AGÊNCIA NACIONAL DE AVIAÇÃO CIVIL - BRASIL

TYPE CERTIFICATE DATA SHEET Nº EM-2009T09

Type Certificate Holder:

TURBOMECA
64 511 Bordes Cedex
FRANCE

EM-2009T09-00
Sheet 01
TURBOMECA
Makila 2A, Makila 2A1
16 June 2009

Engines of models described herein conforming with this data sheet, which is part of Type Certificate No. 2009T09, 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 Makila 2A, Makila 2A1

TYPE Twin spool (free turbine) turboshaft engine consisting of a three-stage axial compressor and a single-stage centrifugal compressor; an annular combustion chamber with centrifugal fuel injection; two-stage gas generator turbine; two-stage power turbine. FADEC controlled, without manual backup.

RATINGS

	Makila 2A	Makila 2A1
Max. continuous, kW (shp):	1 303 (1 747)	--
Takeoff (5 min), kW (shp):	1 303 (1 747)	--
30-minute AEO, kW (shp):	1 303 (1 747)	--
Continuous OEI, kW (shp):	1 573 (2 109)	1 608 (2 156)
2-minute OEI, kW (shp):	1 660 (2 226)	1 668 (2 236)
30-second OEI, kW (shp):	1 758 (2 358)	1 776 (2 381)

ENGINE LIMITATIONS

	Makila 2A	Makila 2A1
Maximum Engine Speed Limits,		
Gas Generator – N1, rpm (%)		
Max. continuous:	32 155 (96.85)	32 022 (96.45)
Takeoff (5 min)):	32 927 (99.18)	32 786 (98.75)
30-minute AEO:	32 927 (99.18)	32 786 (98.75)
Continuous OEI:	32 977 (99.33)	33 008 (99.42)
2-minute OEI:	33 425 (100.68)	33 302 (100.30)
30-second OEI:	33 943 (102.24)	33 895 (102.09)
Transient overspeed (20 seconds):	33 425 (100.68)	33 302 (100.30)
(100% gas generator speed = 33 200rpm)		
Power Turbine – N2, (%)		
Max. stabilized Idle mode:	24 340 (106.0)	--
Min. stabilized Idle mode:	21 355 (45.0)	--
Max. stabilized Flight mode:	24 340 (106.0)	--
Max. stabilized Flight mode, 30-sec OEI:	23 995 (104.5)	--
Min. stabilized Flight mode:	21 355 (93.0)	--
Max. Transient (20 seconds):	25 488 (111.0)	--
Min. Transient (20 seconds):	18 370 (80.0)	--
(100% power turbine speed = 22 962rpm)		
Max. Exhaust Gas Temp. (T45) ^{o}C (^{o}F)		
Start-up:		
Unlimited duration	780 (1 436)	--
Max. overtemp (<5 secs)	830 (1 526)	--
Max. overtemp (<2 secs)	840 (1 544)	--
In Flight:		
Maximum continuous	749 (1 380)	754 (1 389)
Takeoff	796 (1 464)	801 (1 473)
Continuous OEI	799 (1 470)	814 (1 497)
30-minute AEO	796 (1 464)	801 (1 473)

Legend: "--"Same as preceding; " #" Does not apply

OIL TEMPERATURE ºC (ºF)

	Makila 2A	Makila 2A1
Maximum	120 (248)	--
Minimum for starting and ground idle	-30 (-22)	--
Minimum for power-up	10 (50)	--
(Refer to Installation and Operating Manual)		

MAXIMUM ACCESSORY TEMPERATURE

The engine compartment shall be ventilated as necessary to keep the air temperature surrounding accessory components from exceeding the limits defined in the Installation and Operating Manual.

ELECTRICAL SYSTEM

Refer to Section 7 of the Installation and Operating Manual for Electrical System information and Section 13.3.1 for HIRF and Lightning qualification and conformance.

MAXIMUM WEIGHT

278.9 kg (614.8 lb) - (Dry, including basic components, FADEC and sensors required for engine operation and monitoring.)

PRINCIPAL DIMENSIONS

Refer to Installation Drawing in approved Installation and Operating Manual.

C.G. LOCATION

Refer to Installation Drawing in approved Installation and Operating Manual.

FUEL

Fuel Bleed

Fuel from pump output is provided from the Fuel Metering Unit (FMU) motive flow port. Refer to Installation and Operating Manual.

Fuel Pressure

Refer to Installation and Operating Manual.

Fuel temperature

Maximum fuel pump inlet temperature for starting and operating is 50^{o}C (122^{o}F) for normal fuels; minimum temperature for engine starting is -30^{o}C (-22^{o}F). Refer to Installation and Operating Manual for additional information. Use of anti-icing addictive is mandatory for fuel temperature below 0^{o}C (32^{o}F).

Fuel type

Fuels and additives conforming to the specifications listed in the Makila 2A / 2A1 Installation and Operating Manual are approved for use.

