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I. General

1. Type/Variants:

Type: PW4000-100"
Variants: PW4164, PW4164C, PW4164C/B, PW4164-1D, PW4164C-1D, PW4164C/B-1D,
PW4168, PW4168A, PW4168-1D, PW4168A-1D, and PW4170

2. Type Certificate Holder:

Pratt & Whitney Division
United Technologies Corporation
East Hartford, Connecticut 06108
United States of America

3. Manufacturer:

Pratt & Whitney Division
United Technologies Corporation
East Hartford, Connecticut 06108
United States of America

4. Certification Application Date for EASA Certification:

11 April 1991	for the PW4164 and PW4168 variants (application was made to the JAA for JAA Joint Validation)
18 December 1997	for the PW4168A variant (application was made to the JAA for JAA Joint Validation)
22 October 2008	for the PW4164-1D, PW4164C-1D, PW4164C/B-1D, PW4168-1D, PW4168A-1D, and PW4170 variants
29 October 2008	for the PW4164C and PW4164C/B variants

5. EASA Certification Reference Date:

For all variants: 24 August 1990

6. EASA Certification Date:

PW4164, and PW4168 (1)	24 May 1994
PW4168A (2)	8 June 1998
PW4164C, PW4164C/B, PW4164-1D, PW4164C-1D, PW4164C/B-1D, PW4168-1D, PW4168A-1D, and PW4170	25 May 2009

(1) EASA Type Certification for the PW4164 and PW4168 engine models is granted, in accordance with Article 2a paragraph 1(a) of EU Commission Regulation EC 375/2007 amending EU Commission Regulation 1702/2003, based on the DGAC France Engine Type Certificate No. M-IM 37 issued prior to 28 September 2003 following the recommendation of the JAA as per letter JAA 04/12/06/10/94-L083 dated 18 May 1994.

(2) EASA Type Certification for the PW4168A engine model is granted, in accordance with Article 2a paragraph 1(a) of EU Commission Regulation EC 375/2007 amending EU Commission Regulation 1702/2003, based on the DGAC France Engine Type Certificate No. M-IM 37 issued prior to 28 September 2003 following the recommendation of the JAA as per letter JAA 04/12/65/10/98-L145 dated 25 May 1998.

II. Certification Basis

1. FAA Certification Basis:

Refer to FAA TCDS number E36NE, Revision 5 dated 25 November 2008

2. EASA Certification Basis:

2.1 EASA Certification Basis for the PW4164, PW4168 and PW4168A variants (reference JAA Engine Data Sheet No. JAA/E/94-006, Issue 5, dated 20 May 1998, which is hereby superseded)

Airworthiness Standards:	JAR-E Change 8, Effective 4 May 1990
Special Conditions:	SC1 – Ingestion of Rain SC2 – Ingestion of Hail
Equivalent Safety Findings:	JAR-E840 Rotor Integrity JAR-E740(f) Maximum Continuous Speed Limitations JAR-E740(c) & 740(f)(1) Endurance Test Schedules and characteristics of multispool engines JAR-E800 4 lb Bird Ingestion Test JAR-E640(b)(1) Strength-Static Pressure Tests
Deviations:	None
Environmental protection requirements:	CS-34 Issue dated 23.10.2003 in accordance with (Emissions and Fuel Venting) ICAO Annex 16 Volume II, Third Edition, including Amendment 7, as applicable 17 November 2011, The NOx Standard is in accordance with Part III, Chapter 2, § 2.3.2, e) (CAEP/8)

2.2 EASA Certification Basis for the PW4164C and PW4164C/B variants

Airworthiness Standards:	JAR-E Change 8, Effective 4 May 1990 CS-E 790 "Ingestion of Rain and Hail", published 3 December 2007
Equivalent Safety Findings:	JAR-E 740(f) Endurance Test-Maximum Continuous Speed Limitations JAR-E 800 4 lb Bird Ingestion Test JAR-E 640(b)(1) Strength – Static Pressure Tests JAR-E 840 Rotor Integrity
Deviations:	None
Environmental protection requirements: (Emissions and Fuel Venting)	CS-34 Issue dated 23.10.2003 in accordance with ICAO Annex 16, Volume II, second edition, including Amendment 5, effective 24 November 2005. The NOx Standard is in accordance with Part III, Chapter 2, § 2.3.2, d) (CAEP/6)

