

**COMANDO DA AERONÁUTICA
DEPARTAMENTO DE PESQUISAS E DESENVOLVIMENTO
CENTRO TÉCNICO AEROESPACIAL**

TYPE CERTIFICATE DATA SHEET Nº EM-9114

Type Certificate Holder:

PRATT & WHITNEY DIVISION
400 Main Street
East Hartford, Connecticut CT 06108
USA

EM-9114-02

Sheet 01

PRATT & WHITNEY

PW4050, PW4052, PW4056,
PW4060, PW4060A, **PW4060C**,
PW4152, PW4156, PW4156A,
PW4158, PW4160, PW4460,
PW4062, PW4062A, PW4462

September 2004

Engines of models described herein conforming with this data sheet, which is part of Type Certificate No. 9114, meet the minimum standards for use in certificated aircraft in accordance with pertinent aircraft data sheets and applicable portions of the Brazilian Aeronautical Regulations provided they are installed, operated, and maintained as prescribed by the approved manufacturer's manuals and other instructions.

MODEL PW4050, PW4052, PW4056, PW4060, PW4060A, **PW4060C**, PW4152, PW4156, PW4156A, PW4158, PW4160, PW4460, PW4062, PW4062A, PW4462.

TYPE Axial airflow, dual-spool, turbofan, single-stage fan, 4-stage low-pressure compressor, 11-stage high pressure compressor, annular combustor, 2-stage high-pressure turbine, 4-stage low-pressure turbine.

RATINGS	See Note 5	PW4050	PW4052	PW4056	PW4060
	Static thrust at sealevel, daN (lb)	22 241	23 220	25 244	26 689
	Takeoff, dry 5 minutes (See Notes 13 & 21)	(50 000***)	(52 200***)	(56 750***)	(60 000***)

-- "Same as preceding model"

		PW4050	PW4052	PW4056	PW4060
RATINGS (Cont.)	Maximum continuous	21 405 (48 120*)	22 161 (49 820*)	22 032 (49 530*(B767)) 21 338 (47 970**(B747))	22 352 (50 250*)
COMPONENTS	For information regarding components, refer to the approved parts list. (All models)				
FUEL TYPE		See Note 10	See Note 10	See Note 10	See Note 10
OIL, LUBRICATION		See Note 11	See Note 11	See Note 11	See Note 11
TEMPERATURE LIMITS		See Note 2	See Note 2	See Note 2	See Note 2
PRESSURE LIMITS		See Note 3	See Note 3	See Note 3v	See Note 3
PRINCIPAL DIMENSIONS	Length, in.	3 901 (153.6)	3 901 (153.6)	3 901 (153.6)	3 901(153.6)
	Nominal diameter, mm (in.)	2 477 (97.5)	2 477 (97.5)	2 477 (97.5)	2 477 (97.5)
	Maximum radial projection, mm (in.)	1 341 (52.8)	1 341 (52.8)	1 341 (52.8)	1 341 (52.8)
WEIGHT (DRY)	Wight of basic engines includes all essential accessories, but excludes exhaust nozzle and power source for the ignition system kg (lb)	4 273 (9 420)	4 273 (9 420)	4 273 (9 420)	4 273 (9 420)
CENTER OF GRAVITY	Axial: Forward of "K" flange, mm (in.)	238.8 ± 25.4 (9.4 ± 1.0)	238.8 ± 25.4 (9.4 ± 1.0)	238.8 ± 25.4 (9.4 ± 1.0)	238.8 ± 25.4 (9.4 ± 1.0)
	Vertical: Below engine centerline, mm (in.)	17.8 ± 12.7 (0.7 ± 0.5)	17.8 ± 12.7 (0.7 ± 0.5)	17.8 ± 12.7 (0.7 ± 0.5)	17.8 ± 12.7 (0.7 ± 0.5)
	Lateral: Relative to centerline, mm (in.)	2.5 ± 12.7 (0.1 ± 0.5)	2.5 ± 12.7 (0.1 ± 0.5)	2.5 ± 12.7 (0.1 ± 0.5)	2.5 ± 12.7 (0.1 ± 0.5)

