

**UK CIVIL AVIATION AUTHORITY
ENGINE TYPE CERTIFICATE DATA SHEET NO. 1043**

Issue 36
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CIVIL TYPE APPROVAL OF **RB211-524-02, 524B2-19, 524B2-39, 524B-02, 524B3-02, 524C2-19, 524B4-02, 524B4-D-02, 524D4-19, 524D4-39, 524B-B-02, 524B2-B-19, 524D4-B-19, 524D4-B-39, 524C2-B-19, 524D4X-19 and 524D4X-B-19.**

1 **CONSTRUCTOR:** **ROLLS-ROYCE PLC
DERBY**

2 **CERTIFICATION:**

The above-mentioned engines are approved for use in civil aircraft classified in the Transport Category (Passenger) subject to compliance with the appropriate installation requirements of British Civil Airworthiness Requirements. Type Certificates 053, 055/1, 056, 057/1, 058, 059/1, 062/1, 066/2 and 078/1 apply.

Certification Basis: BCAR Section C, Issue 6, dated 15 June 1966, together with Blue Papers 415, 435, 436, 464, 468, 474, 476, 480, 481, 482, 499, 506, 544, 551 (para 3.2.2 only) and 554.

3 **ENGINE PARTICULARS:**

3.1 Build Standard Specified in:

DIS 1041	Issue 2	for	RB211-524-02 [▲]
DIS 1068	Issue 1	for	RB211-524B-02
DIS 1071	Issue 1	for	RB211-524B2-19
DIS 1078	Issue 1	for	RB211-524B2-39 [▲]
DIS 1088	Issue 1	for	RB211-524B3-02
DIS 1089	Issue 1B	for	RB211-524B4-02
DIS 1091	Issue 1	for	RB211-524D4-19
DIS 1093	Issue 1	for	RB211-524C2-19
DIS 2028	Issue 1	for	RB211-524D4-39
DIS 2077	Issue 1	for	RB211-524B4-D-02
DIS 2068	Issue 1	for	RB211-524B2-B-19
DIS 2069	Issue 1	for	RB211-524C2-B-19
DIS 2070	Issue 1	for	RB211-524D4-B-19
DIS 2079	Issue 1	for	RB211-524B-B-02
DIS 2080	Issue 1	for	RB211-524D4-B-39
DIS 2107	Issue 1	for	RB211-524D4X-19
DIS 2108	Issue 1	for	RB211-524D4X-B-19

(or later approved issues)

[▲] The RB211-524-02 and -524B2-39 are no longer in service - see Section 10 of this ETCDS.

3.2	Description	By-pass turbo-jet (by-pass ratio 5:1)	
3.3	Compressor	LP, Single stage fan IP, 7 stage, axial flow HP, 6 stage, axial flow	
		Pressure ratio: (Nominal at sea level ISA conditions)	
		RB211-524D4-19, 524D4-39, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19	29.5:1
		RB211-524C2-19, and 524C2-B-19	29.0:1
		Other marks	28.0:1
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 to end of jet pipe nozzle)	
		RB211-524B-02 and 524B-B-02	4547mm(179.0in)
		RB211-524B2-19, 524C2-19, 524B2-B-19 and 524C2-B-19	4582mm(180.4in)
		RB211-524B3-02, 524B4-02 and 524B4-D-02	4805mm(189.2in)
		RB211-524D4-19, 524D4-39, 524D4-B-19 524D4-B-39, 524D4X-19 and 524D4X-B-19	4821mm(189.8 in)
		Width (maximum over fan casing)	2413mm(95.0 in)
		Height (from lowest point on gearbox to top face of engine mounting pad)	2733mm(107.6in)
3.7	Engine Dry Weight	(as defined in the appropriate DIS but excluding thrust reverser assembly)	
		RB211-524B3-02	4990kg(11,000 lb)
		RB211-524B4-02 and 524B4-D-02	5057kg (11,148 lb)
		RB211-524B2-19,524B-02, 524B2-B-19 and 524B-B-02	5060kg (11,154 lb)
		RB211-524D4-19, 524D4-39, 524D4-B-19 524D4-B-39, 524D4X-19 and 524D4X-B-19	5078kg (11,195 lb)
		RB211-524C2-19 and 524C2-B-19	5080kg (11,199 lb)

4 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 datum air intake system as defined by Drawing JRH 1794 or approved alternatives.