2.3 EASA Certification Basis for the PW4170, PW4168A-1D, PW4168-1D, PW4164-1D, PW4164C-1D, and PW4164C/B-1D variants

Airworthiness Standards:	JAR-E Change 8, Effective 4 May 1990 CS-E 790 "Ingestion of Rain and Hail", published 3 December 2007
Equivalent Safety Findings:	JAR-E 740(f) Endurance Test-Maximum Continuous Speed Limitations JAR-E 800 4 lb Bird Ingestion Test JAR-E 640(b)(1) Strength – Static Pressure Tests JAR-E 840 Rotor Integrity JAR-E740(a) Endurance Test
Deviations:	None
Environmental protection requirements: (Emissions and Fuel Venting)	CS-34 Issue dated 23.10.2003 in accordance with ICAO Annex 16 Volume II, Third Edition, including Amendment 7, as applicable 17 November 2011, The NOx Standard is in accordance with Part III, Chapter 2, § 2.3.2, d) (CAEP/6) for PW4170, <u>PW4164C-1D</u> , and <u>PW4164C/B-1D</u> § 2.3.2, e) (CAEP/8) for <u>PW4168A-1D</u> , <u>PW4168-1D</u> , <u>PW4164-1D</u>

III. Technical Characteristics

1. Type Design Definition:

PW4164	: Parts List 54A100-02
PW4164C	: Parts List 54A100-04
PW4164C/B	: Parts List 54A100-05
PW4164-1D	: Parts List 54A100-11
PW4164C-1D	: Parts List 54A100-10
PW4164C/B-1D	: Parts List 54A100-12
PW4168	: Parts List 54A100-01
PW4168A	: Parts List 54A100-03
PW4168-1D	: Parts List 54A100-08
PW4168A-1D	: Parts List 54A100-09
PW4170	: Parts List 54A100-07

2. Description:

Axial airflow, dual-spool, turbofan, single-stage fan, 5-stage low pressure compressor, 11-stage high pressure compressor, annular combustor, 2-stage high pressure turbine, 5-stage low pressure turbine

3. Dimensions:

Overall Length : 4.25 m (167.22 inches)
Overall Height : 3.13 m (123.246 inches)

4. Dry Weight:

5851.3 kg

Note: Weight of basic engine includes all essential accessories, but excludes exhaust nozzle and power source for the ignition system

5. Ratings (Static thrust at Sea Level, see Note 1):

	Take-off, 5 minutes	Maximum Continuous
PW4164	286.91 kN (64500 lb)	248.21 kN (55800 lb)
PW4164C	286.91 kN (64500 lb)	248.21 kN (55800 lb)
PW4164C/B	305.14 kN (68600 lb)	248.21 kN (55800 lb)
PW4164-1D	286.91 kN (64500 lb)	248.21 kN (55800 lb)
PW4164C-1D	286.91 kN (64500 lb)	248.21 kN (55800 lb)
PW4164C/B-1D	305.14 kN (68600 lb)	248.21 kN (55800 lb)
PW4168	305.14 kN (68600 lb)	264.03 kN (59357 lb)
PW4168-1D	305.14 kN (68600 lb)	264.03 kN (59357 lb)
PW4168A	305.14 kN (68600 lb)	264.03 kN (59357 lb)
PW4168A-1D	305.14 kN (68600 lb)	264.03 kN (59357 lb)
PW4170	311.37 kN (70000 lb)	264.03 kN (59357 lb)

6. Control System:

Fuel Metering Unit	Hamilton Standard Model Number JFC-131
Fuel Pump and filter	Argo-Tech Model 723300
Fuel Distribution Valve	Hamilton Standard Model Number GTA40
Electronic Engine Control (EEC)	Hamilton Standard EEC Model Number 170
EEC Alternator; Stator	Unison P/N 430073
EEC Alternator; Rotor	Unison P/N 430074
Station 2.5 Bleed Actuator	Hamilton Standard Model Number GTA42
Stator Vane Actuator	Hamilton Standard Model Number GTA41
P2/TT2 Probe	Rosemount Model Number 154 GT

7. Fluids:

Fuel Specification, all variants (see also Note 2): Refer to the latest issue of Pratt & Whitney Turbojet Engine Service Bulletin No. 2016

Oil Specifications, all variants: Refer to the latest revision of Pratt & Whitney Turbojet Engine Service Bulletin No. 238

8. Ignition:

Exciter	Unison Industries Model Number TFN-29
Igniters	PW P/N IC709520

9. Accessory Drive Provisions:

Drive (High Pressure Rotor)	Rotation	Speed Ratio to Turbine Shaft	Torque (Nm) (Continuous)	Torque (Nm - Static)	Overload (Nm)	Overhang (Nm)
Starter	CCW	0.841:1	N/A	¹⁾	N/A	56 (500 lb-in)
IDGS	CCW	0.841:1	²⁾	1426 (12620 lb-in)	²⁾	226 (2000 lb-in)
Fluid power pump (R)	CCW	0.389:1	147 (1300 lb-in)	734 (6500 lb-in)	221.5 (1950 lb-in) ³⁾	45 (400 lb-in)
Auxiliary fluid power pump (R)	CCW	0.412:1	147 (1300 lb-in)	734 (6500 lb-in)	221.5 (1950 lb-in) ³⁾	45 (400 lb-in)