RATINGS	See Note 5	PW4060A	PW4152	PW4156	PW4156A
	Static thrust at sealevel, daN (lb)				
	Takeoff, dry 5 minutes (See Notes 13 & 21)	27 388 (61 570)***	23 131 (52 000)*****	24 910 (56 000)**	24 910 (56 000)***
	Maximum continuous	22 352 (50 250)*	21 885 (49 200)**	22 054 (49 580)**	21 885 (49 200)**
COMPONENTS	For information regarding components, refer to the approved parts list. (All models)				
FUEL TYPE		See Note 10	See Note 10	See Note 10	See Note 10
OIL, LUBRICATION		See Note 11	See Note 11	See Note 11	See Note 11
TEMPERATURE LIMITS		See Note 2	See Note 2	See Note 2	See Note 2
PRESSURE LIMITS		See Note 3	See Note 3	See Note 3	See Note 3
PRINCIPAL DIMENSIONS	Length, mm (in.)	3 901 (153.6)	3 901 (153.6)	3 901 (153.6)	3 901 (153.6)
	Nominal diameter, mm (in.)	2 477 (97.5)	2 477 (97.5)	2 477 (97.5)	2 477 (97.5)
	Maximum radial projection, mm (in.)	1 341 (52.8)	1 341 (52.8)	1 341 (52.8)	1 341 (52.8)
WEIGHT (DRY)	Weight of basic engines includes all essential accessories, but excludes exhaust nozzle and power source for the ignition system, kg (lb)	4 273 (9 420)	4 273 (9 420)	4 273 (9 420)	4 273 (9 420)
CENTER OF GRAVITY	Axial: Forward of "K" flange, mm (in.)	238.8 ± 25.4 (9.4 ± 1.0)	--	--	--
	Vertical: Below engine centerline, mm (in.)	17.8 ± 12.7 (0.7 ± 0.5)	20.3 ± 12.7 (0.8 ± 0.5)	20.3 ± 12.7 (0.8 ± 0.5)	20.3 ± 12.7 (0.8 ± 0.5)
	Lateral: Relative to centerline, mm (in.)	2.5 ± 12.7 (0.1 ± 0.5)	2.5 ± 12.7 (0.1 ± 0.5) left	2.5 ± 12.7 (0.1 ± 0.5) left	2.5 ± 12.7 (0.1 ± 0.5) left

-- "Same as preceding model"

RATINGS	See Note 5	PW4158	PW4160	PW4460	PW4062
	Static thrust at sea level, daN (lb)	25 800	26 689	26 689	27 579
	Takeoff, dry 5 minutes (See Notes 13 & 21)	(58 000)**	(60 000)**	(60 000)**	(62 000)**
	Maximum continuous	22 054	22 063	22 708	22 352
		(49 580)**	(49 600)**	(51 050)**	(50 250)*
COMPONENTS	For information regarding components, refer to the approved parts list. (All models)				
FUEL TYPE		See Note 10	See Note 10	See Note 10	See Note 10
OIL, LUBRICATION		See Note 11	See Note 11	See Note 11	See Note 11
TEMPERATURE LIMITS		See Note 2	See Note 2	See Note 2	See Note 2
PRESSURE LIMITS		See Note 3	See Note 3	See Note 3	See Note 3
PRINCIPAL DIMENSIONS	Length, mm (in.)	3 901 (153.6)	3 901 (153.6)	3 901 (153.6)	3 901 (153.6)
	Nominal diameter, mm (in.)	2 477 (97.5)	2 477 (97.5)	2 477 (97.5)	2 477 (97.5)
	Maximum radial projection, mm (in.)	1 341 (52.8)	1 341 (52.8)	1 341 (52.8)	1 341 (52.8)
WEIGHT (DRY)	Weight of basic engines includes all essential accessories, but excludes exhaust nozzle and power source for the ignition system, kg (lb)	4 273 (9 420)	4 273 (9 420)	4 273 (9 420)	4 273 (9 420)
CENTER OF GRAVITY	Axial: Forward of "K" flange, mm (in.)	--	--	--	238.8 ± 25.4 (9.4 ± 1.0)
	Vertical: Below engine centerline, mm (in.)	20.3 ± 12.7 (0.8 ± 0.5)	20.3 ± 12.7 (0.8 ± 0.5)	20.3 ± 12.7 (0.8 ± 0.5)	17.8 ± 12.7 (0.7 ± 0.5)
	Lateral: Relative to centerline, mm (in.)	2.5 ± 12.7 (0.1 ± 0.5) left	2.5 ± 12.7 (0.1 ± 0.5) left	2.5 ± 12.7 (0.1 ± 0.5) left	2.5 ± 12.7 (0.1 ± 0.5)

