UK CIVIL AVIATION AUTHORITY
ENGINE TYPE CERTIFICATE DATA SHEET NO. 1051

Issue 14
22 October 2004

CIVIL TYPE APPROVAL OF RB211 TRENT 895-17, 892-17, 892B-17, 884-17,884B-17, 877-17 & 875-17 ENGINES

I. CONSTRUCTOR

Rolls-Royce plc
P O Box 31
Derby
DE24 8BJ

II CERTIFICATION

1. The above mentioned engines are approved for use in civil aircraft certificated in the Transport Category (Passenger) subject to compliance with the appropriate United Kingdom Installation Airworthiness Requirements.

2. UK CAA Type Certificate 093/4 applies

3 Certification Basis:

3.1. JAR-E Change 8 plus Orange Paper E/91/1. The reference application date for certification is 2 April 1992. The RB211 Trent 884-17, 877-17 and 875-17 engines were approved on 27 January 1995. The RB211 Trent 892-17 engine was approved on 13 November 1996. The RB211 Trent 892B-17 engine was approved on 16 April 1997. The RB211 Trent 895-17 engine was approved on 22 June 1999. The RB211 Trent 884B-17 engine was approved on 26 November 1999.

3.2. Elect to comply Airworthiness Standards: None

3.3. Special Conditions: Ingestion of Rain.
Ingestion of Hail.
Medium & Large Bird Ingestion.

3.4. Exemptions: Exemption from JAR-E 890(a)
Calibration in reverse thrust.

Exemption from JAR-E 570(a)(3)
Scavenge pump inlet strainers.

3.5. Equivalent Safety Finding: JAR-E 740(f) - Speed Limitations at Maximum Continuous Rating - (See Note 4)

3.6. Environmental Standards: Emissions & Fuel Venting: ICAO Annexe 16 Vol. II (first edition 1981), for 875-17, 877-17, 884-17, 884B-17, 892-17, 892B-17. ICAO Annex 16 Vol. II (second edition 1993) for 895-17.

III. TECHNICAL CHARACTERISTICS

1. Reserved

2. Design Standards: The build standards are specified in:

DIS 2175 Issue 1 for Trent 895-17 (or later approved issues).
DIS 2184 Issue 2 for Trent 892-17 (or later approved issues).
DIS 2185 Issue 1 for Trent 892B-17 (or later approved issues)
DIS 2151 Issue 3 for Trent 884-17 (or later approved issues).
DIS 2219 Issue 1 for Trent 884B-17 (or later approved issues).
DIS 2158 Issue 3 for Trent 877-17 (or later approved issues).
DIS 2157 Issue 3 for Trent 875-17 (or later approved issues).

3. Description: These engines are turbo-fans with a by-pass ratio of 6.4:1 at a typical cruise thrust.

3.1 Compressor LP Single Stage fan
IP 8 stage, axial flow
HP 6 stage, axial flow

Nominal overall pressure ratio at Sea Level ISA Conditions:

40.7:1	895-17
39.6:1	892-17 & 892B-17
37.5:1	884-17 & 884B-17
34.7:1	877-17
33.9:1	875-17

3.2 Combustion Chamber: Annular

3.3 Turbine: LP, 5 stage, axial flow
IP, 1 stage, axial flow
HP, 1 stage, axial flow

4. Dimensions:

Overall Length	4568 mm	(178 ins)
Maximum Radius	1524 mm	(60 ins)

5. Dry Weight: The dry weight is 6078 kg (13400 lbs)

6. Ratings: The ISA Sea Level Static thrust ratings are:-

	895-17	892-17& 892B-17*	884-17 & 884B-17**	877-17	875-17
Take-off Thrust kN(lbf) Net	413.4(92940)	406.8(91450)	380.0(85430)	351.0(78910)	340.6(76580)
Equivalent Bare Engine	419.6(94320)	412.8(92800)	385.6(86700)	356.3(80110)	345.9(77750)
Maximum Continuous Thrust kN (lbf) Net	343.3(77170)	343.3(77170)	312.3(70210)	312.3(70210)	276.5(62160)

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 cold con-di nozzle, by-pass duct flow and leakage and the afterbody.