- (e) Turbine gas temperature measured by 34 thermocouples located in the LP NGV and fitted with ballast resistors as follows:-
- (i) MK 524B-O2 a 'C' or 'B' resistor
 - (ii) MK 524B3-02 a 'B' resistor
 - (iii) MK 524B4-02, MK 524B4-D-02 Pre-Mod 7730 a 'D' or 'BB' or, only on engines fitted with Mod 7998, a 'BE' resistor. Post-Mod 7730 a 'BB' or 'BA' resistor.
 - (iv) MK 524B2-19 a 'C' or a 'B' resistor or, only on engines with the combination of Mods 5012, 5583 and 5662, a 'BS' resistor also.
 - (v) MK 524C2-19 a 'BN' or a 'BS' resistor or, only on engines Post-Mod 77-7108, a 'CB' resistor.
 - (vi) MK 524D4-19, MK 524D4-39, MK 524D4X-19 a 'BN' resistor or, only on engines with Mods 5912, 6328, 6520, 6910 and 7257 fitted, a 'B' resistor.
 - (vii) MK524B-B-02 a 'BK' resistor
 - (viii) MK524B2-B-19 a 'BK' resistor
 - (ix) MK524C2-B-19 a 'BK' resistor
 - (x) MK524D4-B-19, MK524D4-B-39, MK524D4X-B-19 a 'E' resistor or, only on engines fitted with Mod 7332 a 'D' resistor or, only on engines fitted with Mods 7332, 8074, 8517 a 'C' resistor.
 - (xi) MK 524B4-02, MK 524B4-D-02 a 'BE' resistor when Mod 7998 fitted.
 - (xii) MK 524D4-19, MK 524D4-39, MK 524D4X-19 a 'BD' resistor when Mod 7998 fitted.
- (f) Fuel having a minimum calorific value of 42.8 MJ/kg (18,400 Btu/lb).
- (g)
- (i) MKs 524B2-19, 524C2-19, 524B2-B-19 and 524C2-B-19 exhaust system as defined by fan thrust reverser TR512 (or the combination of fan nozzle LJ27530 with reverser simulator ATF4809), and jet pipe JP512 or LJ30920 (or later approved equivalents).
 - (ii) MK 524B-02 and 524B-B-02 exhaust system as defined by fan thrust reverser TR514 (or the combination of fan nozzle LJ28580 with reverser simulator ATF 4809), and jet pipe JP515 or LJ30982 (or later approved equivalents).
 - (iii) MKs 524B3-02, 524B4-02 and 524B4-D-02: exhaust system as defined by fan thrust reverser TR512 (or the combination of fan nozzle LJ27530 with reverser simulator ATF 4809), and jet pipe JP515 or LJ 30982 (or later approved equivalents).
 - (iv) MKs 524D4-19, 524D4-39, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19 exhaust system as defined by fan thrust reverser TR525 and jet pipe JP518 or LJ31118 (or later approved equivalents).

- (h) Test Bed Integrated Engine Pressure Ratio defined as:-
PINT (integrated fan and exhaust pressure) divided by PTO
(ambient pressure)
- (i) 100% HP = 10,611 rpm 100% IP = 7000 rpm 100% LP = 3900 rpm

4.1 Maximum Take-off Rating

4.1.1 Thrust, minimum (lbf)

MKs 524B-02, 524B3-02, 524B4-02, 524B4-D-02, 524B2-19, 524B-B-02 and 524B2-B-19	49,120
MKs 524C2-19, and 524C2-B-19	50,600
MKs 524D4-19, 524D4-39, 524D4-B-19, and 524D4-B-39	51,980
MKs 524D4-19*, 524D4-B-19 *, 524D4X-19*, and 524D4X-B-19*	53,460
Mks 524D4X-19 and 524D4X-B-19	52,810

Note: The thrusts quoted above for the acceptance conditions include the losses of the production propulsion fan duct and thrust reverser, jet pipe and afterbody cowlings and that portion of the pylon washed by the fan stream. The equivalent bare engine thrust values for take-off are:

Mks 524B-02, 524B3-02, 524B4-02, 524B4-D-02, 524B2-19, 524B-B-02 and 524B2-B-19	50,000
Mks 524C2-19 and 524C2-B-19	51,500
Mks 5 24D4-19, 524D4-39, 524D4-B-19 and 524D4-B-39	53,000
Mks 524D4-19*, 524D4-B-19*, 524D4X-19* and 524D4X-B-19*	54,500
Mks 524D4X-19 and 524D4X-B-19	53,835