-- "Same as preceding model"

		PW4062A	PW4462	PW4060C
RATINGS	See Note 5			
	Static thrust at sea level, daN (lb)	27 579	27 579	26 689
	Takeoff, dry 5 minutes (See Notes 13 & 21)	(62 000)**	(62 000)**	(60 000)***
	Maximum continuous	21 338 (47 970)**	22 708 (51 050)**	22 352 (50 250)*
COMPONENTS	For information regarding components, refer to the approved parts list. (All models)			
FUEL TYPE		See Note 10	See Note 10	See Note 10
OIL, LUBRICATION		See Note 11	See Note 11	See Note 11
TEMPERATURE LIMITS		See Note 2	See Note 2	See Note 2
PRESSURE LIMITS		See Note 3	See Note 3	See Note 3
PRINCIPAL DIMENSIONS	Length, mm (in.)	3 901 (153.6)	3 901 (153.6)	3 901 (153.6)
	Nominal diameter, mm (in.)	2 477 (97.5)	2 477 (97.5)	2 477 (97.5)
	Maximum radial projection, mm (in.)	1 341 (52.8)	1 341 (52.8)	1 341 (52.8)
WEIGHT (DRY)	Weight of basic engines includes all essential accessories, but excludes exhaust nozzle and power source for the ignition system, kg (lb)	4 273 (9 420)	4 273 (9 420)	4 273 (9 420)
CENTER OF GRAVITY	Axial: Forward of "K" flange, mm (in).	238.8 ± 25.4 (9.4 ± 1.0)	--	238.8 ± 25.4 (9.4 ± 1.0)
	Vertical: Below engine centerline, mm (in).	17.8 ± 12.7 (0.7 ± 0.5)	20.3 ± 12.7 (0.8 ± 0.5)	17.8 ± 12.7 (0.7 ± 0.5)
	Lateral: Relative to centerline, mm (in).	2.5 ± 12.7 (0.1 ± 0.5)	2.5 ± 12.7 (0.1 ± 0.5) left	2.5 ± 12.7 (0.1 ± 0.5)

-- "Same as preceding model"

IMPORT REQUIREMENTS Each engine imported separately and/or spare parts must be accompanied by an Airworthiness Certificate for Export and/or an Airworthiness Approval Tag, respectively, issued by FAA (or a third country authority, in case of used engine imported from such country) attesting that the particular engine and/or parts were submitted to the governmental quality control before delivery and are in conformity with the CTA approved type design. The CTA type design corresponds to the FAA approved type design, as stated in CTA Report V33-046-00 dated 28 October 2003 or further revisions

CERTIFICATION BASIS RBHA 33 which endorses FAR 33 - including Amendments 33-1 through 33-9 effective on 14 October 1980 and Amendment 33-10 effective on 26 march 1984 for RBHA/FAR 33.7 /.14 /.23 /.27 /.77 /.88 /.90 /.92 /.94.