*The 892B-17 engine's rated take-off thrust is identical to the 892-17 engine at ISA Sea Level Static conditions and at most other conditions except that the 892B-17 engine's rating provides increased thrust for take-off at altitudes between 2,000 and 8,000 ft. The magnitude of this increased thrust varies with altitude, Mach number and ambient temperature and is limited to a maximum of 5.2%.

**The 884B-17 Maximum Continuous thrust is as the 884-17 rating up to 12,000ft, increasing linearly to be as the 892-17 maximum continuous thrust at 25,000ft and above.

7. Control System: The engines are equipped with an Electronic Engine Control System (EECS) in which the software is designated Level 1 according to DO-178A/ED-12A

8. Fuel:

8.1 Approved Fuels:

See the Operating Instructions manual.

9. Oil:

9.1 Approved types:

See the Operating Instructions manual.

10. Equipment: For identification of equipment approved for use on these engines refer to Rolls-Royce report DNS 12938.

11. Special Features: These engines' build standards do not include a thrust reverser (see note 3) or engine mounts, but do include the starter.

IV LIMITATIONS

1.0 Acceptance Limitations

Static sea-level ratings under the following conditions:-

a) International Standard Atmospheric conditions at Sea Level.

b) All optional air bleeds closed.

c) Aircraft Service equipment drives unloaded.

d) 100% intake recovery corrected from the datum air intake system defined by drawings ATF 14670 for the diffuser and ATF 14542 for the flare or approved alternatives.

e) Turbine gas temperature measured by 11 (pre-service bulletin 72-B456) or 17 (post -service bulletin 72-B456) paired thermocouples located in the LP1 NGVs.

f) Fuel having a minimum calorific value of 43.2 MJ/kg (18,580 Btu/lb).

g) Engine exhaust system defined by Primary Nozzle to drawing 314W5510/1, Tail Plug to drawing 314W5520/1, and -2½% Cold Convergent-Divergent Nozzle Slave C-ducts to drawing RX75502.

h) Test bleed Engine Pressure Ratio defined as:- P50 (Tail Bearing Housing Inlet Pressure) divided by PT0 (ambient pressure).

i) 100% HP = 10611 rpm
100% IP = 7000 rpm
100% LP = 3300 rpm

The acceptance limitations are defined in Rolls-Royce report PTR 42623.

2.0 Operating Limitations

The following operating limitations are applicable when the accuracy of the installed engine instrumentation is in accordance with Rolls-Royce Report DNS 13020 for the Trent 800.

The engines may be used in ambient temperatures up to ISA + 40°C. Refer to the Installation Brochure for the Operating Envelope.

2.0.1 Trent 895-17

At take-off ratings, the Trent 895-17 is flat rated as follows:

a) Between -2000ft and 457ft, ISA+10°C
b) Between 457ft and 1500ft, varies linearly between ISA+10°C and ISA+9°C
c) Between 1500ft and 2000ft, varies linearly between ISA+9°C and ISA +10°C
d) Between 2000ft and 4000ft, varies linearly between ISA+10°C and ISA +5°C
e) Between 4000ft and 6000ft, ISA+5°C
f) Between 6000ft and 6550ft, varies linearly between ISA+5°C and ISA +10°C
g) Between 6550ft and 10000ft, ISA+10°C
h) Between 10000ft and 12000ft, varies linearly between ISA+10°C and ISA + 15°
i) At and above 12000ft, ISA+15°C

At maximum continuous ratings, the Trent 895-17 is flat rated to ISA+10°C at all altitudes.

2.0.2 Trent 892-17

At take-off ratings the Trent 892-17 is flat rated to ISA + 15ºC at all altitudes.

At maximum continuous ratings the Trent 892-17 is flat rated to ISA + 10ºC at all altitudes.