4.1.2 RPM, maximum, (%) HP

MK 524B2-19	93.4
MKs 524D4-19, 524D4-39 and 524D4X-19	94.6
MKs 524B-02 and 524B3-02	93.9
MK 524C2-19	94.0
MKs 524B4-02 and 524B4-D-02	94.4
MKs 524D4-19* and 524D4X-19*	94.5
MKs 524D4-B-19, 524D4-B-39 and 524D4X-19	95.7
MK 524B-B-02	95.2
MK 524B2-B-19	95.3
MK 524C2-B-19	95.5
MKs 524D4-B-19* and 524D4X-B-19*	95.6

RPM, maximum, (%) IP

MKs 524B2-19, 524B-02, 524B3-02, 524B2-B-19 and 524B-B-02	100.3
MKs 524C2-19 and 524C2-B-19	100.9
MKs 524B4-02 and 524B4-D-02	101.3
MKs 524D4-19, 524D4-39, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19	103.4
MKs 524D4-19* and 524D4-B-19*, 524D4X-19* and 524D4X-B-19*	104.1

* These figures are applicable to the Reduced Envelope described in Paragraph 5 only.

RPM, maximum, (%) LP

MKs	524B2-19, 524B-02, 524B3-02, 524B4-02, 524B4-D-02, 524B2-B-19 and 524B-B-02	99.7
MKs	524D4-19, 524D4-39, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19	100.2
MKs	524D4-19*, 524D4-B-19*, 524D4X-19* and 524D4X-B-19*	101.6
MKs	524C2-19 and 524C2-B-19	102.0

4.1.3. Turbine Gas Temperature, maximum (°C)

MK	524B4-D-02	725
MKs	524D4-19, 524D4-39, 524D4-B-19, 524D4X-19, 524D4X-B-19 and 524D4-B-39	727
MKs	524B2-19, 524C2-19, 524B2-B-19 and 524C2-B-19	728
MKs	524B-02, 524B3-02, 524B4-02 and 524B-B-02	730
MKs	524D4-19*, 524D4-B-19*, 524D4X-19* and 524D4X-B-19*	740

4.1.4. Integrated Engine Pressure Ratio (PINT/PTO) maximum, trimmed

MKs	524B2-19 and 524B2-B-19	1.622
MKs	524B-02, 524B3-02, 524B4-02, 524B4-D-02 and 524B-B-02	1.636
MK	524C2-19 and 524C2-B-19	1.646
MKs	524D4-19, 524D4-39, 524D4-B-19 and 524D4-B-39	1.680
MK	524D4-19*, 524D4-B-19*, 524D4X-19* and 524D4X-B-19*	1.699
MKs	524D4X-19 and 524D4X-B-19	1.694

4.1.5. Fuel consumption, maximum (lb/lbf thrust/hr)

MKs	524B4-02 and 524B4-D-02	0.384
MKs	524B2-19, 524B3-02 and 524B2-B-19	0.388
MKs	524B-02, 524C2-19, 524D4-19, 524D4-39, 524B-B-02, 524C2-B-19, 524D4-B-19 and 524D4-B-39	0.392
MKs	524D4-19*, 524D4-B-19*, 524D4X-19* and 524D4X-B-19*	0.397
MKs	524D4X-19 and 524D4X-B-19	0.395

4.2 Maximum Continuous Rating

4.2.1. Thrust, minimum (lbf)

MKs	524B-02, 524B3-02, 524B4-02, 524B4-D-02, 524B2-19, 524B-B-02 and 524B2-B-19	44,780
MKs	524C2-19 and 524C2-B-19	46,120
MKs	524D4-19, 524D4-39, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19	47,230

*These figures are applicable to the Reduced Envelope described in Paragraph 5 only.

