

DEPARTMENT OF TRANSPORTATION  
FEDERAL AVIATION ADMINISTRATION

E18NE  
Revision 7  
AlliedSignal  
TPE331-14A  
TPE331-14B  
TPE-331-14F  
TPE331-14GR  
TPE331-14HR  
TPE331-15AW  
  
January 2, 1996

TYPE CERTIFICATE DATA SHEET E18NE

Engine models described herein conforming with this data sheet (which is part of Type Certificate E18NE) and other approved data on file with the Federal Aviation Administration (FAA) meet the minimum standards for use in certified 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 Holder:           AlliedSignal Inc.  
  111 South 34th Street  
  Phoenix, Arizona 85034

Type:                                    Single-shaft engine with two-stage centrifugal compressor, three-stage axial turbine and singular annular combustion chamber.

The letters "A", "F" and "G" indicate clockwise propeller rotation. The letters "B" and "H" indicate counter-clockwise propeller rotation. The letter "R" indicates automatic power reserve capability. The letter "W" indicates water-methanol augmentation capability.

RATINGS (see NOTES 3, 4, and 18)

	<u>TPE331-14A</u>		<u>TPE331-14GR</u>
	<u>TPE331-14B</u>	<u>TPE331-15AW</u>	<u>TPE331-14HR</u>
	<u>TPE331-14F</u>		
Maximum Continuous			
SHP	1250	1645	1650
ESHP	1312	1712	1723
Output Shaft RPM	1540	1390	1552
Takeoff (5 minutes)			
SHP	1250	1645	1650
ESHP	1312	1712	1723
Output Shaft RPM	1540	1390	1552
Automatic Power Reserve, (APR, 10 minutes)			
SHP	NA*	NA	1650
ESHP	NA	NA	1723
Output Shaft RPM	NA	NA	1552

\* Not Applicable (NA)

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PRINCIPLE DIMENSIONS OF BASIC ENGINE

Refer to the Installation Drawings for each specific engine model configuration for dimensions and center of gravity location.

WEIGHT

<u>MODEL</u>	<u>Weight, dry, lbs.</u>
TPE331-14A	581
TPE331-14B	592
TPE331-14F	620
TPE331-14GR	620
TPE331-14HR	633
TPE331-15AW	659

The engine weights shown herein are that of the engine assemblies. Not included are Engine Parts List, or Engine Equipment List items coded "A" together with their attaching hardware (See Note 12).

PROPELLER OUTPUT SHAFT SPEED RATIO

<u>MODEL</u>	<u>Propeller-shaft to engine rotor ratio</u>
TPE331-14A	1:22.6546
TPE331-14B	1:22.6794
TPE331-14F	1:22.6546
TPE331-14GR	1:22.9671
TPE331-14HR	1:22.9285
TPE331-15AW	1:25.1108

FUEL

Engine operation is approved with the following aviation turbine fuels:

- AlliedSignal EMS53111 (Type A)
- AlliedSignal EMS53112 (Type A-1)
- AlliedSignal EMS53112 (British D. Eng. R.D. 2494 Issue 7)
- AlliedSignal EMS53113 Class A (British D. Eng. R.D. 2386 Issue 8)
- AlliedSignal EMS53113 (Type A, JP-4 and Class B-Type B)
- AlliedSignal EMS53116 (Type JP-5)

Other approved fuels are listed in the Installation Manual (IM)-3500 for -14A, -14B, IM-7364 for TPE331-14F, IM-6350 for TPE331-15AW and IM-7544A for TPE331-14GR, -14HR. Fuels not containing anti-icing inhibitors may have MIL-I-27686E Fuel System Icing Inhibitor, or an equivalent inhibitor, added, but not in excess of 0.15 percent by volume.

Aviation gasoline MIL-G-5572D, Grade 80/87, not in excess of 1,000 gallons per 100 hours of operation, may be used for emergency fuel operation.

