

MODEL	APPLICATION DATE	TYPE CERTIFICATE ISSUED / AMENDED	TYPE CERTIFICATE SURRENDERED
MAKILA 2A	9/21/2006	1/25/08	
MAKILA2A1	3/23/2009	9/21/2010	

IMPORT REQUIREMENTS

To be considered eligible for installation on U.S. registered aircraft, each new engine to be exported to the United States with the DGAC or EASA airworthiness approval shall have a Joint Aviation Authorities (JAA) or EASA Form 1, Authorized Release Certificate. The JAA or EASA Form 1 should state that the engine conforms to the type design approved under the U.S. Type Certificate E00077EN is in a condition for safe operation and has undergone a final operational check.

NOTES

NOTE 1. MAXIMUM PERMISSIBLE OPERATING SPEEDS. For variation of these limits with outside air temperature, or if these limits are exceeded, refer to the Installation and Operating Manual.

I. MODELS:

A. GAS GENERATOR (N1)

	MAKILA 2A	MAKILA 2A1			
% (RPM)	%.....(RPM)				
30-second OEI	102.24% (33,943)	102.09% (33,895)			
2-minute OEI	100.68% (33,425)	100.30% (33,302)			
Continuous OEI	99.33% (32,977)	99.42% (33,008)			
30-minute AEO	99.18% (32,927)	98.75% (32,786)			
Takeoff (5 minutes)	99.18% (32,927)	98.75% (32,786)			
Maximum continuous	96.85% (32,155)	96.45% (32,022)			
Transient overspeed (20 seconds)	100.68% (33,425)	100.30% (33,302)			
	100% gas generator speed equals 33,200 rpm				

B. POWER TURBINE (N2)

- IDLE Mode
- Min stabilized
- Max stabilized
- FLIGHT Mode
- Min stabilized
- Max stabilized, 30 sec. OEI
- Max stabilized, other ratings
- Min Transient (20 secs.)
- Max Transient (20 secs.)

% (RPM)	%.....(RPM)				
45% (10,333)	--				
106% (24,340)	--				
93% (21,355)	--				
104.5% (23995)	--				
106% (24,340)	--				
80% (18,370)	--				
111% (25,488)	--				
	100% power turbine speed equals 22,962 rpm				

NOTE 2.

MAXIMUM PERMISSIBLE TEMPERATURES. Refer to the Installation and Operating Manual for required action if limits are exceeded.

A. EXHAUST GAS (T45)

Start-up:

- Unlimited duration
- Max overtemp (<5 secs)
- Max overtemp (<2 secs)

In Flight:

- Continuous OEI
- 30 minute AEO
- Take-off
- Max Continuous

780 °C	--				
830 °C	--				
840 °C	--				
799 °C	814 °C				
796 °C	801 °C				
796 °C	801 °C				
749 °C	754 °C				

B. OIL

MEASURED AT OIL-FUEL EXCHANGER OUTLET

- Min for Starting
 - 30°C for 5 cSt oils (having a 5x10⁻⁶ m²/s kinematic viscosity)
 - 45°C for 3 cSt or 4 cSt oils (having a 3x10⁻⁶ or 4x10⁻⁶ m²/s kinematic viscosity)
- Min for power-up
 - 10°C for 5 cSt oils (having a 5x10⁻⁶ m²/s kinematic viscosity)
 - 30°C for 3 cSt or 4 cSt oils (having a 3x10⁻⁶ or 4x10⁻⁶ m²/s kinematic viscosity)

Maximum 120°C

C. Fuel (See NOTE 8)

MEASURED AT ENGINE INLET

Maximum 50°C

NOTE 3. POWER TURBINE OUTPUT SHAFT TORQUE LIMITS

Maximum torque on engine output shaft is 406 ft-lb (551Nm) at the maximum continuous, takeoff and 30 minute all engine operative ratings.

Maximum torque on engine output shaft at all One Engine Inoperative ratings is 688 ft-lb (933Nm).

These torque values correspond to the engine torque limit. An engine electronic control limit may be implemented to protect the main gearbox of the helicopter.

NOTE 4. FUEL AND OIL PRESSURE LIMITS

Fuel

Normal operation minimum absolute fuel pressure at engine inlet - psia (kPa)		
Altitude	From Idle (included) to T/O power (not included)	From T/O power (included) to 30 second OEI power (included)
-2000 ft	9.3 (64)	6.1 (42)
0 ft	7.4 (51)	4.9 (34)
5,000 ft	6.8 (47)	4.5 (31)
10,000	5.1 (35)	3.2 (22)

Starting or relight operation minimum relative fuel pressure at engine inlet: 3.6 psig (25 kPa)

Maximum relative fuel pressure at engine inlet: 21.8 psig (150 kPa).