Note: The thrusts quoted above for the acceptance conditions include the losses of the production propulsion fan duct and thrust reverser, jet pipe and afterbody cowlings and that portion of the pylon washed by the fan stream. The equivalent bare engine thrust values for maximum continuous are :

Mks 524B-02, 524B3-02, 524B4-02, 524B-B-02, 524B2-B-19, 524B4-D-02 and 524B2-19.	45,625 lbf
Mks 524C2-19 and 524C2-B-19.	47,000 lbf
Mks 524D4-19 524D4-39, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19.	48,160 lbf

4.2.2. RPM, maximum, (%) HP

MK 524B2-19	91.3
MK 524C2-19	92.0
MKs 524B-02 and 524B3-02,	92.1
MKs 524D4-19, 524D4-39 and 524D4X-19	92.9
MKs 524B4-02 and 524B4-D-02	92.9
MKs 524D4-B-19, 524D4-B-39 and 524D4X-B-19	94.2
MKs 524B2-B-19, 524C2-B-19 and 524B-B-02	93.9

RPM, maximum, (%) IP

MKs 524B-02, 524B3-02, and 524B2-19	98.4
MK 524C2-19	98.9
MKs 524B4-02 and 524B4-D-02	99.9
MKs 524B-B-02, 524B2-B-19 and 524C2-B-19	100.4
MKs 524D4-19, 524D4-39, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19	102.1

RPM, maximum, (%) LP

MKs 524B-02, 524B3-02, 524B4-02, 524B4-D-02, 524B2-19, 524B-B-02 and 524B2-B-02	95.2
MKs 524D4-19, 524D4-39, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19	95.5
MKs 524C2-19 and 524C2-B-19	96.4

4.2.3. Turbine Gas Temperature, maximum (°C)

MKs 524D4-19, 524D4-39, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19	682
MKs 524B2-19, 524C2-19, 524B2-B-19 and 524C2-B-19	696
MKs 524B-02, 524B3-02, 524B4-02, 524B4-D-02 and 524B-B-02	698

4.2.4. Integrated Engine Pressure Ratio (PINT/PTO) maximum, trimmed

MKs 524B2-19 and 524B2-B-19	1.555
MKs 524B-02, 524B4-02, 524B4-D-02 and 524B-B-02	1.568
MK 524B3-02	1.571
MK 524C2-19 and 524C2-B-19	1.575
MKs 524D4-19, 524D4-39, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19	1.607

4.2.5. Fuel consumption, maximum (lb/lbf thrust/hr)

MKs 524B4-02 and 524B4-D-02	0.371
MK 524B3-02	0.375
MKs 524B2-19 and 524B2-B-19	0.378
MKs 524D4-19, 524D4-39, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19	0.380
MKs 524B-02, 524C2-19, 524B-B-02 and 524C2-B-19	0.382

4.2.6. Oil Consumption, maximum (Imp pt/hr)

MKs 524B-02, 524B3-02, 524B4-02, 524B4-D-02 and 524B-B-02	1.6
MKs 524B2-19, 524C2-19, 524D4-19, 524D4-39, 524B2-B-19, 524C2-B-19, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19	2.0

4.2.7 Oil Pressure, minimum for acceptance (lbf/sq.in)

MKs 524B4-02, 524B4-D-02, 524D4-19, 524D4-39, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19 at 165°C combined oil scavenge temperature	40
MKs 524B-02, 524B3-02, 524B-B-02, 524B2-19, 524C2-19, 524B2-B-19, and 524C2-B-19 at 170°C 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 RR report APS 1028 (MKs 524B-02, 524B3-02, 524B4-02, 524B4-D-02 and 524B-B-02), APS 1030 (MKs 524B2-19, 524C2-19, 524B2-B-19 and 524C2-B-19) or APS 1037 (MKs 524D4-19, 524D4-39, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19).

The engines may be used in ambient temperatures up to ISA +40°C. The MKs 524D4-19, 524D4-39, 524D4-B-19 and 524D4-B-39 engines are flat-rated to ISA +15°C for Take-off rating and to ISA +10°C for Maximum Continuous rating at 51980 and 47230 lbf equivalent sea level thrust respectively. The MKs 524D4-19, 524D4-B-19, 524D4X-19 and 524D4X-B-19 may also be used flat rated to ISA +11.2°C for Take-off rating up to 2000 ft. altitude at 53460 lbf equivalent sea-level thrust. The MK 524B4-D-02 is flat rated to ISA +17.8°C up to 5000 ft for Take-off. All other marks of engines are flat rated to ISA +13.9°C for Take-off rating and to ISA +9°C for Maximum Continuous rating up to 25,000 ft and then to ISA +10°C for Maximum Continuous at higher altitudes. The Mks 524D4X-19 and 524D4X-B-19 engines are flat-rated to ISA +15°C for Take-off rating and to ISA +10°C for Maximum Continuous rating at 52810 and 47230 lbf equivalent sea level thrust respectively.

