

**UK CIVIL AVIATION AUTHORITY  
ENGINE TYPE CERTIFICATE DATA SHEET NO. 1049**

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Issue 2  
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**CIVIL TYPE APPROVAL OF THE RB211-535E4-B-75 ENGINE**

1. **CONSTRUCTOR:** ROLLS-ROYCE plc  
DERBY

2. **CERTIFICATION**

The above mentioned engine is approved for use in civil aircraft classified in the Transport Category (Passenger) subject to compliance with Notes at Item 10 of this document and the appropriate United Kingdom Installation Airworthiness requirements.

Certification Basis: JAR-E change 6 dated 28 August 1981  
(BCAR Section C Issue 13)

Installation Assumptions are defined in MDR 59943

3. **ENGINE PARTICULARS**

3.1	Build Standard	Specified in:- DIS 2142 Issue 1 (or later approved issues)
3.2	Description	Bypass turbofan Bypass ratio : 4.4:1
3.3	Compressor	LP, single stage fan IP, 6 stage, axial flow HP, 6 stage, axial flow  Overall Pressure Ratio: (Normal Sea Level) ISA conditions) 25.0:1
3.4	Combustion Chamber	Annular
3.5	Turbine	LP, 3 stage, axial flow IP, single stage, axial flow HP, single stage, axial flow
3.6	Overall Dimensions:	Length (from front of nose spinner to rear of common nozzle): 5035.9mm (198.2ins)  Width (maximum over fan casing):2276mm (89.6 ins)  Height (from lowest point on gearbox to top face of engine mounting pad):2416mm (95.1 ins)

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3.7 Engine Dry Weight 3705kg (8169lbs)  
 (as defined in Chapter 1 of the DIS but  
 excluding nose cowl, fan cowl doors, pod  
 items, thrust reverser and jet pipe/common  
 nozzle assembly).

4. **ACCEPTANCE LIMITATIONS**

Static sea-level ratings, which already include the losses due to scrubbing drag over nacelle afterbody and strut, nacelle cooling and ventilation flow including thrust reverser leakage and the IDG oil-cooler airflow, established 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 Rolls-Royce Nacelle Control Document NCD 1009 or approved alternatives.
- e) Turbine gas temperature measured by 34 thermocouples located in the LP NGV's and fitted with ballast resistors K or E.  
  
 Code K resistor is defined by RT Sch. 66030.  
 Code E resistor is defined by RT Sch. 66025.
- f) Fuel having a minimum calorific value of 42.8 MJ/Kg (18,400 Btu/lb).
- g) Test Bed Engine Pressure Ratio defined as PF (fan pressure) divided by PTO (ambient pressure).
- h) 100% HP = 10,611 rpm, 100% IP = 7000 rpm, 100% LP = 4500 rpm.

4.1 Maximum Take off Sea Level

4.1.1 Thrust (minimum) lbf: 42,540\*

\*Note: The normal ISA sea-level take-off thrust quoted includes losses, the equivalent bare engine thrust is 43100 lbf.

4.1.2	RPM, maximum, (%) HP:	97.1
	RPM, maximum, (%) IP:	98.4
	RPM, Maximum, (%) LP:	106.2
4.1.3	Turbine Gas Temperature (°C):	830
4.1.4	Engine Pressure Ratio, maximum trimmed:	1.799
4.1.5	Specific Fuel Consumption, maximum (lb/lbf thrust/hr):	0.411

4.2	Maximum Continuous Rating	
4.2.1	Thrust, minimum, (lbf):	35,205*
	*Note: The equivalent bare engine maximum continuous thrust rating is	35,640 lbf
4.2.2	RPM, maximum, (%) HP:	93.2
	RPM, maximum, (%) IP:	92.5
	RPM, maximum, (%) LP:	95.4
4.2.3	Turbine Gas Temperature: maximum (°C)	722
4.2.4	Engine Pressure Ratio: maximum trimmed	1.652
4.2.5	Specific Fuel Consumption: maximum (lb/lbf thrust/hr)	0.381
4.2.6	Oil consumption, maximum: (Imp pt/hr)	1.6
4.2.7	Oil Pressure, minimum for acceptance (lbf/sq.ins) at maximum combined oil scavenge temperature.	40

## 5. OPERATING LIMITATIONS

The following operating limitations are applicable when the accuracy of the installed engine instrumentation is in accordance with Rolls-Royce Report APS 1057.