Notes:

CCW = counterclockwise

N/A = Not applicable

1) Maximum start continuous torque = 1424 Nm (1050 lb-ft) at zero rpm and 1695 Nm (1250 lb-ft) maximum impact torque. Maximum allowable starter torque value is 2031-2349 Nm (1498-1732 lb-ft).

2) Maximum allowable continuous torque values are equivalent to 130 kW (175 HP) at any engine speed at or above sea level idel. The following overload conditions can be accomodated:

kW (HP)	DURATION TIME	RECURRING TIME
168 (225)	5 minutes	1000 hours
168 (225)	5 seconds	1 hour
336 (450)	5 seconds	1000 hours

3) Maximum allowable for 5 minute duration recurring at four-hour intervals minimum

9. Maximum Permissible Air Bleed Extraction (in % of the primary engine airflow):

8th Stage Bleed:

	Normal	Maximum Bleed (one engine out)
Idle to 40% Maximum Continuous	0.0	0.0
Above 40% Maximum Continuous Thrust	4.0	6.0

15th Stage Bleed:

	Normal	Maximum Bleed (one engine out)
Idle to 40% Maximum Continuous	8.0	12.0
Above 40% Maximum Continuous Thrust	6.0	7.6

IV.Operational Limits:

1. Temperature Limits (see also Note 9):

For in-flight starts which result in exceedance of the ground start limit, the maximum temperature and duration must be recorded for maintenance action, the PW4164, PW4164C, PW4164C/B, PW4164-1D, PW4164C-1D, PW4164C/B-1D, PW4168, PW4168A, PW4168-1D, PW4168A-1D, and PW4170 Maintenance Manual.

Turbine Exhaust gas temperature (all variants - see Note 3) °C / °F:

	actual	indicated
At takeoff (5 minutes, see Note 4)	645 / 1193	620 / 1148
Maximum continuous	615 / 1139	600 / 1112
At start-up, ground	535 / 995	535 / 995
At start-up, In-flight	645 / 1193	620 / 1148

Oil outlet temperature (all variants) °C / °F:

Continuous operation	163 / 325
Transient operation (20 minutes)	177 / 350

External Engine Components:

External engine components maximum limiting temperatures are specified in the Installation and Operating Manual, section 4.3.

2. Rotational Speed Limits (rpm, see also Note 9):

Maximum Rotational Speeds:

PW4164, PW4164C, PW4164C/B, PW4164-1D, PW4164C-1D, PW4164C/B-1D, PW4168, PW4168A, PW4168-1D, and PW4168A-1D		PW4170	
Low pressure rotor (N1)	High pressure rotor (N2)	Low pressure Rotor (N1)	High Pressure Rotor (N2)
3600	10450	3680	10450

Minimum Rotational Speeds (all variants):

Low pressure rotor (N1): 736 (In-flight)
High pressure rotor (N2): 5860 (In-flight and on ground operation)

3. Pressure Limits:

Fuel Pressure Limits: At inlet to engine system pump, not less than 34.5 kPa (5 psig) above the true vapour pressure of the fuel and not greater than 482.6 kPa (70 psig) above absolute ambient pressure, with a vapour/liquid ratio of zero.

Oil Pressure Limits: Minimum 482.6 kPa (70 psid - differential)
Temporary interruption of oil pressure associated with negative "G" operation is limited to 30 seconds maximum. Normal oil pressure will be restored rapidly once the negative "G" effect has been eliminated. There is no maximum oil pressure limit.

4. Installation Assumptions:

Refer to the applicable Installation and Engine Operation Manuals.

5. Time Limited Dispatch:

Refer to Note 12

V. Operating and Service Instructions

Installation and Operating Manual	PWA-6335
Operating Instructions (Airbus A330 aircraft)	Oper. Instr. 325
Engine Maintenance Manual	P/N 51A341
Engine Manual	P/N 51A342
Illustrated Parts Catalogue	P/N 51A343

VI. Notes

Note 1: The Sea Level Static Ratings are ideal and based on ICAO Standard Atmosphere conditions, a Pratt & Whitney hardwall bellmouth inlet, no fan or compressor air bleed or load on accessory drives, an exhaust system having no internal pressure or external scrubbing losses, and fan duct and primary nozzle velocity coefficients equal to 1.0.