Refer to the Installation and Operating Manual for additional information.

Oil

Minimum relative oil pressure: 23.2 psig (160 kPa)

Maximum relative oil pressure: 87.0 psig (600 kPa)

NOTE 5. MAXIMUM PERMISSIBLE AIR BLEED - Standard day sea level condition.

Max P3 air for A/C use: 0.485 lbm/sec (220 g/sec) at OEI Continuous
0.463 lbm/sec (210 g/sec) at Max Continuous

Max P24 air for A/C use: 0.044 lbm/sec (20 g/sec) at Max Continuous
Only in case of failure of the helicopter main gearbox lubricating system.
For further information refer to the Installation manual.

NOTE 6. AIR INTAKE REQUIREMENTS

These engines have not been tested to evaluate the effects of foreign object ingestion in accordance with FAR 33.76 and FAR 33.77. Protection against foreign object ingestion must be provided by the installation. Refer to The Installation Manual

The Makila 2A engine has been shown to comply with the induction system icing requirements of FAR 33.68 when tested with an air intake per Eurocopter France drawing numbers 332.A58.0013 (air intake with screen) or 332.A58.0041 (multi-purpose air intake). Refer to the Installation and Operating Manual for additional information.

NOTE 7. ACCESSORY DRIVE PROVISIONS / ALL MODELS

COMPONENT	(*) ROTATIO N	RPM	REDUCTION RATIO	Maximum Over- Torque mda.N (in-lb)	Maximum Static Overhang Moment mda.N (in-lb)	Shear Shaft Breaking- Torque mda.N (in-lb)
Starter	CW (1)	23,355	0.70350	2.8 (247.82)	0.4 (35.40)	6.1 (539.90)
(*) CW = Clockwise						
(1) Direction of rotation of accessory drives is indicated with the off-take flange seen from outside; i.e., the direction of rotation of the accessory drive shaft on the engine.						

NOTE 8. Engine ratings are the minimum values defined under the following conditions:
 Static sea level standard conditions at 59°F and 29.92 in/Hg.
 No airbleed, no accessory power offtake other than that necessary for the engine operation.
 Engine equipped with test bed air intake and primary exhaust pipe.
 Mean swirl angle at the compressor air intake plane is less than or equal to 0.5 degrees.
 OEI Mode selected
 Output shaft rotational speed: 22962 rpm
 Lower fuel heating value: 18545 BTU/lbm (43,136 kJ/kg)

NOTE 9. FUEL SUPPLY REQUIREMENTS

Fuel supply from helicopter system must be delivered to the engine through a 10-micron filter provided by the aircraft manufacturer.

NOTE 10. OIL SYSTEM: Refer to Installation and Operating Manual

NOTE 11. ENGINE MONITORING TRANSMITTERS: Refer to the Installation and Operating Manual

NOTE 12. ELECTRICAL EQUIPMENT: Refer to the Installation and Operating Manual

NOTE 13. OIL BRANDS: Refer to the Installation and Operating Manual for approved oil brands. Mixing oils of different brands or specifications is prohibited.

NOTE 14. FUEL AND FUEL ADDITIVES: Refer to the Installation and Operating Manual for specifications.

NOTE 15. ENGINE AIRWORTHINESS LIMITATIONS: Listed in the EASA-approved Maintenance Manual.

NOTE 16.	APPROVED MANUALS	<u>MAKILA 2A</u>	<u>MAKILA 2A1</u>
	Installation Dwg and Manual	X 298 N7 001 2	X298 N7 001 2
	Operating Instructions	X 298 N7 001 2	X298 N7 001 2
	Performance Brochure	X 298 N7 002 9	X298 U3 001 9
	Maintenance Manual	X 298 N7 450 1	X298 N7 450 1
	Overhaul Manual	X 298 N7 500 2	X298 N7 500 2

NOTE 17. TIME LIMITED DISPATCH: These engines have not been approved for time limited dispatch with any engine systems and equipment inoperative.

NOTE 18. During normal operation the engine electronic control receives electrical power from a dedicated engine driven alternator. A backup electrical power source must be provide by the aircraft.

NOTE 19. The effects of an inoperative electronic control on aircraft operational characteristics must be evaluated prior to installation approval.

NOTE 20

SERVICE INFORMATION:

Each of the documents listed below must state that it is approved by the European Aviation Safety Agency (EASA). Any such documents, including those approved under a delegated authority, are accepted by the FAA and are considered FAA approved.

- Service bulletins,
- Structural repair manuals,
- Vendor manuals,
- Aircraft flight manuals, and
- Overhaul and maintenance manuals.

These approvals pertain to the type design only.

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