At maximum continuous rating, the engines are flat rated to ISA + 10°C at all flight conditions. At take-off rating, the engines are flat rated as follows:-

- (a) At sea-level, ISA + 10°C
- (b) Between sea-level and 4000ft. varies approximately linearly between ISA + 10°C and ISA + 13.9°C
- (c) Between 4000ft and 10000ft, ISA + 13.9°C
- (d) Between 10000ft and 12500ft varies linearly between ISA + 13.9°C and ISA + 20°C
- (e) Between 12500ft and 15000ft, ISA + 20°C

### 5.1 Rotational Speed (%)

#### 5.1.1. Maximum for take-off (5 min limit)\*

HP % :	99.0
IP % :	100.3
LP % :	108.8

#### 5.1.2 Maximum Continuous:

HP % :	95.8
IP % :	98.0
LP % :	108.4

5.1.3	Maximum overspeed (20sec limit).		
		HP % :	100.2
		IP % :	101.3
		LP % :	110.0
5.1.4	Low idle (minimum):		See Note 10.1
5.1.5	Maximum for reverse thrust		
	LP (40 second limit)		84.3
5.2	Turbine Gas Temperature (°C)		
5.2.1	Momentary max. during starts on the ground		570
5.2.2.	Momentary max. during re-lights in flight		570
5.2.3.	Maximum for take-off (5 min limit)*		877
5.2.4	Maximum Continuous		795
5.2.5	Maximum overtemperature (20sec limit)		897
	*Note: These operating limitations may be used for up to 10 minutes in the event of engine failure (JAR-E Change 6).		
5.3	Fuel		
5.3.1.	Approved Fuels:		
	For list of fuels and fuel additives approved for use in the engines, see relevant Operating Instructions.		
5.3.2.	Minimum pressure at engine inlet (measured at inlet to engine LP fuel pump).		
	No less than 5lb/sq.in abs. plus true fuel vapour pressure with zero vapour/liquid ratio between sea-level and 45,000ft altitude.		
5.3.3.	Temperature at inlet to LP fuel pump (°C)		
	(a) Maximum		49
	(b) Minimum		minus 54
5.3.4	Minimum drainage period from closing fuel cock after a false start (seconds)		30

## 5.4 Oil

### Approved Types:

Aero Shell Turbine Oil 500 (Also known as Royco Turbine Oil 500)  
Aero Shell Turbine Oil 555 (Also known as Royco Turbine Oil 555)  
Castrol Aero 5000 Gas Turbine Oil  
Esso/Exxon Turbo Oil 25  
Esso/Exxon Turbo Oil 2380  
Mobil Jet Oil II  
Mobil Jet Oil 254

Note: Oil of the above types, when reclaimed to the approved Rolls-Royce standards for the appropriate viscosity grade, are approved for use.

### 5.4.2 Temperature at combined scavenge return (°C)

(a) Minimum for starting	Minus 40
(b) Minimum for opening-up	zero
(c) Maximum for unrestricted use	177

### 5.4.3 Pressure (lbf/sq.in.)

The minimum pressures vary linearly between the following listed HP rpm conditions:

(a) Minimum acceptance for flight	
(i) at 50% HP rpm	25
(ii) at 70% HP rpm	35
(iii) at 93% HP rpm	40
(b) Minimum to complete flight	
(i) at 50% HP rpm or less	18
(ii) at 70% HP rpm	25
(iii) at 93% HP rpm	35