Aviation gasoline MIL-G-5572D, Grade 100/130, not in excess of 250 gallons per 100 hours of operation, may be used for emergency fuel operation. Total usage must be limited to 7,000 gallons during any 3,000 hour period. If combinations of the above aviation gasolines are used, the following formula is required for establishing proportions of combinations during any 3,000 hour period:

$$\frac{\text{Amount of Grade 100/130 (low lead, gal.)}}{7,000 \text{ gal.}} + \frac{\text{Amount of Grade 80/87 gal.}}{30,000 \text{ gal.}} < 1.0$$

If 25 percent or more of aviation gasoline is used at anytime, one quart of aviation grade oil must be added to the mixture for 100 gallons of aviation gasoline.

Shell ASA-3 anti-static additive, or equivalent, in amounts to bring the fuel up to 300 conductivity units may be used, but in no event shall the additive exceed 1 ppm.

Biobor JF Biocide (Sohio or equivalent) 270 ppm maximum (20 ppm of elemental boron) may be used in the fuel for pesticide purposes.

#### OIL

Oils conforming to AlliedSignal Specification EMS 53110 (Type I and Type II)

#### CERTIFICATION BASIS

Part 33 of the Federal Aviation Regulations dated February 1, 1965 and Amendment 1, 2, 3, 4, 5, 6, 7, 8 and 9 exemption No. 82-ANE-004-E dated December 23, 1982.

Type Certificate No. E18NE

Model TPE331-14A issued April 26, 1984  
 Model TPE331-14B issued April 26, 1984  
 Model TPE331-15AW issued December 5, 1988  
 Model TPE331-14F issued May 24, 1989  
 Model TPE331-14GR issued July 13, 1992  
 Model TPE331-14HR issued July 13, 1992

#### PRODUCTION BASIS

Production Certificate No. 413 issued March 4, 1965.

#### NOTE 1. MAXIMUM PERMISSIBLE TEMPERATURES

Exhaust gas temperature, deg F(deg C)

	TPE331 Engine Model	
	<u>-14A, -14B</u> <u>-14F, -15AW</u>	<u>-14GR, -14HR</u>
Maximum Continuous	1134(612)	1159(626) (See Notes 14 & 18A)
Takeoff (5 minute)	1134(612)	1122(605)
Automatic Power Reserve (APR)	Not applicable	1191(644) (See Note 18B)

The above APR, Takeoff and Maximum Continuous exhaust gas temperatures are for uninstalled U.S. Standard sea-level conditions. Exhaust gas temperature will vary as a function of ambient conditions, engine operating speed and installation effects. Consult Installation Manual IM-3500 for TPE331-14A,-14B, IM-7364 for TPE331-14F, IM-6350 for TPE331-15AW or IM-7544A for TPE331-14GR,-14HR for other than standard day sea-level limits. (See NOTE 13).

	TPE331-14A,-14B,-14F	
	<u>-15AW</u>	<u>-14GR/HR</u>
<u>Exhaust gas temperature</u> <u>during starting</u> deg F (deg C) for 5 seconds	1429 (776)	1607 (875)

See IM for more complete operating limits and actions if above temperature is exceeded

Oil temperature, deg F (deg C)

Engine Model	Oil Type	<u>Condition</u>			Above	Hot Oil
		<u>Starting</u> (Minimum)	<u>Ground Idle</u> (Maximum)	<u>Above Ground Idle to</u> <u>Hot oil SHP Limit</u> (Range for 5 min)	<u>Hot Oil</u> <u>SHP Limit</u> Maximum	<u>SHP</u> <u>Limit</u>
All	MIL-L-7808	-40 (-40)	200 (93)	175-200 (79-93)	175 (79)	1000
All	MIL-L-7808G	-40 (-40)	230 (110)	187-215 (86-102)	187 (86)	1000
-14A	MIL-L-23699	-40 (-40)	260 (127)	230-260 (110-127)	230 (110)	1000
-14B	"	"	"	"	"	"
-14F	"	"	"	"	"	"
-14GR	"	"	"	"	"	1500
-14HR	"	"	"	"	"	"
-15AW	"	"	230 (110)	230 (110) Max	N/A	1650

