

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

TYPE CERTIFICATE DATA SHEET Nº EM-2001T04

Type Certificate Holder:

TURBOMECA S.A.
64511 - Bordes Cedex
FRANCE

EM-2001T04
Sheet 01
TURBOMECA
MAKILA 1A
MAKILA 1A1
MAKILA 1A2
January 2002

Engines of models described herein conforming with this data sheet, which is part of Type Certificate No. 2001T04, 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.

MODELS MAKILA 1A, MAKILA 1A1, MAKILA 1A2

TYPE Twin spool (free turbine engine); turboshaft engine for twin-engined helicopter; three stages axial compressor; single-stage centrifugal compressor; annular combustion chamber with centrifugal fuel injection; two-stage gas generator turbine; tow-stage power turbine.

RATINGS (See Note 1)	kW (shp)	MAKILA 1A	MAKILA 1A1	MAKILA 1A2
	Maximum continuous	1 130 (1 515)	1 185 (1 589)	1 139 (1 527)
	Takeoff (5 minutes)	1 240 (1 662)	1 357 (1 819)	1 292 (1 732)

RATINGS (See Note 1) (Cont.)	kW (shp)	MAKILA 1A	MAKILA 1A1	MAKILA 1A2
	30 second OEI	#	#	1 504 (2 016)
	2 minute OEI	#	#	1 392 (1 886)
	2 ½ minute OEI	1 310 (1 756)	1 400 (1 877)	#
	30 minute or continuous OEI	1 240 (1 662)	1 330 (1 783)	1 139 (1 527)
FUEL TYPE	See Note 11 and 12.			
OIL, LUBRICATION / ADDITIVES	See Note 12.			
IGNITION	Low tension, high energy system, including: - 1 high-energy (H.E) ignition unit - 2 ignition cables - 2 igniter plugs		All Models	
TEMPERATURE LIMITS	See Note 2.			
PRESSURE LIMITS	See Note 5.			
PRINCIPAL DIMENSIONS	Length, cm (in)	210.3 (82.80)	--	211.7 (83.35)
	Width , cm (in)	52.8 (20.79)	--	49.8 (19.61)
	Height, cm (in)	68.0 (26.77)	--	67.3 (26.50)
WEIGHT	Weight / Dry / Maximum / kg (lb) Refer to engine manual for definition of dry weight	243 (535.72)	241 (531.31)	247 (544.54)
CENTER OF GRAVITY	Refer to Installation Manual			

ENGINE CONTROL SYSTEM	See Notes 19, 20 and 21.
EQUIPMENT	See Notes 22 and 23.
AIR BLEED	See Note 10.
DRIVE SHAFT TYPE	Refer to Installation Manual
STARTING	For detail, see Installation Manual.

LEGEND: -- Same as preceding
Does not apply

CERTIFICATION BASIS		Application	Issued TC
The Certification Basis for the engine are those indicated in the RBHA 21.29 and in the RBHA 33, which endorses the FAR 33 effective 01 February 1965 including Amendments 33-8, and Special Condition No. SC-92-01-NE for MAKILA 1A2.	MAKILA 1A	06 Feb. 2001	07 Jan. 2002
	MAKILA 1A1	06 Feb. 2001	07 Jan. 2002
	MAKILA 1A2	06 Feb. 2001	07 Jan. 2002

IMPORT REQUIREMENTS Each engine imported separately and/or spare parts must be accompanied by an export airworthiness approval issued by DGAC, 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.

PRODUCTION BASIS DGAC Production Organization Approval n° P 04.

NOTES

NOTE 1 The engine ratings are based on calibrated static test stand performance under the following conditions:

A.

- (1) Static, sea level standard conditions 15°C. 1 013.21 hPa (59°F, 29.92 in.Hg);
- (2) No air bleed, no accessory power extraction;
- (3) 22 850 rpm output shaft drive speed for the MAKILA 1A and 1A1;
- (4) 22 962 rpm output shaft drive speed for the MAKILA 1A2.

B.

