

524G2-19, 524G3-19:-

- (i) Pre-Mods 72-9045 & 72-9101: Code CD, resistance 141.04 ohms and code CJ, resistance 153.70 ohms.
- (ii) Post Mods 72-9045 & 72-9101: Code CJ, resistance 153.70 ohms.
- (iii) Post Mod 77-9626: Code CN, resistance 163.94 ohms.
- (iv) Post Mod 77-B780: Code CY, resistance 184.42 ohms.
- (v) Post Mod 77-C219: Code DC, resistance 194.66 ohms.

524G2-T-19, 524G3-T-19:-

- (i) Code DA, resistance 189.54 ohms
- f) Fuel having a minimum calorific value of 42.8 MJ/Kg (18,400 Btu/lb).
- g) Engine exhaust system defined by fan thrust reverser TR537 and Jet Pipe JP520.
- 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 Ratings	524G2	524G2-T	524G3	524G3-T
4.1.1	Net Thrust, minimum (lbf)	56870	56870	56870	56870
Note: Bare engine thrust is 58000lbf					
4.1.2	RPM, maximum, (%) HP	96.9	96.1	96.4	95.6
	RPM, maximum, (%) IP	104.4	103.8	103.9	103.2
	RPM, maximum, (%) LP	105.9	105.8	105.9	105.8
4.1.3	Turbine Gas Temperature, (°C) maximum, trimmed	713	729	702	719
4.1.4	Integrated Engine Pressure Ratio (PINT/PTO) maximum, trimmed	1.740	1.740	1.740	1.740
4.1.5	Fuel Consumption, maximum (lb/lbf thrust/hr)	0.3889	0.3889	0.3889	0.3889

4.2	Maximum Continuous Rating	524G2	524G2-T	524G3	524G3-T
4.2.1	Net Thrust, minimum (lbf)	47230	47230	47230	47230
4.2.2	RPM, maximum, (%) HP	93.3	93.1	93.3	93.1
	RPM, maximum, (%) IP	99.5	100.9	99.5	100.9
	RPM, maximum, (%) LP	98.7	98.6	98.7	98.6
4.2.3	Turbine Gas Temperature (°C) maximum, trimmed	647	657	647	657
4.2.4	Integrated Engine Pressure Ratio (PINT/PTO) maximum, trimmed	1.602	1.602	1.602	1.602
4.2.5	Fuel Consumption, maximum (lb/lbf thrust/hr)	0.3651	0.3651	0.3651	0.3651
4.2.6	Oil Consumption, maximum (imp. pt/hr)	2.0	2.0	2.0	2.0

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 1047 for the 524G2-19, 524G3-19, 524G2-T-19 and 524G3-T-19. The engines may be used in ambient temperatures up to ISA + 40°C.

At maximum continuous ratings, the engines are flat rated to ISA + 10°C at all flight conditions. At take-off ratings, the 524G2 and 524G2-T are flat rated as follows:-

- (a) Up to sea-level, ISA + 15°C
- (b) Between sea-level and 5000 ft, varies linearly between ISA + 15°C and ISA + 10°C
- (c) At and above 5000ft, ISA + 10°C

The 524G3 and 524G3-T take-off ratings are as above except for an increase of +2.9% thrust at ISA +21.2°C between 0.1 and 0.4 Mach No at 600'.

5.1	Rotational Speed (%)	HP	IP	LP
5.1.1	Maximum for take-off (5 min limit)*	99.2	107.7	110.5
5.1.2	Maximum continuous	97.1	105.0	109.8
5.1.3	Maximum overspeed (20 sec limit)	101.5	109.5	111.5

5.1.4	Maximum for reverse thrust (40 second limit)	-	-	91.0
5.2	Turbine Gas Temperature, (°C)			
5.2.1	Below 50% HP speed, maximum trimmed, no time restriction			600
	Above 50% HP speed, the following limits apply:-			
5.2.2	Maximum trimmed for take-off (5 min. limit)*			785
5.2.3	Maximum trimmed continuous			733
5.2.4	Maximum trimmed over temperature (20 sec limit)			805

* These operating limitations may be used for up to 10 minutes in the event of engine failure.