Ambient Air Temperature, deg F (deg C)

	<u>Starting</u>	<u>Operation</u>
Minimum	-65 (-54)	---
Maximum	131 (55)	131 (55)

Engine External Components Surface Temperature Limits

See Installation Manual IM-3500 for TPE331-14A,-14B, IM-7364 for TPE331-14F, IM-6350 for TPE331-15AW and IM-7544A for TPE331-14GR,-14HR

NOTE 2: Pressure Limits

	TPE331 Engine Model		
	-14A, -14B, -14F	-14GR, -14HR	-15AW
Fuel pump inlet pressure	See IM	See IM	See IM
Oil pressure at inlet connection to the engine, minimum	5 psia	5 psia	5 psia
Oil operating pressure at ground idle (Minimum at 65 percent speed)	15 psig	30 psig	15 psig
Normal oil operating range (95 to 100 percent speed)	35 to 70 psig (130 to 230F oil temp.)	45 to 75 psig (122 to 230F oil temp.)	45 to 75 psig (130 to 230F oil temp.)
Minimum water-methanol augmentation manifold inlet pressure (TPE331-14GR,-14HR, & -15AW)	7 psig (See NOTE 17)	7 psig (See NOTE 17)	7 psig (See NOTE 17)

NOTE 3. The engine ratings are based on:

Dynamometer operation at U.S. Standard Atmosphere, Sea-Level Static Conditions.

AlliedSignal EMS53111 aviation turbine fuel Type A with lower heating value of 18,400 BTU per pound.

MIL-L-23699B Type II

No bleed-air extraction.

No anti-icing airflow.

No external accessory loads.

Zero inlet loss.

Exhaust gas discharging to ambient-static pressure through the turbine exhaust diffuser furnished with the engine.

NOTE 4. Equivalent shaft horsepower (ESHP) for static conditions is based on:

$$ESHP = \frac{\text{Net thrust, pounds} + SHP}{2.5}$$

NOTE 5. ACCESSORY PROVISIONS

	All Models	TPE331 Engine Model			
		-15AW <u>-14A, -14F</u>	<u>-14B</u>	<u>-14GR</u>	<u>-14HR</u>
(a) Aircraft Accessory					
Type of drive: (one each)					
AS961-1CT		X	X		
AND 20001 Type XI-B				X	X
Drive Modifications:		Rotation, T <sub>S</sub> , T <sub>O</sub> , Stud pattern rotated 37 deg.		Rotation, T <sub>C</sub> , Stud pattern rotated 37 deg.	
Rotation (facing drive pad)	CCW				
RPM at 100% engine speed		4010	4014	4087	4080
Maximum torque (lb-in)					
T <sub>C</sub> , continuous torque	300				
T <sub>O</sub> , overload torque	375				
T <sub>S</sub> , static torque	1,650				
Overhung moment (lb-in)	100				
Speed ratio, drive to engine rotor		0.11488	0.11488	0.11466	0.11466

	All Models	TPE Engine Model					
		-14A	-14B	-14F	-15AW	-14GR	-14HR
(B) Starter, Starter-Generator							
Type of drive: (one each)	AS468 Type AV-1						
Drive Modification:	Rotation, RPM T <sub>C</sub> , T <sub>O</sub> , T <sub>S</sub>						
Rotation (facing drive pad)	CCW						
RPM at 100% engine speed		11,881	11,894	11,881	11,885	12,115	12,095
Maximum torque (lb-in)							
T <sub>C</sub> , continuous torque	132						
T <sub>O</sub> , overload torque	265						
T <sub>S</sub> , static torque	2,200						
Overhung moment (lb-in)		6,300*	6,300*	500	500	600	600
Speed ratio, drive to engine rotor		0.34054	0.34054	0.34054	0.34054	0.33989	0.33989

\*Maximum overhung moment allowed at 1g when starter generator is restrained to engine casing.