5.1. Rotational Speed (%)		HP	IP	LP
5.1.1. Maximum for take-off: (5 min limit) ♦				
MKs	524B4-02 and 524B4-D-02	97.5	107.0	103.0
MKs	524D4-B-19, 524D4-B-39 and 524D4X-B-19	98.6	106.0	104.4
MK	524B2-19	96.5	106.0	103.0
MKs	524B-02 and 524B3-02	97.0	106.0	103.0
MK	524C2-19	97.1	106.0	104.0
MKs	524D4-19, 524D4-39 and 524D4X-19	97.5	106.0	104.4
MK	524B2-B-19	98.4	106.0	103.0
MK	524B-B-02	98.3	106.0	103.0
MK	524C2-B-19	98.6	106.0	104.0
5.1.2 Maximum Continuous				
MK	524B2-19	93.7	102.0	103.0
MKs	524B-02 and 524B3-02	94.5	102.0	103.0
MK	524C2-19	94.4	102.5	103.0
MKs	524D4-19, 524D4-39 and 524D4X-19	95.2	103.0	103.7
MKs	524B-B-02, 524B2-B-19 and 524C2-B-19	96.3	104.0	103.0
MKs	524B4-02 and 524B4-D-02	95.3	103.5	103.0
MKs	524D4-B-19, 524D4-B-39 and 524D4X-B-19	96.5	103.0	103.7
5.1.3. Maximum overspeed (20 sec limit)				
MK	524C2-19	98.3	107.0	105.0
MKs	524D4-19, 524D4-39 and 524D4X-19	98.9	107.0	106.0
MKs	524B-02, 524B2-19 and 524B3-02	98.3	107.0	104.0
MKs	524B4-02 and 524B4-D-02	98.5	108.0	104.0
MK	524C2-B-19	99.6	107.0	105.0
MKs	524B-B-02 and 524B2-B-19,	99.6	107.0	104.0
MKs	524D4-B-19, 524D4-B-39 and 524D4X-B-19	99.6	107.0	106.0
5.1.4. Ground Idling, L P Speed				
MKs	524B-02, 524B3-02, 524B4-02, 524B4-D-02 and 524B-B-02		22.5 +1/-0	
MKs	524B2-19, 524C2-19, 524B2-B-19 and 524C2-B-19		22.0 +1.5/-0	
MKs	524D4-19, 524D4-39, 524D4-B-19 524D4-B-39, 524D4X-19 and 524D4X-B-19		22.6 +1.5/-0	
Note:Ground idling limit applies to 15°C ambient temperature conditions and varies linearly by 0.5% per 15°C change in air temperature.				
5.1.5. Maximum for reverse thrust (60 second limit) -			-	90.0

♦ These operating limitations may be used for up to 10 minutes in the event of engine failure. (BCAR Section C Issue 13)

5.2	Turbine Gas Temperature (°C)	
5.2.1.	Momentary maximum during starts on the ground	600
5.2.2.	Momentary maximum during re-lights in flight	550
5.2.3.	Maximum for take-off (5 min limit) ♦	785
5.2.4.	Maximum Continuous:	
	MKs 524D4-19, 524D4-39, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19	722
	MKs 524-02, 524B2-19, 524B2-39, 524B-02, 524B3-02, 524C2-19, 524B4-02, 524B4-D-02, 524B-B-02, 524B2-B-19 and 524C2-B-19	732
5.2.5.	Maximum over temperature (20 sec limit)	800
5.3	Fuel	
5.3.1.	Approved Fuels:	
	For list of fuels and fuel additives approved for use in the engine, see relevant Operating Instructions.	
5.3.2.	Minimum pressure at engine inlet (measured at inlet to engine LP fuel pump):	
	Not less than 5 lbf/sq.in. abs.plus true fuel vapour-pressure with zero vapour/liquid ratio between sea-level and 45,000 ft altitude.	
5.3.3.	Maximum temperature (°C)	
(a)	At inlet to LP fuel pump	
(i)	Mks 524B4-02 and 524B4-D-02	47
(ii)	All other Mks	57
(b)	At inlet to HP fuel pump (measured at fuel filter outlet)	
(i)	Unrestricted	95
(ii)	Maximum during transient overshoots on reducing rpm (15 min limit)	115
5.3.4.	Minimum drainage period (from closing HP fuel cock after a false start) (seconds)	30
5.4	Oil	
5.4.1	Approved Types:	
	Castrol 599 Gas Turbine oil	
	Aeroshell Turbine Oil 560	
	Aeroshell Turbine Oil 500 (Also known as Royco Turbine Oil 500)	
	Castrol 5000 Gas Turbine Oil	
	Castrol 580 Gas Turbine Oil	
	Aeroshell Turbine Oil 555 (Also known as Royco Turbine Oil 555)	
	Esso/Exxon Turbo Oil 25	
	Mobil Jet Oil II	
	Mobil Jet Oil 254	
	Esso/Exxon Turbo Oil 2380	
Note:	Oil of the above types, when reclaimed to the approved Rolls-Royce standards for the appropriate viscosity grade, are approved for use in all - 524 marks.	
♦	These operating limitations may be used for up to 10 minutes in the event of engine failure. (BCAR Section C Issue 13)	