2.0.3 Trent 892B-17

At take-off ratings the Trent 892B-17 is flat rated as follows;

(a) Between -2000ft and 2000ft, ISA + 15°C.
(b) Between 2000ft and 4550 ft, varies linearly between ISA + 15°C and ISA + 4°C.
(c) Between 4550 ft and 6550 ft, varies linearly between ISA + 4°C and ISA + 8°C.
(d) Between 6550 ft and 8000 ft, varies linearly between ISA + 8°C and ISA + 15°C.
(e) At and above 8000 ft, ISA + 15°C.

At maximum continuous ratings the Trent 892B-17 is flat rated to ISA + 10°C at all altitudes.

2.0.4 Trent 884-17

At take-off ratings the Trent 884-17 is flat rated to ISA + 15ºC at all altitudes

At maximum continuous ratings the Trent 884-17 is flat rated to ISA + 10ºC at all altitudes.

2.0.5 Trent 884B-17

At take-off ratings, the Trent 884B-17 is flat rated to ISA + 15º at all altitudes.

At maximum continuous ratings the Trent 884B-17 is flat rated to ISA + 10ºc at all altitudes.

2.0.6 Trent 877-17

At take-off ratings the Trent 877-17 is flat rated as follows:

a) Between -2000 feet and 2000 feet, ISA + 22.8ºC.

b) Between 2000 feet and 5000 feet, varies linearly between ISA + 22.8ºC and ISA + 15ºC.

c) At and above 5000 feet, ISA + 15ºC.

At maximum continuous ratings the Trent 877-17 is flat rated to ISA + 10ºC at all altitudes.

2.0.7 Trent 875-17

At take-off ratings the Trent 875-17 is flat rated to ISA + 15ºC at all altitudes.

At maximum continuous ratings the Trent 875-17 is flat rated to ISA + 10ºC at all altitudes.

2.1 Rotational Speed (%)

	HP	IP	LP
2.1.1. Maximum for take-off (5 min limit)(See Note 5)			
Pre-mod. 72-B672	100.5	105.0	100.5
Post-mod 72-B672	102.5	105.0	100.5
2.1.2 Maximum Continuous (see Note 4)	——	——	——
2.1.3 Maximum for reverse thrust (33 second limit).	——	——	80.5

2.1.4	Maximum overspeed (20 second limit)		
	Pre-mod 72-B672	100.9	107.0	101.2
	Post-mod 72-B672	102.8	107.0	101.2

2.2 Turbine Gas Temperature (°C)

2.2.1	Momentary maximum during starts or relights.	700
2.2.2	Maximum for take-off (5 min limit) (See Note 5)	900
2.2.3	Maximum continuous (unrestricted duration)	850
2.2.4	Maximum over-temperature (20 second limit)	920

2.3 Fuel

2.3.1 Minimum absolute pressure at engine inlet (measured at inlet to engine LP fuel pump) kPa (psi):

34 (5) plus true fuel inlet vapour pressure.

2.3.2 Maximum gauge pressure at engine inlet (measured at inlet to engine LP fuel pump) kPa (psi):

(i)	Continuous	414 (60)
(ii)	Transiently	483 (70)
(iii)	Static	1172 (170)

2.3.3 Maximum Temperature (°C)

At outlet from HP fuel pump

(i)	Unrestricted	140
(ii)	Maximum during transient overshoots on reducing rpm (15min limit)	165

2.3.4 Minimum drainage period (from closing HP fuel cock after a false start) (seconds) 30

2.4 Oil

2.4.1 Combined scavenge temperature (°C)

a)	minimum for starting	-40
b)	minimum for opening up	50
c)	maximum for unrestricted use	191

2.4.2 Pressure kPa (psi):

a)	Minimum acceptance for flight		
	(i)	Ground idle to 70% HP rpm	241.0 (35)
	(ii)	Above 95% HP rpm	414.0 (60)
b)	Minimum to complete flight		
	(i)	Ground idle to 70% HP rpm	172.0 (25)
	(ii)	Above 95% HP rpm	345.0 (50)