NOTE 5. ACCESSORY PROVISIONS - CONTINUED

		TPE331 Engine Models			
		14A,14F, <u>-15AW</u>	<u>-14B</u>	<u>-14GR</u>	<u>-14HR</u>
(C) <u>Propeller Governor</u>	<u>All Models</u>				
Type of drive: (one each)	AND20010				
Drive Modifications:	Rotation, RPM stud length & negative torque system supply port				
Rotation (facing drive pad)	CCW				
RPM at 100 percent engine speed		3739	3743	3807	3801
Maximum torque (lb-in)					
T <sub>C</sub> , continuous torque	125				
T <sub>O</sub> , overload torque	188				
T <sub>S</sub> , static torque	825				
Overhung moment (lb-in)	125				
Speed ratio, drive to engine rotor	0.10714				
(D) <u>Propeller Pitch Control</u>					
Type of drive: (one each)	Mounting pad provides overhung moment of 30 in-lb				
(E) <u>Auxiliary Aircraft Accessory</u>		<u>TPE331-15AW</u>	<u>TPE331-14F</u>		
Type of drive: (one each)		AND20002 Type XII D Modified	AND20002 Type XII D Modified		
Drive modifications:		Rotation, RPM T <sub>C</sub> , T <sub>O</sub> , T <sub>S</sub> & stud pattern rotated 30 deg.	Rotation, RPM T <sub>C</sub> , T <sub>O</sub> , T <sub>S</sub> & stud pattern rotated 30 deg.		
Rotation (facing drive pad)		CCW	CCW		
RPM at 100 percent engine speed		12,254	12,511		
Maximum torque (lb-in)					
T <sub>C</sub> , continuous torque		309	300		
T <sub>O</sub> , overload torque		463	463		
T <sub>S</sub> , static torque		1,700	1,700		
Overhung moment (lb-in)		500	500		
Speed ratio, drive to engine rotor		0.35107	0.35844		

NOTE 6. Maximum allowable propeller shaft torque as sensed by the torque sensor, in pound-feet:

	<u>TPE331-14A, -14B, 14F</u>	<u>TPE331-15AW</u>	<u>TPE331-14GR, -14HR</u>
5 minute torque limit:	4262	6234	5584
Maximum continuous torque limit:	4262	6234	5584

See IM for transient engine over torque limits.

NOTE 7. Propeller Output Shaft, (Bolted Flange) Maximum Speed Percent (RPM):

	<u>TPE331-14A, -14B, -14F</u>	<u>TPE331-15AW</u>	<u>TPE331-14GR, -14HR</u>
Normal operation	100.0(1540)	100.0(1390)	100.0(1552)
Continuous operation	101.0(1555)	101.0(1404)	101.0(1568)
Transient limit	104.0(1602)	104.0(1446)	104.0(1614)

NOTE 8. Propeller Output Shaft, (Bolted Flange) Direction of Rotation:

	<u>TPE331-14A, -14F,-14GR,-15AW</u>	<u>TPE331-14B, -14HR</u>
Rotation when looking forward at turbine exhaust flange	CW	CCW

NOTE 9.

High Pressure (HP) Compressor discharge bleed air - Up to 12 percent of the engine airflow is available for bleed air purposes (except during starting). Of this 12 percent total, 1.0 percent is used by the engine mounted anti-icing system.

NOTE 10.

Low Pressure (LP) Compressor interstage bleed air - Up to 10 percent of the engine airflow is available as option except total of HP and LP bleed not to exceed quantity allowed for HP bleed. These engines meet FAA requirements for adequate turbine disk integrity and rotor blade containment and do not require external armoring.

NOTE 11.

These engines meet FAA requirements for operation in icing conditions within the envelope defined in Part 25, Appendix C.

NOTE 12.

Variations in engine configuration and installation components are identified by a suffix to the basic model number on the engine nameplate, i.e. TPE331-14A-XXXX, TPE331-14B-XXXX, etc., and an Engine Parts List or Equipment List number. Certain features of these components are influenced by aircraft design considerations. In the Engine Parts List or Equipment List, those items coded "A" have been demonstrated as compatible with the basic engine during engine certification testing; however, the operation, functioning and rigging of these in a specific aircraft installation must be demonstrated during certification. Subsequent design change to the engine associated with these factors is the responsibility of the aircraft manufacturer and must be in compliance with Part 33.

