 2225 Issue 4 for Trent 556B-61
DIS 2209 Issue 4 for Trent 560-61
DIS 2230 Issue 1 for Trent 553A2-61
DIS 2231 Issue 1 for Trent 556A2-61
DIS 2232 Issue 1 for Trent 556B2-61
DIS 2233 Issue 1 for Trent 560A2-61

These build standards do not include a thrust reverser (refer to Note 4) or the engine mounts, and they do include the starter.

2. Description:

The Trent 500 series engines are 3 spool turbofans with a by-pass ratio of 8.5:1 at typical cruise thrust. They comprise a single stage Low Pressure fan, an 8 stage Intermediate pressure axial flow compressor, a 6 stage High Pressure axial flow compressor, 1 annular combustion chamber, a single stage High Pressure axial flow turbine, a single stage Intermediate Pressure axial flow turbine as well as a 5 stage Low Pressure axial flow turbine.

3. Equipment:

The equipment which is approved for use on the engine is identified in Rolls-Royce report DNS65918 issue 3 or later approved issue.

4. Dimensions:

Overall Length (mm)	4689
Maximum Radius (mm)	1687

5. Dry Weight:

Dry engine weight (kg)	4990
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(Not including fluids and Nacelle EBU)

6. Ratings:

The ISA Sea-Level Static thrust ratings are:-

Model		553-61 553A261	556-61 556A2-61	556B-61 556B2-61 ²	560-61 560A2-61
Thrust, kN (lbf)	Take-off (net), Flat rated at ISA + 15°C	248.1 (55780)	260.0 (58462)	260.0 (58462)	275.3 (61902)
	Equivalent Bare Engine ¹ Take-off	252.0 (56655)	264.0 (59350)	264.0 (59350)	279.1 (62740)
	Maximum Continuous (net), Flat rated at ISA + 10°C	197.3 (44359)	197.3 (44359)	197.3 (44359)	197.3 (44359)
	Equivalent Bare Engine ¹ Maximum Continuous	200.9 (45160)	200.9 (45160)	200.9 (45160)	200.9 (45160)
¹ The Equivalent Bare Engine Take-off Thrust quoted above is derived from the approved Net Take-off Thrust by excluding the losses attributable to the inlet, cold convergent nozzle, by-pass duct flow, leakage and the afterbody. No bleed or power offtakes are assumed.					
² The engine rated take-off thrust for 556B-61 and 556B2-61 engines is identical to the 556-61 engine at ISA Sea Level Static conditions and it is increased for take-off at altitudes above sea level. The magnitude of this increased thrust varies with altitude, Mach number and ambient temperature and provides the 560-61 rating at 7341 feet and above. This increased thrust is limited to a maximum of 5%.					

See also Notes 5 and 6.

7. Control System:

Variants RB211 Trent 553-61, 556-61, 556B-61 and 560-61 are equipped with an Electronic Engine Control System, comprising:

EEC Part Number EECS500-04 or later approved standard.
Software Part Number RRY21-0370-000L, version L3.7 or later approved standard.

Variants RB211 Trent 553A2-61, 556A2-61, 556B2-61 and 560A2-61 are equipped with an Electronic Engine Control System, comprising:

EEC Part Number EECS500-04 or later approved standard.
Software Part Numbers RRY23-0413-000L, version L4.1.3 or later approved standard.

See also Notes 7 and 8.

8. Fluids:

8.1 Fuel

Refer to the Operating Instructions for information on approved fuel and additive specifications for the Trent 500 series engines.

8.2 Oil

Nominal Total Oil System Capacity:	40 litres (70 Imperial pints)
Nominal Oil Tank Capacity:	23.2 litres (41 Imperial pints)
Minimum Usable Oil (including effect of altitude):	16 litres (28 Imperial pints)

Refer to the Operating Instructions for information on approved oil specifications for the Trent 500 series engines.

9. Accessory Drives:

The loads, weights and power extractions are defined in the Installation Manual.