5.4.2. Combined Scavenge Temperature (°C)

(a)	Minimum for starting	
	MKs 524D4-19, 524D4-39, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19	minus 40
	MKs 524-02, 524B2-19, 524B2-39, 524B-02, 524B3-02, 524C2-19, 524B4-02, 524B4-D-02, 524B-B-02, 524B2-B-19 and 524C2-B-19	minus 50
(b)	Minimum for opening-up	minus 10
(c)	Maximum for un-restricted use	
	MKs 524B2-19, 524B-02, 524B3-02, 524C2-19, 524B2-B-19, 524B-B-02, and 524C2-B-19	170
	MKs 524D4-19, 524D4-39, 524D4-B-19, 524D4-B-39 524D4X-19 and 524D4X-B-19	167
	MKs 524B4-02 and 524B4-D-02	160

5.4.3. Pressure (lbf/sq.in)

(a)	Minimum acceptance for flight	
	(i) Ground idle to 70% HP rpm	35
	(ii) Above 70% HP rpm	40
(b)	Minimum to complete flight	
	(i) Ground idle to 70% HP rpm	25
	(ii) Above 70% HP rpm	35

Note: Large reductions in engine rpm to below 70% HP rpm may result in transient reductions in oil pressure below 25 lbf/sq.in. This is acceptable provided the oil pressure does not fall below 18 lbf/sq.in. and recovers to at least 25 lbf/sq.in. within 5 minutes of throttling back.

5.4.4. Consumption (Imp pt/hr)

Overall in flight, maximum for unrestricted operation

MKs	524B2-19, 524C2-19, 524D4-19, 524D4-39, 524B2-B-19, 524C2-B-19, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19	2.0
MKs	524B-02, 524B3-02, 524B4-02, 524B4-D-02 and 524B-B-02	1.6

5.4.5. Capacity (Imp pt)

(a)	Nominal total oil system capacity	
	MKs 524B-02, 524B3-02, 524B4-02, 524B4-D-02 and 524B-B-02	62.5
	MKs 524B2-19, 524C2-19, 524D4-19, 524D4-39, 524B2-B-19, 524C2-B-19, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19	73.0

(b)	Nominal oil tank capacity	
MKs	524B-02, 524B3-02, 524B4-02, 524B4-D-02 and 524B-B-02	38.0
MKs	524B2-19, 524C2-19, 524D4-19, 524D4-39, 524B2-B-19, 524C2-B-19, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19	47.8
(c)	Usable oil (including effect of attitude), minimum	
MKs	524B-02, 524B3-02, 524B4-02 524B4-D-02 and 524B-B-02	27.5
MKs	524B2-19, 524C2-19, 524D4-19, 524D4-39, 524B2-B-19, 524C2-B-19, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19	39.6

6 COMPRESSOR AIR BLEEDS:

6.1 MKs 524B-02, 524B3-02, 524B4-02, 524B4-D-02 and 524B-B-02

The engine bleed is automatically scheduled from the engine IP and HP bleed ports by a valve in the aircraft ducting which selects the appropriate supply in response to a signal sensing IP compressor delivery pressure (P3).

Bleed air is extracted from the IP delivery port at engine power settings above that giving a P3 greater than 39.5 ± 3 lbf/sq.in. (gauge) at sea-level (decreasing linearly through 22 ± 1.5 lbf/sq.in. at 35,000 ft).

