U.S. DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION TYPE CERTIFICATE DATA SHEET E46NE	TCDS NUMBER E46NE REVISION: 8 DATE: January 23, 2012 PRATT & WHITNEY MODELS: PW4074 PW4074D PW4077 PW4090D PW4077D PW4098 PW4084 PW4084D PW4090 PW4090-3

Engines of models described herein conforming with this data sheet (which is part of Type Certificate Number E46NE) and other approved data on file with the Federal Aviation Administration, meet the minimum standards for use in certificated aircraft in accordance with pertinent aircraft data sheets and applicable portions of the Federal Aviation Regulations, provided they are installed, operated, and maintained as prescribed by the approved manufacturer's manuals and other approved instructions.

TYPE CERTIFICATE (TC) HOLDER: Pratt & Whitney Division
United Technologies Corporation
East Hartford, Connecticut 06108

I. MODELS	PW4074	PW4077	PW4084	
TYPE	Axial airflow, dual-spool, turbofan, single-stage fan, 6-stage low-pressure compressor, 11-stage high pressure compressor, annular combustor, 2-stage high-pressure turbine, 7-stage low-pressure turbine.			
RATINGS (See NOTE 5)				
Static thrust at sea level, lbs.				
Takeoff, Dry 5 Minutes (See NOTE 18)	77,440	79,960	86,760	
Maximum Continuous	69,600	70,990	70,990	
COMPONENTS				
Fuel Metering unit	Hamilton Standard Model Number JFC-131-4			
Fuel pump and filter	Argo-Tech Model 723300			
Electronic engine control (EEC)	Hamilton Standard EEC 170 P/N 812460-All			
Ignition				
Exciter	Unison Industries P/N 10-621630-1			
Ignitors	Auburn P/N 0270408 Champion P/N AA1345-1			

*

PAGE	1	2	3	4	5	6	7
REV.	7	7	5	5	8	4	6

LEGEND: "- -" INDICATES "SAME AS PRECEDING MODEL"
"---" NOT APPLICABLE
NOTE: ALL PAGES ARE REFORMATTED. SIGNIFICANT CHANGES IF ANY, ARE BLACK-LINED IN THE LEFT MARGIN.

UTC-2021.001
GE v. UTC
Trial IPR2017-00428

I. MODELS (CONT.)	PW4074	PW4077	PW4084	
COMPONENTS (CONT.)				
EEC alternator				
Stator	Unison (formerly B.F. Goodrich) P/N 430073			
Rotor	Unison (formerly B.F. Goodrich) P/N 430074			
Fuel distribution valve	Hamilton Standard P/N GTA40			
Station 2.5 bleed actuator	Hamilton Standard P/N GTA42			
Stator vane actuator	Hamilton Standard P/N GTA41			
PT2/TT2 probe	Rosemount P/N 154 GT			
PRINCIPAL DIMENSIONS				
Room Temperature				
Length (flange to flange)	190.423 (in.)			
Nominal diameter (fan case)	119.000 (in.)			
Maximum radial projection (oil tank)	69.946 (in.)			
WEIGHT (DRY)	15,095 Weight of basic engine includes PW supplied engine build-up components.			
CENTER OF GRAVITY (IN)				
Axial: Engine station	117.2 ± 1.0			
Vertical: Relative to engine	-1.4 ± 0.5			
Lateral: Relative to centerline	-0.6 ± 0.5			

II. MODELS	PW4074D	PW4077D	PW4084D	PW4090	PW4090-3
TYPE	Axial airflow, dual-spool, turbofan, single-stage fan, 6-stage low-pressure compressor, 11-stage high pressure compressor, annular combustor, 2-stage high-pressure turbine, 7-stage low-pressure turbine.				
RATINGS (See NOTE 5)					
Static thrust at sea level, lbs.					
Takeoff, Dry 5 Minutes (See NOTE 18)	77,440	79,960	86,760	91,790	91,790 (See Note 19)
Maximum Continuous	69,600	70,990	70,990	74,950	74,950
COMPONENTS					
Fuel Metering unit	Hamilton Standard Model Number JFC-131-4				
Fuel pump and filter	Argo-Tech Model 723300				
Electronic engine control (EEC)	Hamilton Standard EEC 170 P/N 816200-All				
Ignition					
Exciter	Unison Industries P/N 10-621630-2				
Ignitors	Auburn P/N 0270307 Champion P/N AA72S				
COMPONENTS (CONT.)					
EEC alternator					
Stator	Unison (formerly B.F. Goodrich) P/N 430073				
Rotor	Unison (formerly B.F. Goodrich) P/N 430074				
Fuel distribution valve	Hamilton Standard P/N GTA40-1				
Station 2.5 bleed actuator	Hamilton Standard P/N GTA42-2				
Stator vane actuator	Hamilton Standard P/N GTA41-1				
PT2/TT2 probe	Rosemount P/N 154GT				