10. Bleed Extraction:

The extracted air is automatically scheduled from the engine HP stage 1 and HP stage 6 compressor bleed ports by means of a shut-off valve in the HP stage 6 port, which operates in response to signals sensing the HP compressor delivery static pressure (P30S) and temperature (T30). A non-return valve in the HP stage 1 port prevents HP stage 6 air re-entering the compressor when the valve is open.

10.1 Maximum rotor speed at which bleed may be used: Unrestricted

10.2 Air delivery for aircraft services, excluding powerplant anti-icing

The switchover from the HP6 to HP1 compressor delivery bleed port occurs whenever the following conditions are met:

a) Out of Icing conditions:

Switch from HP6 to HP1: when the rising HPC delivery static pressure (P30S) reaches 758 kPa (110 psi) gauge.

Switch from HP1 to HP6: when the falling HPC delivery static pressure (P30S) reaches 689 kPa (100 psi) gauge.

b) In Icing conditions:

Switch from HP6 to HP1: when the rising HPC delivery static pressure (P30S) reaches 1069 kPa (155 psi) gauge, **or** the rising HPC delivery temperature (T30) reaches 400°C

Switch from HP1 to HP6: when the falling HPC delivery static pressure (P30S) reaches 1000 kPa (145 psi) gauge, **and** the falling HPC delivery temperature (T30) reaches 380°C

10.3 Maximum HP6 bleed (in percent of gas generator compressor flow)

This bleed decreased linearly between the values listed below for the 1190K TET (1210K TET and 1400K TET for abnormal operation) and switchover points.

a) Normal operation

- i) At low idle and up to 1190K TET 9.5%
- ii) At switchover 4.0%

b) Abnormal (one engine inoperative) operation

- i) At low idle and up to 1210K TET 16.25%
- ii) At 1400 K TET 7.7%
- iii) At switchover 4.6%

10.4 Maximum HP1 bleed (in percent of gas generator compressor flow)

This bleed decreases linearly between the values listed below for the switchover point and 1700 K TET.

	Normal operation	Abnormal operation (one engine inoperative)
At switchover	4.0%	4.6%
Up to 1700K TET	1.0%	2.0%
At Take-off	1.0%	2.0%

10.5 Maximum LP bleed (in percent of fan flow)

This bleed decreases linearly between the values listed below for 1130K TET and 1650K TET points.

a) Normal & Abnormal (one engine inoperative) operation

- i) At low idle and up to 1130K TET 0.53%
- ii) Above 1650K TET 0.25%

10.6 Maximum HP3 bleed (in percent of HPC inlet flow)

This bleed decreases linearly between the values listed below for the 1000K TET and 1600K TET points.

- i) At low idle and up to 1000K TET 1.75%
- ii) At 1600K TET and up to Take-off 1.50%

IV. Operating Limitations:

The operating limitations are applicable when the accuracy of the installed engine instrumentation is in accordance with Rolls-Royce report DNS74022 issue 1 or later approved issue.

1. Maximum Permissible Rotor Speeds

	HP	IP	LP
Reference speeds, 100% rpm	13300	9100	3900
Maximum for Take-off (5 minute limit, refer to note 5)	97.4% (refer to note 10)	99.4%	92.5%
Maximum in Reverse thrust (30 seconds)	-	-	69.0%
Maximum Continuous (refer to note 3)	- (refer to note 3)	- (refer to note 3)	- (refer to note 3)

2. 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.

1.2 Turbine Gas Temperature (°C)

For all engine marks the following Turbine Gas Temperature (°C) limits apply:

Maximum Take-off (5 minutes):	900
Maximum Continuous (unrestricted duration)	850
Maximum Over-Temperature (20 seconds)	920
Maximum during starts on the ground, below 50% HP speed	700
Maximum during relights in flight, below 50% HP speed	850
Maximum during starts on the grounds or relights in flight, above 50% HP speed	850

1.3 Fuel Temperature (°C)

Minimum fuel temperature: - 54

1.4 Oil temperature (°C)

Combined oil scavenge temperature -

Minimum for engine starting for engines incorporating
Modification Bulletin 79-E065: -40

Minimum for engine starting:	-20
Minimum for acceleration to power:	20
Maximum for unrestricted use:	190

3. Pressure Limits:

2.1 Fuel Pressure (kPa)

Minimum absolute fuel pressure at engine inlet plus true fuel inlet vapour pressure measured at inlet to engine LP fuel pump: 34

Maximum gauge pressure at engine inlet, measured at inlet to engine LP fuel pump:

(i)	Continuous:	276
(ii)	Transiently:	689
(iii)	Static:	586

2.2 Oil Pressure (kPa)

Minimum oil pressure:

(i)	Ground idle to 70% HP rpm	172
(ii)	Above 95% HP rpm	275

Between 70% HP rpm and 95% HP rpm, the minimum oil pressure rises linearly with HP speed.