<u>Model</u>	<u>Application</u>	<u>Issued TC</u>	<u>Model</u>	<u>Application</u>	<u>Issued TC</u>
PW4056	26 October 1983	09 Julho 1986	PW4050	24 February 1989	12 October 1989
PW4156	26 October 1983	09 Julho 1986	PW4060A	26 Junho 1989	30 March 1990
PW4152	01 April 1986	09 Julho 1986	PW4156A	02 Março 1990	06 August 1991
PW4052	09 Julho 1987	13 October 1987	PW4062	04 Maio 1989	21 January 1992
PW4060	04 Junho 1987	21 October 1988	PW4462	04 Maio 1989	21 January 1992
PW4160	04 Junho 1987	21 October 1988	PW4062A	22 March 2002	19 April 2002
PW4460	04 Junho 1987	21 October 1988	PW4060C	27 August 2004	15 September 2004
PW4158	23 Julho 1987	29 April 1988			

PRODUCTION BASIS All models: Production Certificate Number 2 (FAA)

NOTES:

NOTE 1 Maximum Permissible Engine Rotor Speeds (also See Note 6):

	PW4050/PW4052/PW4152	PW4056/PW4060/PW4060A/PW4060C/ PW4156/PW4156A/PW4158/PW4160/PW4460/PW4462	PW4062/PW4062A
Low pressure rotor (N1), rpm	4 012 ()	4 012 ()	4 044 ()
High pressure rotor (N2), rpm	10 300 ()	10 450 ()	10 450 ()

NOTE 2

Maximum Permissible Temperatures: 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 PW4000 Maintenance Manual.

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

	PW4050	PW4052	PW4152	PW4056/ PW 4156/ PW 4156A/ PW 4158/ PW 4060/ PW 4060A/ PW 4160/ PW 4460/ PW 4062/PW 4062A/ PW 4462/PW4060C
Turbine exhaust gas Temperature at takeoff (5 min. See Note 21)	625°C/1 157°F	644°C/1 191°F	644°C/1 191°F	654°C/ 1 209°F
Max. continuous at start-up ground	600°C/ 1112°F	629°C/1 164°F	619°C/1 146°F	629°C/ 1 164°F
In-flight	535°C/995°F	--	--	--
Oil outlet temperature	625°C/ 1157°F	640°C/1 184°F	640°C/1 184°F	650°C/ 1 202°F
Continuous operation	163°C/325°F	--	--	--
Transient operation*	177°C/350°F	--	--	--

NOTE 3

Fuel Pressure Limits: At inlet to engine system pump, not less than 5 psig above the true vapor pressure of the fuel and not greater than 70 psig with a vapor/liquid ratio of zero.

Oil Pressure Limits: Minimum : 70 psid

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.

NOTE 4

Maximum Permissible Air Bleed:

	NORMAL	MAXIMUM BLEED
8TH STAGE BLEED		
Idle to 40% Maximum Continuous	0.00	0.00
40% Maximum Continuous to Takeoff	6.00	6.00
15TH STAGE BLEED		
Idle to 40% Maximum Continuous	12.0	12.0
40% Maximum Continuous to Takeoff	1.6	1.6

NOTE 5

The Sea Level Static Ratings are ideal and are 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 1.00.

- * Flat-rated to 77°F/25°C *** Flat-rated to 92°F/33°C ***** Flat-rated to 108°F/42°C
- ** Flat-rated to 86°F/30°C ***** Flat-rated to 95°F/35°C

NOTE 6

The following accessory drive provisions are incorporated:

Drive	Rotation	Speed Ratio to Turbine Shaft	Torque N.m (lb.in)		Overload	Overhang m.N (in.lb)
			Continuous	Static		
<u>High Pressure Rotor</u>						
Starter	CC	0.841:1	#	*	#	57 (500)
IDGS	CC	0.841:1	**	1 426 (12 620)	**	226 (2 000)
Fluid power pump (R)	CC	0.389:1	147 (1 300)	734 (6 500)	220 (1 950)***	45 (400)
Auxiliary fluid power pump	CC	0.379:1	147 (1 300)	734 (6 500)	220 (1 950)***	45 (400)

Legend: # Does not apply CC = counterclockwise

* Maximum starter continuous torque = 1 234 N.m (910 lb-ft) at zero rpm and 1 695 N.m (1 250 lb-ft) maximum impact torque. Maximum allowable starter torque value is 2 031 N.m (1 498 lb-ft).