Note 2: Fuel and fuel additives conforming to the latest applicable issue of FAA-approved Pratt & Whitney Turbojet Engine Service Bulletin No. 2016 may be used separately or mixed in any proportions without adversely affecting the engine operation or power output.

Note 3: Electronic Engine Control (EEC) software version SCN5C has maximum permissible exhaust gas temperatures of 625°C actual and 620°C indicated for takeoff (5 minutes) and 600°C for maximum continuous. To provide an 20°C EGT margin, EEC software version SCN6B and later versions can provide maximum permissible EGT of 645°C actual (620°C indicated) for takeoff, and 615°C actual (600°C indicated) for maximum continuous. The noted engine ratings and limits are controlled by EEC P/N and Engine Programming Plug (EPP) P/N, and are implemented by specific Service Bulletin instructions only. The engine data plate also reflects the engine ratings and limits configuration.

Note 4: The normal 5 minute takeoff time limit may be extended to 10 minutes for engine out contingency.

Note 5: Power setting, power checks, and control of engine output in all operations are to be based upon Pratt & Whitney engine charts referring to either turbine discharge section gas pressure or low rotor speed. Pressure probes and a low rotor speed sensor are included in the engine assembly for this reason.

Note 6: Lightning protection requirements and electromagnetic interference emitted by the electronic engine control system, including cables, are specified in the Installation and Operating Manual, Section 4.12

Note 7: Certain engine parts are life-limited. Limits are listed in Pratt & Whitney PW4164, PW4164C, PW4164C/B, PW4164-1D, PW4164C-1D, PW4164C/B-1D, PW4168, PW4168A, PW4168-1D, PW4168A-1D, PW4170 Turbofan Engine Manual, Part No. 51A342, Time Limit Section.

Note 8: The maximum permissible engine inlet distortion limit is specified in the Installation and Operating Manual, Section 4.4, Report PWA-6335

Note 9: Limits regarding transient rotor shaft overspeed rpm and transient gas overtemperature and the number of overtemperature occurrences are specified in the Maintenance Document, Part No. 51A341.

Note 10: Information regarding approved fuel filter and oil filter replacement parts is contained in the PW4000 Series Illustrated Parts Catalog, Part No. 51A343.

Note 11: Requirements and limitations associated with automatic fuel system anti-icing are specified in the Installation and Operating Manual, Section 4.5, Report PWA-6335.

Note 12: The PW4164, PW4168, PW4168A, PW4164C, PW4164C/B, PW4170, PW4168A-1D, PW4168-1D, PW4164-1D, PW4164C-1D and PW4164C/B-1D engine models have been approved to operate with certain faults present in the control system, based on satisfaction of FAR 33/ JAR-E and appropriate FAR25/JAR25 control system reliability requirements. The following criteria exist as dispatch and maintenance requirements for the engine control system. These criteria are specified in Pratt & Whitney report PWA6436 which defines the various configurations and maximum operating intervals as follows:

Fault Level A: No dispatch allowed

Dispatchable: maximum operating interval for Fault Level B faults is 20 days

Fault Levels A and B constitute Pratt & Whitney nomenclature. The airframe manufacturers may use different nomenclature in adapting these fault categories to the aircraft maintenance and display systems. However, the maximum operating intervals are restricted as shown above.

Note 13: The PW4168A engine model provides the same takeoff thrust as the PW4168 engine model at or below sea level pressure altitude, and increased takeoff thrust at pressure altitudes above sea level and below 14100 feet and below temperatures of STD & 40°C.

Note 14: The PW4164C engine model provides the same takeoff thrust as the PW4164 engine model, and the increased maximum climb thrust of the PW4168A engine model.

Note 15: The PW4164C/B engine model provides the same takeoff thrust as the PW4168A engine model, and the increased maximum climb thrust of the PW4168A engine model.

Note 16: Installation and use of Thrust Reverser and Exhaust System (Reverser Assembly Part Number 70M001, Nozzle Assembly Part Number 76A008 and Exhaust Plug Assembly Part Number 75A001 according to FAA STC SE825NE is approved.

Note 17: The engine models PW4164, PW4164-1D, PW4168, PW4165A, PW4168-1D, PW4168a-1D and PW4170 were recertified to show compliance with the NOx Standards defined in ICAO - Annex 16, Volume II, Part III, Chapter 2 paragraph 2.3.2 d (CAEP/6 NOx production rule) in case of PW4170 and compliance with paragraph 2.3.2 e (CAEP/8 NOx Standard) for the others.