## NOTE 13.

The TPE331-14A,-14B,-14F,-14GR,-14HR and -15AW engine have been designed to accommodate a "Variable Red Line/Auto-Start" (VRL) temperature indicating system and an automatic "Torque and Gas Temperature Limiting" system. The temperature limiting system for these engines will vary with the operating condition to produce rated shaft power without exceeding the maximum rated temperature (see Note 3).

With the VRL inoperative, the EGT limit the TPE331-14A,-14B,-14F,-14GR,-14HR, and -15AW engines will vary as a function of ambient conditions. Consult IM for off-standard day EGT limits.

Component interface and installation requirements of the aircraft-installed components are also described in IM-3500 for TPE331-14A, -14B model engines, IM-7364 for TPE331-14F engine model, IM-6350 for TPE331-15AW model engine and IM-7544A for TPE331-14GR,-14HR model engines.

## NOTE 14.

Certain engine parts are life limited. These are listed in FAA approved AlliedSignal Service Bulletins as follows:

	<u>Component Life Limit Bulletin</u>
TPE331-14A,-14B	TPE331-72-7002 dated February 27, 1995
TPE331-14F	TPE331-72-7050 dated June 17, 1994
TPE331-14GR,-14HR	TPE331-72-7082 dated December 22, 1995
TPE331-15AW	TPE331-72-7502 dated May 17, 1994

## NOTE 15.

Transient operation of propeller output shaft speed above 104 percent to a maximum of 106.0 percent is allowable for fuel control overspeed governor test when the propeller is on the start locks. Refer to engine maintenance manual for proper procedures and limitations for this test.

## NOTE 16.

The power management system incorporates a limited authority IEC (Integrated Engine Computer) that limits engine maximum torque and maximum exhaust gas temperature. This device incorporates digital circuitry. The software programming procedures have been determined to meet the "critical" category under the guidelines of RTCA document DO 178.

## NOTE 17.

Augmented performance for the TPE331-14GR,-14HR and TPE331-15AW models may be obtained by the addition of a water-methanol injection system. Water-methanol mixture must conform to that shown in FAA approved installation manual IM-6350 for the TPE331-15AW and IM-7544 for the TPE331-14GR,-14HR. The torque limit remains as shown in NOTE 6. Exhaust gas temperature limit remains as per NOTE 1, except that for IEC-inoperative mode, EGT limits per the appropriate IM must be used.

	<u>TPE331-14GR,-14HR</u>	<u>TPE331-15AW</u>
SHP at sea level, static, ambient temperature limit	1650	1645
Sea level, static, ambient temperature limit, deg F (deg C)	131(55)	100(38)
Minimum Water/Methanol flow rate, lb/hr	1680	1680
Maximum Water/Methanol flow rate, lb/hr	1850	1850

## NOTE 18.

- A) The Continuous Power Reserve (CPR) mode of the IEC provides engine operation with EGT between 1105 F and 1159 F, inclusive, and meets Part 33 requirements. The CPR mode is available only with the IEC operational (refer to Installation Manual IM-7544). The torque limit remains as shown in Note 6. Engine operation above 1104 F EGT requires applying engine hour and cycle maintenance factors in accordance with Engine Maintenance Manuals 72-04-05 and 72-04-07, and Service Bulletins TPE 331-72-7081 dated December 22, 1995, and TPE331-72-7082 dated December 22, 1995. The use of CPR mode in an aircraft installation must be certified per Part 23 or 25 requirements (refer to Note 12 - items coded "A").
- B) The Automatic Power Reserve (APR) feature of the IEC is a 10 minute emergency power rating which automatically increases engine power and the VRL temperature in the event of power loss in another engine. The torque limit remains as shown in NOTE 6.

.....END.....