** Maximum allowable continuous torque values are equivalent to 175 horsepower at any engine speed at or above sea level idle. The following overload conditions can be accommodated:

<u>Horsepower</u>	<u>Duration time</u>	<u>Recurring time</u>
225	5 minutes	1 000 hours
225	5 seconds	1 hour
450	5 seconds	1 000 hours

*** Maximum allowable for 5-minute duration recurring at four-hour intervals minimum.

- NOTE 7** 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 8** For inflight operation during icing conditions, the minimum allowable fan speed (N1) is 20% (720 rpm).
- NOTE 9** 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 10** 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 11** The following oils are eligible: Oils conforming to Pratt & Whitney Turbojet engine Service Bulletin No. 238, latest revision.
- NOTE 12** Certain engine parts are life-limited. Limits are listed in Pratt & Whitney PW4000 Turbofan Engine Manuals, Part Nos. 50A443, 50A605 and 50A822. Time Limit Section.
- NOTE 13** The engines meet the 01 January 1984, smoke and gaseous emission requirements of SFAR 27. The same requirements are now incorporated into RBHA/FAR 34 effective 10 September 1990.
- NOTE 14** The engines meet the 01 January 1975, fuel venting emission requirements of SFAR 27. The same requirements are now incorporated into RBHA/FAR 34 effective 10 September 1990.
- NOTE 15** The maximum permissible engine inlet distortion limit is specified in the Installation and Operating Manual, Section 4.4, Report PWA-6049.
- NOTE 16** Limits regarding transient rotor shaft overspeed rpm and transient gas overtemperature and the number of overtemperature occurrences are specified in the Maintenance Documents, Part Nos. 50A444, 50A606, and 50A823.
- NOTE 17** Information regarding approved fuel filter and oil filter replacement parts is in the PW4000 Series Illustrated Parts Catalogs, Part Nos. 50A445, 50A607, and 50A824.

- NOTE 18** Requirements and limitations associated with automatic fuel system anti-icing are specified in the Installation and Operating Manual, Section 4.5, Report PWA-6049.
- NOTE 19** The PW4000 series engines have been approved to operate with certain faults present in the control system, based on satisfaction of RBHA/FAR 33 requirements and appropriate RBHA/FAR 25 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 PWA 6139 Addendum, which defines the various configurations and maximum operating intervals as follows:
- Fault Level A: No dispatch allowed
- Fault Level B: Dispatchable: maximum operating interval for Fault Level B fault(s) is 20 days.
- Fault Level C: Dispatchable; maximum operating interval for Fault level C is 1000 operating hours
- Review of EEC fault data from only the most recent flight leg is sufficient at the 1000 hour interval except for the following EEC part numbers: P&W P/N 50D791, 50D824, 51D037, 50D823, 51D319, 51D586.
- Fault Levels A, B and C 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.
- A control system reliability monitoring program has been established with Pratt & Whitney in compliance with the reporting requirements as outlined in the FAA Engine and Propeller Directorate Policy, letter dated 28 October 1993, for Time Limited Dispatch of Engine fitted with FADEC Systems.
- NOTE 20** Incorporation of Pratt & Whitney Service Bulletin PW4ENG 79-43 provides an alternative means of compliance with the requirements of RBHA/FAR 33.71(c)(1).
- NOTE 21** The normal 5 minutes takeoff time limit may be extended to 10 minutes for engine out contingency.
- NOTE 22** Engines in which Engineering Change Number EC92KK322G, H, I, J, and K were incorporated during manufacturer are designated by a (-3) on the Engine Data Plate.

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