II. MODELS (CONT.)	PW4074D	PW4077D	PW4084D	PW4090	PW4090-3
PRINCIPAL DIMENSIONS Room Temperature					
Length (flange to flange)	190.423 (in.)				
Nominal diameter (fan case)	119.000 (in.)				
Maximum radial projection (oil tank)	69.946 (in.)				
WEIGHT (DRY)	15,741 Weight of basic engine includes PW supplied engine build-up components.				
CENTER OF GRAVITY (IN)					
Axial: Engine station	119.0±1.0				
Vertical: Relative to engine	-1.2±0.5				
Lateral: Relative to centerline	-0.5±0.5				
FUEL	See NOTE 9				
OIL	See NOTE 10				

III. MODELS	PW4090D	PW4098		
TYPE	Axial airflow, dual-spool, turbofan, single-stage fan, 7-stage low-pressure compressor, 11-stage high pressure compressor, annular combustor, 2-stage high-pressure turbine, 7-stage low pressure turbine.			
RATINGS (See NOTE 5)				
Static thrust at sea level, lbs.				
Takeoff, Dry 5 Minutes (See NOTE 18)	91,790	99,040		
Maximum Continuous	74,950	77,320		
COMPONENTS				
Fuel Metering unit	Hamilton Standard Model Number JFC-131-4			
Fuel pump and filter	Argo-Tech Model 827800			
Electronic engine control (EEC)	Hamilton Standard EEC 170 P/N 822830-5-All			
Ignition				
Exciter	Unison Industries P/N 10-621630-2			
Ignitors	Champion P/N CH31923-5			
EEC alternator				
Stator	Unison (formerly B. F. Goodrich) P/N 430073			
Rotor	Unison (formerly B. F. Goodrich) P/N 430074			
Fuel distribution valve	Hamilton Standard P/N GTA40-1			
Station 2.5 bleed actuator	Hamilton Standard P/N GTA42-2			
Stator vane actuator	Hamilton Standard P/N GTA41-1			
PT2/TT2 probe	Rosemount P/N 154GT			

III. MODELS (CONT.)	PW4090D	PW4098		
PRINCIPAL DIMENSIONS Room Temperature				
Length (flange to flange)	190.423 (in.)			
Nominal diameter (fan case)	119.466 (in.)			
Maximum radial projection (oil tank)	69.946 (in.)			

III. MODELS (CONT.)	PW4090D	PW4098		
WEIGHT (DRY)	16,260 Weight of basic engine includes PW supplied engine build-up components.			
CENTER OF GRAVITY (IN)				
Axial: Engine station	117.0±1.0			
Vertical: Relative to engine	-1.3±0.5			
Lateral: Relative to centerline	-0.5±0.5			
FUEL	See NOTE 9			
OIL	See NOTE 10			

CERTIFICATION BASIS FAR 33 effective February 1, 1965, as amended by 33-1 through 33-15

Type Certificate Number E46NE

MODEL	APPLICATION	ISSUED
PW4074	DEC 10, 1990	APR 29, 1994
PW4077	DEC 10, 1990	APR 29, 1994
PW4084	DEC 10, 1990	APR 29, 1994
PW4074D	MAR 17, 1998	MAR 27, 1998
PW4077D	JUN 19, 1996	JUN 28, 1996
PW4084D	JUN 19, 1996	JUN 28, 1996
PW4090	JUL 28, 1994	JUN 28, 1996
PW4090-3	JAN 22, 1999	APR 8, 1999
PW4090D	JUL 23, 1998	JUL 24, 1998
PW4098	JUL 25, 1995	JUL 24, 1998

PRODUCTION BASIS (All Models) Production Certificate Number 2

NOTES

NOTE 1. Maximum Permissible Operating Speeds for Engine Rotors

	PW4074/PW4077/ PW4084	PW4077D/PW4084D/ PW4090/PW4074D/ PW4090-3	PW4090D/ PW4098
Low pressure rotor (N_1), RPM	2,990	3,045	3,155
High pressure rotor (N_2), RPM	10,850	10,850	
-transient (25 seconds)			10,850
- steady state			10,785

Minimum Permissible Operating Speeds for Engine Rotors

Low pressure rotor (N_1), RPM 590 (In-flight)
High pressure rotor (N_2), RPM 5,900 (In-flight and on ground operation)

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, per the PW4000-112 series Engine Maintenance Manual.