5.4.4 Consumption (Imp pt/hr) Overall in flight, maximum for unrestricted operation	2.0
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5.4.5 Capacity (Imp pt)	
(a) Nominal total oil system capacity	64.0
(b) Nominal oil tank capacity	34.0
(c) Usable oil (including effect of altitude), minimum	32.0

5.5 Thrust Reverser

5.5.1 Approved Hydraulic Fluid:

Monsanto Skydrol LD-4  
Monsanto Skydrol 500B-4  
Chevron Hyjet IV-A  
(or alternative complying with Boeing  
Specification BMS3-11 Revision G)

6 **COMPRESSOR AIR BLEED FOR AIRCRAFT SERVICES**

The Tupolev installation for these engines will incorporate an automatic scheduling system which will select the appropriate bleed supply source in response to a signal sensing HP compressor delivery pressure (P4).

Bleed air is extracted from the HP2 delivery port at engine power settings above that giving a P4 greater than 107 lbf/sq.in. (gauge) for the 535E4-B-75 between sea-level and 31,000ft and 91 lbf/sq.in. (gauge) for the 535E4-B-75 above 31,000ft.

At power settings below these pressures bleed is extracted from the HP6 bleed port with the exception of the nose cowl anti-icing air which is always taken from the HP2 port. This nose cowl anti-icing air is approximately 1.5% of HP compressor flow and is included in the maximum bleed flow values quoted below for HP2 bleed.

In the aircraft system the cabin air bleed is passed through a pre-cooler with the required degree of cooling adjusted by valves controlling the fan delivery off-take cooling air supply. The valves respond to the temperature of the cabin air bleed.

The compressor air bleeds are to be used in accordance with the Rolls-Royce instructions and such that the Operating Limitations are not exceeded.

6.1 Maximum rpm at which bleed may be used: Unrestricted

6.2 Air Delivery for aircraft services:

6.2.1 Maximum HP6 bleed (% gas generator flow)

- |     |                               |     |
|-----|-------------------------------|-----|
| (a) | Normal Operation              |     |
|     | Low Idle to change over point | 5.5 |
| (b) | Abnormal Operation            |     |
|     | Low Idle to change over point | 9.4 |

6.2.2 Maximum HP2 bleed (% gas generator compressor flow)

(a) Normal Operation

- |       |                                |     |
|-------|--------------------------------|-----|
| (i)   | Low idle to change over point  | 2.3 |
| (ii)  | Change over up to Maximum      |     |
|       | Continuous                     | 4.8 |
| (iii) | Maximum Continuous             | 3.6 |
| (iv)  | Maximum Continuous to Take-off | 2.0 |

(b) Abnormal Operation

(i)	Low Idle to Change over	2.3
(ii)	Changeover up to Maximum Continuous	7.7
(iii)	Maximum Continuous	5.4
(iv)	Maximum Continuous to Take-off	2.5

6.2.3 Maximum Fan Bleed (% Fan flow)

(a) Normal and Abnormal Operation

	Low Idle to Take-off	1.0
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7. **EQUIPMENT**

For identification of equipment approved on these engines refer to latest approved issues of DIS 2142.

8. **MANUALS**

Operating Instructions	:	F-211 (535) - TU
Maintenance	:	M-211 (535) - TU
Installation	:	MISC 2717

9. **SPECIAL FEATURES**

- 9.1 A thrust reverser system, excluding control and hydraulic supply system, is incorporated to reverse the fan stream and is included in this approval.
- 9.2 An optional feature is a supervisory control system by which electronic trimming of fuel is applied through the prime hydromechanical fuel flow regulator via a torquemotor in order to control the engine at throttle selected values of Engine Pressure Ratio. The software of this systems meets "critical" standard of RTCA DO-178.

10. **NOTES**

- 10.1 The crew drills for ground starting must include a statement that at stabilised Low Idle, LP rotational speed should not be below 19.8%.
- 10.2 The RB211-535E4-B-75 engines comply with the aircraft engine emission requirements of BCAR Section M (Issue 1) plus Blue Paper M847 and the recommendations of ICAO annex 16 vol 2.