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

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

6.1.2. Air delivery for aircraft services

(i)	Maximum HP bleed (for mixed HP and IP bleed) (% gas generator compressor flow)	
	Ground idle to changeover point	
(a)	Normal operation	9.0
(b)	Abnormal operation	12.0
(ii)	Maximum IP bleed (% gas generator compressor flow)	
(a)	Normal operation	
	Ground idle conditions to changeover point	1.5
	Changeover point to Maximum Take-off Conditions	6.5

(b) Abnormal operation

Ground idle to Maximum
Take-off Conditions 6.5

- 6.2 MKs 524B2-19, 524C2-19, 524D4-19, 524D4-39, 524B2-B-19, 524C2-B-19, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19.

The engine bleed is automatically scheduled from the engine IP and HP bleed ports by a valve in the aircraft ducting which selects the appropriate supply in response to a signal sensing HP compressor delivery pressure (P4).

With valve controller 60B 40123-2, bleed air is extracted from the IP delivery port at engine power settings above that giving a P4 greater than 84 ± 3 lbf/sq. in. (gauge) at Sea Level and 84 ± 4 lbf/sq.in. at 30,000 ft, then decreasing linearly with ambient pressure to 71 ± 3 lbf/sq.in. at 45,000 ft.

With valve controller 60B 40123-3, bleed air is extracted from the IP delivery port at engine power settings above that giving, at maximum setting, a P4 greater than 89 lbf/sq.in. (gauge) between Sea Level and 36,000 ft decreasing linearly to 66 lbf/sq.in. at 45,000 ft and, at minimum setting, 79 lbf/sq.in. between Sea Level and 30,000 ft decreasing linearly to 56 lbf/sq.in. at 45,000 ft.

At power settings below these switching pressures, bleed air is extracted from the HP bleed port. The nose cowl anti-icing air bleed flow is included in the maximum bleed flows quoted below for IP and HP bleeds.

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

6.2.1 Maximum rpm at which bleed may be used: Unrestricted

6.2.2. Air delivery for aircraft services

(i) Maximum HP bleed (% gas generator compressor flow)

Ground idle to changeover point 9.0

(ii) Maximum IP bleed (% gas generator compressor flow)
Decreases linearly with increases of HP compressor delivery pressure such that the bleed is:-

At the changeover point 7.2

At Maximum Continuous conditions 5.0

At Maximum Take-off conditions 3.4

(iii) Maximum LP bleed (% fan flow)

From Ground idle to 93% HP rpm 0.5

At Maximum Continuous 0.4

At Maximum Continuous to Maximum Take-off 0.6

7 EQUIPMENT:

For identification of equipment approved for use on these engines refer to Chapter 6 of the appropriate engine DIS.

8 SPECIAL FEATURES:

A thrust reverser system is incorporated to reverse the fan stream.

A hot stream spoiler is not fitted.

A non-heated nose spinner is fitted to the RB211-524B3-02, 524B4-02, 524B4-D-02, 524D4-19, 524D4-39, 524D4-B-19, 524D4-B-39, 524D4X-19 and 524D4X-B-19.

9 MANUALS:

Engine Mark Number	Operating Instructions	Maintenance Manual	Engine Manual
RB211-524B-02 RB211-524B3-02 RB211-524B4-02 RB211-524B4-D-02 RB211-524B-B-02	F-211 (524B) -T	M-211 (524) -T	E-211 (524) -3RR
RB211-524B2-19 RB211-524D4-19 RB211-524D4-39 RB211-524B2-B-19 RB211-524D4-B-19 RB211-524D4-B-39 RB211-524C2-19 RB211-524C2-B-19	F-211 (524) -BSP	M-211 (524) - B	E-211 (524) -2RR
RB211-524B2-19 RB211-524C2-19 RB211-524D4-19 RB211-524B2-B-19 RB211-524C2-B-19 RB211-524D4-B-19 RB211-524D4X-19 RB211-524D4X-B-19	F-211 (524) -B		

10 ENGINE VARIANTS:

The RB211-524-02 was approved originally on 19 December 1975. It had installation features to suit the Lockheed Tristar aircraft. This variant is no longer in service, all -524-02 engines having been converted to the -524B-02 variant. The -524-02 engine type's identity and approval have been retained on this ETCDS for reference purposes only, but all other acceptance and operating details were deleted at Issue 21 dated 2 June 1981. Its take-off thrust rating was 47,140 lbf (bare engine equivalent was 48,000 lbf) flat rated to ISA + 13.9°C, and its maximum continuous thrust rating was the same as the -524B-02.