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

Turbine Exhaust gas temperature

	PW4074/PW4077/ PW4084	PW4077D/PW4084D/ PW4090/PW4074D/ PW4090-3	PW4090D/ PW4098
At takeoff (5 minutes, see NOTE 18)	625°C/1157°F	675°C/1247°F	675°C/1247°F
Maximum continuous	605°C/1121°F	650°C/1202°F	617°C/1143°F
At start-up			
Ground	535°C/995°F	535°C/995°F	535°C/995°F
In-flight	625°C/1157°F	675°C/1247°F	675°C/1247°F
Oil outlet temperature			
Continuous operation	163°C/325°F	163°C/325°F	163°C/325°F
Transient operation (20 min.)	177°C/350°F	177°C/350°F	177°C/350°F

NOTE 3. Fuel Pressure Limits:

At inlet to engine system pump, not less than 3.25 psi 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 psig

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: 11.4 pounds/second airflow - PW4074, PW4077 and PW4084
10.7 pounds/second airflow - PW4077D, PW4084D, PW4090, PW4090-3, and PW4074D
11.0 pounds/second airflow - PW4090D, PW4098

NOTE 5. The Sea Level Static Ratings are ideal and are based on ICAO Standard Atmosphere conditions, a Pratt & Whitney ideal 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 6. The following accessory drive provisions are incorporated:

			TORQUE (lb-in)			
DRIVE	**ROTATION**	**SPEED RATIO TO TURBINE SHAFT**	**CONTINUOUS**	**STATIC**	**OVERLOAD**	**OVERHANG (in-lb)**
High pressure rotor						
Starter	CCW	0.841:1	- - -	*	- - -	500
IDGS	CCW	0.841:1	**	10,500	**	2,000
Fluid power pump (R)	CCW	0.391:1	1,500	6,500	1,950	400
VSCF	CCW	2.435:1	***	4,500	***	400

LEGEND: CCW = counterclockwise

* Maximum starter continuous torque = 1050 lb-ft at zero rpm and 1,250 lb-ft maximum impact torque. Maximum allowable starter torque value is 1,498 - 1,732 lb-ft.

** Maximum allowable continuous torque values are equivalent to 243 horsepower at any engine speed at or above sea level idle. The following overload conditions can be accommodated:

HORSEPOWER	**DURATION TIME**	**RECURRING TIME**
304	5 minutes	1,000 hours
304	5 seconds	1 hour
500	5 seconds	1,000 hours

*** Maximum allowable continuous torque values are equivalent to 58 horsepower at any engine speed at or above sea level idle. The following overload conditions can be accomodated:

HP	**DURATION TIME**	**RECURRING TIME (HRS)**
87	5 min	1000
87	5 sec	1
128	5 sec	1000

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. Lightning protection requirements and electromagnetic interference emitted by the electronic engine control system, including cables, are specified in the Installation and Operating Manual, Section 5.12.

NOTE 9. 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 10. The following oils are eligible: Oils conforming to Pratt & Whitney Turbojet Engine Service Bulletin No. 238, latest revision.

NOTE 11. Certain engine parts are life limited. Limits are listed in Pratt & Whitney PW4000-112 series engine Turbofan Engine Manual, Part Number 51A345, time limit section for models PW4074, PW4077 and PW4084 and Part Number 51A751 for models PW4077D, PW4084D, PW4090, PW4090-3, PW4074D, PW4090D and PW4098.

NOTE 12. The engines meet the smoke and gaseous emission requirements of Part 34.

NOTE 13. The maximum permissible engine inlet distortion limit is specified in the Installation and Operating Manual, Section 5.4, Report PWA-6510-09.

NOTE 14. 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. 51A344.

NOTE 15. Information regarding approved fuel filter and oil filter replacement is in the PW4000 Series Illustrated Parts Catalog, Part Number 51A346 for models PW4074, PW4077 and PW4084 and Part Number 51A742 for models PW4077D, PW4084D, PW4090, PW4090-3, PW4074D, PW4090D and PW4098.

NOTE 16. Requirements and limitations associated with automatic fuel system anti-icing are specified in the Installation and Operating Manual, Section 5.5, Report PWA-6510-09.

NOTE 17. The PW4000-112 series engine model engines have been approved to operate with certain faults present in the control system, based on satisfaction of FAR 33 requirements and appropriate 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-6600-05 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 D:	Unlimited dispatch

Fault Levels A, B and D: unlimited dispatch 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. Fault Level C is not applicable for PW4000-112 series engines.

A control system reliability monitoring program has been established with Pratt & Whitney in compliance with the reporting requirements as outlined in the Engine and Propeller Directorate Policy, letter dated October 18, 1993, for Time Limited Dispatch of Engine fitted with FADEC Systems.

NOTE 18. The normal 5 minute takeoff time limit may be extended to 10 minutes for one engine inoperative contingency.

NOTE 19. The PW4090-3 engine model provides the same takeoff thrust as the PW4090 engine model up to a 1000 foot altitude for all temperature days. Above 1000 feet in altitude the PW4090-3 rating provides increased takeoff thrust as a function of both ambient temperature and altitude as shown in the Installation and Operating Manual, Section 4 and Table 1, Report PW-6510-09. Above ambient temperatures of 86^{o}F the altitude ratings do not exceed that of the sea level rating for the PW4090 and PW4090-3 engine models.

----END----