- (1) For the MAKILA 1A and 1A1, the indicated ratings are minimum final test performance of production and overhaul engines measured with engine acceptance test specification Number 0.298.00.940.9 calibrated test bed air intake Number 6.202.88.704.0, and Turbomeca exhaust duct Number 0.301.51.755.0;
- (2) For the MAKILA 1A2, the indicated ratings are minimum final test performance of production and overhaul engines measured with engine acceptance test specification Number 0.298.00.950.0, calibrated test bed air intake Number 6.202.88.704.0, and Turbomeca exhaust duct Number 0.301.53.731.0.

NOTE 2 Maximum Permissible Temperatures - °C (°F). Refer to Operation Manual for required action if limits are exceeded

	MAKILA 1A	MAKILA 1A1	MAKILA 1A2
a) Exhaust Gas T4			
30 second OEI rating	#	#	#
2 minute OEI rating	#	#	870 (1 598)
2 ½ minute OEI rating	810 (1 490)	830 (1 526)	--
Continuous OEI rating	775 (1 427)	785 (1 445)	825 (1 517)
Takeoff rating	785 (1 445)	795 (1 463)	760 (1 400)
Max. Continuous rating	735 (1 355)	--	--
Starting	750 (1 382)	--	--
Transient (5 seconds)	800 (1 472)	800 (1 472) ⁽¹⁾	800 (1 472) ⁽³⁾

NOTE 2
(Cont.)

MAKILA 1A

MAKILA 1A1

MAKILA 1A2

Transient (2 seconds)

810 (1 490)

810 (1 490)⁽¹⁾810 (1 490)⁽³⁾

Transient (5 seconds)

#

820 (1 508)⁽²⁾820 (1 508)⁽⁴⁾

Transient (2 seconds)

#

850 (1 562)⁽²⁾850 (1 562)⁽⁴⁾

b) Oil

Maximum operating

+ 120° C (248 ° F)

Minimum for starting

Between -50° C (122 ° F) and -30° C (-22 ° F), according to oil specifications. Refer to operation Manual.

c) Fuel (See Note 7)

Maximum operating

+50° C (122 ° F)

- LEGEND:**
- ⁽¹⁾ Altitude less than 6 000 meters
 - ⁽²⁾ Altitude equal to or greater than 6 000 meters
 - ⁽³⁾ Altitude less than 6 100 meters
 - ⁽⁴⁾ Altitude equal to or greater than 6 100 meters

NOTE 3 Maximum / Minimum Permissible Engine Operating Speeds (rpm)

	MAKILA 1A	MAKILA 1A1	MAKILA 1A2
a) Gas Generator Speed (Ng)			
Maximum Stabilized Speed			
30 second OEI rating	#	#	34 650
2 minute OEI rating	#	#	33 815
2 ½ minute OEI rating	34 000	--	--
Continuous OEI rating	33 200	--	33 565
Takeoff rating	33 200	33 350	33 245
Maximum continuous rating	32 500	32 300	32 360
Transient over speed (20 seconds)	34 900	--	33 625

For variation of these limits with outside air temperature (OAT), refer to Installation Manual. For required action if limits are exceeded, refer to Maintenance Manual.

100 % gas generator speed equals = 33 200 rpm.

b) Power Turbine Speed (Np)

Limit values authorized other than during starting and idle (FLIGHT mode)

Maximum stabilized	25 100	--	25 258
Maximum transient (20 seconds)	26 700	--	27 072
100 % Power turbine speeds equals	22 850	--	22 962

NOTE 4 Torque limitation

There is no torque limitation on the MAKILA engine. The maximum output by the MAKILA 1A2 engine is 750 N.m. It corresponds to operation at maximum power of the OEI 30 seconds rating, within the flight envelope.

NOTE 5 Fuel and Oil Pressure Limits

a) Fuel

Refer to Operation Manual.

b) Oil pressure

Minimum: 170.3 kPa (24.7 psi), measured at engine pump outlet, after filter.

Maximum: 600 kPa (87.0 psi).