The RB211-524B-19 was approved originally on 19 December 1975. It had a build standard similar to the RB211-524-02, installation features to suit the Boeing 747

aircraft, and higher take-off rating and take-off thrust. This variant is no longer in service and was deleted from this ETCDS at Issue 10 on 4 July 1979.

The RB211-524B2-19 was approved originally on 12 October 1977. It is a derivative of the RB211-524B-19, has similar installation features to suit the Boeing 747 and 747SP aircraft, but incorporates modifications that improve the handling characteristics and the hot day performance.

The RB211-524B2-39 was approved originally on 19 April 1978. Its performance and handling characteristics are identical to the RB211-524B2-19 with similar installation features to suit the Boeing 747 and 747 SP aircraft. The -524B2-39 engine type's identity and approval have been retained on this ETCDS for record purposes only, all other acceptance and operating limitations were deleted at Issue 31 dated 20 March 1987, as there are no longer any of these models remaining in service.

The RB211-524B-02 was approved originally on 28 July 1978. It is a derivative of the RB211-524-02, has similar installation features to suit the Lockheed Tristar aircraft, but incorporates modifications to provide higher take-off rating and take-off thrust. The build standard is similar to the RB211-524B2-19.

The RB211-524B3-02 was approved originally on 4 July 1979. It is a derivative of the RB211-524B-02, with the same rating and similar installation features to suit the Lockheed Tristar aircraft, but incorporates modifications to improve the weight and SFC. These include both a forward repositioning and an increase in the tip diameter of the fan rotor assembly with no increase in the maximum diameter of the fan casing.

The RB211-524C2-19 was approved originally on 21 December 1979. It is a derivative of the RB211-524B2-19, has similar installation features to suit the Boeing 747 aircraft, with increased take-off and maximum continuous ratings basically achieved by increased fuel flow but with improvements in the HP turbine assembly.

The RB211-524B4-02 was approved originally on 31 July 1980. It is a derivative of the RB211-524B3-02, with the same rating and similar installation features to suit the Lockheed Tristar aircraft, but incorporates further modifications to improve the SFC. These include improvements in the HP turbine assembly and a new design of IP and LP turbine assemblies within increased diameter turbine casings.

The RB211-524D4-19 was approved originally on 31 March 1981. It has installation features to suit the Boeing 747 aircraft and is a derivative of the RB211-524C2-19 but incorporates further modifications for increased takeoff and maximum continuous ratings. These include a revised IP compressor and, similar to the RB211-524B4-02, a moved forward fan and an improved IP/LP turbine assembly. The thrust reverser has been redesigned to reduce its weight.

The RB211-524D4-39 was approved originally on 1st August 1983. Its performance and handling characteristics are identical to the RB211-524D4-19 with similar installation features to suit the Boeing 747 and 747SP aircraft.

The RB211-524D4-19 was approved on 13 November 1985 for operation at an increased take-off thrust rating up to 2000 ft altitude flat rated to ISA + 11.2C ambient air temperature. Engine operating limitations are not affected by this change.

The RB211-524B4-D-02 was approved on 14 July 1987, it is mechanically identical to the 524B4-02. However it features an extended envelope for Maximum Take-off thrust, which is increased to ISA + 17.8C, 5000 ft altitude.

The RB211-524B-B-02, 524B2-B-19, 524C2-B-19, 524D4-B-19 and 524D4-B-39 were approved on 28 August 1987 and are mechanically identical to 524B-02, 524B2-19, 524C2-19, 524D4-19 and 524D4-39 respectively with the exception of the new HP Turbine Package 72-7730. Both pre and post mod engines are rated at the same thrusts for Take-off and Max Continuous, but post mod engines have slightly increased operating limitations for speed.

RB211-524B-B, B2-B, C2-B, B4, B4-D and D4-B engine models, comply with the aircraft engine emissions and fuel venting requirements BCAR section M Issue 1.

The RB211-524D4X-19 and RB211-524D4X-B-19 were approved on 29 July 1988. They are mechanically identical to the 524D4-19 and 524D4-B-19 respectively but feature a 1.6% increase in Maximum Take-off Thrust over the whole Take-off flight envelope. Engine operating limitations are not affected by this change. Both of these new engines comply with the aircraft engine emissions and fuel venting requirements of BCAR Section M Issue 1.

The RB211-524D4X-19 and D4X-B-19 models were approved on 12 October 1988 to use the increased take-off thrust rating of the 524D4-19, at the same reduced ambient take-off envelope conditions of 2000 ft maximum, flat rated to ISA +11.2C.