2.3 Maximum allowable Oil Consumption for unrestricted operation l/hr: 0.63

4. Installation Assumptions:

Refer to Installation Manual for details.

5. Dispatch Limitations:

These engines have been approved to operate with certain faults present in the control system for a limited time. The dispatch criteria are specified in the approved Rolls-Royce Dispatch Statement Report DNS73288 issue 11 or later approved issues.

V. Operating and Service Instructions:

The instructions for continued airworthiness are specified in the latest approved issue of the following documents and manuals:

Trent 500 Variants	Document	Document Reference
RB211 Trent 553-61, 556-61, 556B-61 and 560-61	Installation Manual	RR reports No. DNS62612
RB211 Trent 553A2-61, 556A2-61, 556B2-61 and 560A2-61	Installation Manual	RR reports No. DNS96273
All Variants	Operating Instructions	OI-Trent-A340
All Variants	Engine Overhaul Manual	E-Trent-5RR
All Variants	Maintenance Manual	M-Trent-A340
All Variants	Time Limits Manual	T-Trent-5RR
All Variants	Service Bulletins and Service Letters	as required

VI. Notes

1. Variants RB211 Trent 553-61, 556-61, 556B-61 and 560-61 were previously covered under CAA-UK Engine Type Certificate No. 100 dated 15 December 2000 and CAA-UK Type Certificate Data Sheet No. 1056 prior to being superseded by the EASA Type Certificate and Type Certificate Data Sheet.
2. Variants RB211 Trent 553A2-61, 556A2-61, 556B2-61 and 560B-61 were previously covered under CAA-UK Engine Type Certificate No. 100/1 dated 18 February 2003 and CAA-UK Type Certificate Data Sheet No. 1056 prior to being superseded by the EASA Type Certificate and Type Certificate Data Sheet.
3. The maximum rotor speeds demonstrated at Maximum Continuous conditions are 94.5% for HP, 95.1% for IP and 89.2% for LP. In accordance with the equivalent safety finding made against JAR-E740, these speeds are not required to be displayed as operating limitations.
4. The engine is approved for use with Aircelle Thrust Reverser Part No. APE0010-02-0 for the port installation and Part No. APE0050-02-0 for the starboard installation.
5. The take-off rating and its associated operating limitations may be extended to 10 minutes in the event of one engine failure.
6. The engine ratings are defined at ISA, Sea Level Static, with no external bleed or accessory drive power for aircraft accessories, with the following exhaust and inlet systems:
 - i) Exhaust system comprising hot nozzle F78A-E5110-000, Forward Plug F78A-E0201-000 and Cone/Rear Plug F78A-0205-000, together with Aircelle Thrust Reverser.
 - ii) 100% intake recovery corrected from the datum air intake system defined by drawings ATF16471 for the diffuser and ATF16470 for the flare or approved alternatives.
7. The engine control system software is designated Level A as defined by RTCA/EUROCAE Document DO-178B/ED-2B.
8. HIRF, Lightning and Magnetic interference levels are defined in the Installation Manual.
9. The approved life limitations for Critical parts are published in the Time limits Manual T-Trent-5RR
10. With certain Control System configurations, engines incorporating Modification Bulletin 72-F264 or Modification Bulletin 72-F265 may be operated up to a Maximum Take-Off HP shaft speed limit of 98.0%. The speed signal which is transmitted to the aircraft by the Control System, however, is scaled in order to maintain the same cockpit indicated Maximum Take-Off speed as the pre-modification standard, i.e., 97.4% HP.