2.4.3 Consumption, l/hr (Imp pt/hr)

Overall inflight, maximum for unrestricted operation 0.66 (1.17)

2.4.4 Capacity, l (Imp pt)

a)	Nominal total oil system capacity	44.5 (78.2)
b)	Nominal oil tank capacity	23.3 (41.0)
c)	Usable oil (including effect of attitude) minimum	15.4 (27.1)

3.0 Compressor Air Bleeds

3.1. Maximum rpm at which bleed may be used: Unrestricted.

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

This 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 the HP compressor delivery pressure (P30), IP compressor delivery pressure (P25), altitude and corrected HP compressor speed. The switchover from the HP to the IP compressor delivery bleed port occurs whenever the following conditions are met:

i) P25 at the IP8 check valve is greater than 303 kPa ± 34 (44 psi ± 5) gauge up to 22,000 feet.

ii) Above 22,000 feet there are two bleed switchover levels, both varying as a function of altitude and corrected HP compressor speed. The upper and lower switch points vary linearly from

260 and 224 kPa (37.7 and 32.5 psi) gauge at 30,000 feet to 224 and 145 kPa (32.5 and 21.0 psi) gauge at 43,000 feet.

3.2.1 Maximum HP6 bleed (% gas generator compressor flow):

(This bleed decreases linearly between the values listed below for the 1230K TET (1465K TET abnormal operation) and switchover points.)

a) Normal operation.

i)	Low idle and up to 1230K TET	11.5%
ii)	At switchover point	5.4%

b) Abnormal (one engine inoperative) operation.

i)	Low idle and up to 1465K TET	11.5%
ii)	At switchover point	7.3%

3.2.2 Maximum IP8 bleed (% gas generator compressor flow):

(This bleed (IP8) decreases linearly between the values listed below for the maximum continuous and take-off points).

a) Normal operation.

i)	At switchover and up to max continuous	5.0%
ii)	At take-off	2.2%

b) Abnormal operation (one engine inoperative).

i)	At switchover and up to max continuous	6.0%
ii)	At take-off	3.4%

3.2.3 Maximum LP bleed (% fan flow)

a) Normal & Abnormal (one engine inoperative) operation: 0.8%

3.3 Air delivery for powerplant anti-icing.

3.3.1 Maximum HP3 bleed (% HPC inlet flow):

(This bleed decreases linearly between the values listed below for the 1050K TET and take-off points).

a) Maximum operation:

i)	At low idle and up to 1050K TET	0.63%
ii)	At take-off	0.57%

V MANUALS:OPERATING, SERVICE AND INSTALLATION INSTRUCTIONS

Operating Instructions	F - Trent - 777
Maintenance Manual	D633W101 - RRY
Engine Manual	E - Trent - 2RR
Installation Brochure	EL 2839
Time Limits Manual	T-Trent - 2RR
Service Bulletins	RB211 - -

VI Notes

1. Installation Assumptions are defined in Rolls-Royce report MDR 42063 Issue 4.

2. The RB211 Trent 800 series engines have been approved to operate with certain faults present in the control system. The dispatch criteria for the control system are specified in Rolls-Royce plc report DNS 14049.

3. The Trent 800 series engines are approved for use with Boeing Thrust Reverser Part No. 315W5000-1/-2.

4. The maximum rotor speeds demonstrated for use at Maximum Continuous conditions are HP 98.8% without mod. Bulletin 72-B672, HP 99.9% with mod. Bulletin 72-B672, IP 102.8%, LP 98.5%, as quoted in Rolls-Royce report DNS 38035 Issue 1. In accordance with the equivalent safety finding made against JAR-E 740(f), these speeds are not required to be quoted as operating limitations.

5. The take-off rating and its associated operating limitations may be used for up to 10 minutes in the event of engine failure, but their use is otherwise limited to not more than 5 minutes.

6. The Trent 890-17 engine was redesignated as the Trent 892-17 on 13 November 1996.