5.3	Fuel			
5.3.1	Approved Fuels:			
	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 plus true fuel vapour-pressure with zero vapour/liquid ratio between sea-level and 45,000 ft altitude.		
5.3.3	Minimum drainage period (from closing HP fuel cock after a false start) (seconds)			30
5.4	Oil			
5.4.1	Approved types:			
	See relevant operating instructions			
5.4.2	Combined scavenge temperature (°C)			
	(a) minimum for starting			minus 30
	(b) minimum for opening up			minus 10
	(c) maximum for unrestricted use			171

5.4.3 Pressure (lbf/sq.in)

Minimum

(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 inflight, maximum for unrestricted operation	2.0
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5.4.5 Capacity (Imp pt)

(a) Nominal total oil system capacity	72.6
(b) Nominal oil tank capacity	47.4
(c) Usable oil (including effect of attitude) minimum	39.6

6. **COMPRESSOR AIR BLEEDS**

6.1 Air Bleeds

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 (P3.0).

With valve controller 60B 40123-103 bleed air is extracted from the IP delivery port at engine power settings above that giving a P3.0 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 45,000ft.

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.

6.1.1 Maximum rpm at which bleed may be used:

Unrestricted.

6.1.2 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	6.3
	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	0.6
	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 engines DIS.

8 **SPECIAL FEATURES**

The engine is fitted with a Digital Electronic Engine Fuel Control system in which the software is designated level 1 according to Airworthiness Notice 45A (DO-178A/ED-12A).

9 **MANUALS**

Operating Instructions	F-211 (524G/H)-747
Maintenance Manual	Aircraft Maintenance Manual Boeing 747-400 D633U101-RR
Engine Manual	E-211 (524)-7RR
Time Limits Manual	T-211(524)-7RR
Installation Brochure	EL2806 A

10 **NOTES**

The RB211-524G2-19 and 524G3-19 engines comply with the aircraft engine emissions requirements of BCAR section M iss 1 as amended by Blue Paper M 847 and the recommendations of ICAO annex 16 vol 2, First Edition - 1981.

The RB211-524G2-T-19 and 524G3-T-19 engines comply with the aircraft engine emissions requirements of BCAR section M. Issue 1 as amended by Blue Paper M847 and the recommendation of ICAO annex 16 vol 2, Second Edition - 1993.

The engine is fitted with an independent HP spool overspeed governor. Despatch with this item unserviceable is not permitted.

The 524G2-19, 524G3-19, 524G2-T-19 and 524G3-T-19 satisfy the certification base defined in section 2 of this ETCDS when operating with the FAFC in reversionary control mode.

Rolls-Royce add suffixes to an Engine Type Designation to identify approved specific configuration variations within the Type. This suffix, which is of the form /00 is used when necessary to provide traceability of customer option equipment selections and is included on the engine nameplate and in engine documentation.

11 VARIANTS

The RB211-524G-19 was originally approved for installation in the B747-400 aircraft on 25 March 1988. This variant is no longer in service and was deleted from this ETCDS at Issue 4 on 9 May 1990.

The RB211-524G2-19 was first approved on 12 January 1989, it is a variant of the existing 524G-19 model, it incorporates a new rating plug in the FAFC to provide increased thrust during climb.

The RB211-524G3-19 was approved on 27 April 1989, it is a variant of the existing 524G2 model, it incorporates a new rating plug in the FAFC to provide increased thrust in the take-off envelope at 600', ISA +21.2°C between 0.1 and 0.4 Mach number.

The RB211-524G2-T-19 and RB211-524G3-T-19 were approved on 7 May 1997. They are variants of the RB211-524G2-19 and -524G3-19 respectively and feature the RB211 Trent 700 04 Module and accommodating modification (72-C067) to provide improved engine reliability and performance.