NOTE 6 Accessory Drive Provisions (All Models)

Drive	Direction of Rotation ⁽¹⁾	Rotation Speed rpm	Redution Ratio	Maximum Permanent Power kW (shp)	Maximum Over-Troque N.m (lb.in)	Maximum Static Overhant Moment N.m (lb.in)	Shear Shaft Breaking- Torque N.m (lb.in)
Generator rotor	CC ⁽²⁾	33 200	0.70350				
Starter	C ⁽³⁾	23 355			17 (148)	5 (43.5)	66 to 74 (574 to 643)
Oil pump pack ⁽⁴⁾	CC ⁽³⁾	4 184	0.12602				
Fuel pump & governor	C ⁽³⁾	4 184	0.12602				
Free turbine rotor							
MAKILA 1A	CC ⁽²⁾	22 850		1 240 (1 662)			
MAKILA 1A1	CC ⁽²⁾	22 850		1 357 (1 818)			
MAKILA 1A2	CC ⁽²⁾	22 962		1 292 (1 732)			

LEGEND: ⁽¹⁾ C: Clockwise; CC: counterclockwise.

⁽²⁾ Direction rotation of engine rotors and main drives is indicated according to French standard MF-L-85010: i.e., engine observed aft looking forward.

⁽³⁾ 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.

⁽⁴⁾ Integrated accessories (engine internal accessories); otherwise data not given.

NOTE 7 Reserved

NOTE 8 Reserved

NOTE 9 Reserved

NOTE 10 P2 air bleed for helicopter ancillaries.
Maximum flow rate at standard sea level conditions:

Take-off rating: 0.18 kg/s (0.40lb/s)

Maximum continuous rating: 0.16 kg/s (0.35 lb/s)

For further details, see Installation Manual.

NOTE 11 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 12 Fuel and Fuel Additives: Refer to Operation Manual for specifications.

NOTE 13 Air Intake Requirements

These engines have not been tested in icing conditions in accordance with RBHA / FAR 33.68.

These engines have not been tested to evaluate the effects of foreign object ingestion in accordance with RBHA / FAR 33.77.

Operation under icing conditions and protection against foreign object ingestion should be evaluated before installation approval and suitable protection devices should be provided as required.

Protection grid as defined by SNIAS drawing numbers 332 A58 0050 / 332 A58 0054 -06 /-07 /-08 / and -09 meet the requirements of FAR 33.77.

- NOTE 14** Reserved
- NOTE 15** Reserved
- NOTE 16** Reserved
- NOTE 17** Engine Monitoring Transmitters: Refer to Operation Manual.
- NOTE 18** Reserved
- NOTE 19** The electronic section of the fuel control will be located in the airframe in accordance with applicable Installation Manual requirements and Turbomeca Drawing Number 0 177 69 9000.
- NOTE 20** The electronic control must receive electrical power from two separate and independent buses, either one of which is capable of supplying the full electrical needs of the control, or to be switched to an independent secondary bus in the event of a failure of the primary bus.
- NOTE 21** The effects of an inoperative electronic control on aircraft operational characteristics must be evaluated prior to installation approval.
- NOTE 22** Engine Fire Detector: Six fire detectors are provided on the engine. The characteristics of the fire detectors are to be evaluated prior to approval of the engine installation.
- NOTE 23** Electrical Equipment: Refer to Operation Manual.
- NOTE 24** Certain engine parts are life-limited. These limits are listed in the DGAC-approved Maintenance Manual, Chapter 5.
- NOTE 25** Oil Brands: Refer to Operation Manual for approved oil brands. Mixing of different oil brands or specifications is prohibited.
- NOTE 26** Oil System: Refer to Operation Manual.
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NOTE 27 Engine maintenance program requirements are defined in the approved Maintenance Manual.

NOTE 28 Manuals Required by RBHA / FAR 33.5

Models:	MAKILA 1A	MAKILA 1A1	MAKILA 1A2
Overhaul Manual	298 01 933	--	X 298 H2 101 2
Installation Manual	298 00 931	X298 EO 001 1	X 298 H2 001 2
	#	X298 EO 001 9	X 298 H2 202 G
Operation Manual	298 00 934	X298 EO 300 2	X 298 H2 400 2
Maintenance Manual	298 01 936	--	--

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