LUBRICATION

Oil Pressure (psig)	Makila 2A	Makila 2A1
Minimum	23.2	--
Maximum	87.0	--
(Refer to Installation and Operating Manual)		
Oil Tank Capacity		
Total capacity (liters)	4.50	--
Imperial gallons	0.83	--
U.S. gallons	0.99	--
Usable capacity (liters)	2.95	--
Imperial gallons	0.65	--
U.S. gallons	0.78	--

Oil Type:
Oils conforming to the specifications listed in the Makila 2A / 2A1 Installation and Operating Manual are approved for use.

AIR BLEED

A. The engine is equipped with two high pressure compressor delivery air bleed ports. The maximum bleed air flow extraction from P3 is 795 l/s (210 g/s) at maximum continuous rating and 833 l/s (220 g/s) for OEI continuous rating. The maximum bleed air flow extraction from P24, is 75.7 l/s (20 g/s) at maximum continuous rating.
B. During starting: bleed air not permitted.
C. Bleed air contamination meets JAR-E 690 (b) (2).

EQUIPMENT

Equipment such as the Electronic Control System (ECS), Fuel Metering Unit (FMU), Fuel Pump, Bleed Valve Actuator, Fuel Oil Heat Exchanger, Ignition Exciter, Ignition Plug, fuel and oil filters, engine harness and sensors, oil system chip detector collector are standard equipments as shown in the approved Installation and Operating Manual. For output drive specification, accessory drives, principal dimensions, weights, inertias and C.G. locations, refer to approved Installation and Operating Manual.

IMPORT REQUIREMENTS

Each engine imported separately and/or spare parts must be accompanied by an export airworthiness approvals issued by EASA (or a third country authority, in case of used engine imported from such country) attesting that the particular engine and/or parts were submitted for airworthiness authority inspection before delivery and are in conformity with the ANAC approved type design. The ANAC type design corresponds to the EASA approved type design, as stated in ANAC Validation Report V33-0260-0.

CERTIFICATION BASIS

RBHA 33 (Brazilian Requirements for Aeronautical Certification), which endorses the 14 CFR Part 33 Amendments 1 through 20 inclusive, effective 13 December 2000 and RBHA 34, which endorses the 14 CFR Part 34, Amendment 3, effective 03 February 1999 (compliance with ICAO Annex 16 Volume II), plus, for Makila 2A, EASA Special Conditions SC1: for approval of the 30-second and 2-minute OEI ratings; SC2: for approval of a 30-minute AEO rating; SC3: for approval of the software and programmed Logic Devices and, for Makila 2A1, SC1 for approval of the 30-second and 2-minute OEI ratings; SC2: for approval of a 30-minute AEO rating.

Model	Application	Issued TC
Makila 2A	14 August 2008	16 June 2009
Makila 2A1	14 August 2008	16 June 2009

NOTES:

NOTE 1 The engine ratings for Makila 2A and Makila 2A1 engine models are based on dry sea level static ICAO standard atmospheric conditions. No accessory loads or air bleed. Engine intake and exhaust as described in the approved Installation and Operating Manual.

NOTE 2 Certain engine parts are life limited. Life limits are listed in Airworthiness Limitation Section of the Makila 2A / 2A1 Maintenance Manual P/N X 298 N7 450 1.

NOTE 3 Recommended overhaul and inspection intervals are listed in the Makila 2A / 2A1 Maintenance Manual P/N X 298 N7 450 1.

NOTE 4 The software contained in the Electronic Control System (ECS) has been designed, developed tested and documented in accordance with the provision of the Critical Category, Level A of RTCA/DO178B.

NOTE 5 Take-off ratings are limited to 5 minutes duration without adverse effects upon engine airworthiness. Refer to Installation and Operating Manual for additional information.

NOTE 6 The engine is approved for multiple engine installation only.

NOTE 7 Operating instructions are provided in Chapter 15 of the Installation and Operating Manual.

NOTE 8

A power turbine overspeed shut-down device is a standard additional protection for Makila 2A and Makila 2A1 engine models.

NOTE 9

Accessory Drives

The following apply to the accessory drives, which are provided by the engine and included in the basic engine weight::

Drive			Max. Power kW (shp)	Max. Torque (N.m)	Max. Overhang (N.m)
Drive Driven by High Rotor	Rotation (*) / RPM	Reduction Ratio	Continuous	Static	Static
Generator Rotor	CCW / 33 200		#	#	#
Starter	CCW / 23 355	0.70350	#	2.8	6.1
Oil Pump	CCW / 6 066	0.18271	#	#	#
HP Fuel Pump	CW / 6 066	0.18271	#	#	#
LP Fuel Pump	CCW / 23 355	0.70350	#	#	#
Free Turbine Rotor	CCW / 22 962	#	#	933	#

(*) CW – Clockwise; CCW – Counterclockwise (facing accessory pad).

NOTE 10

Approved Publications for Makila 2A and Makila 2A1 engine models:
- Installation and Operating Manual P/N X 298 N7 001 2.
- Engine Installation Drawing P/N 0 298 00 906 0 and subsequent for production engine configuration.

Instructions for Continued Airworthiness
- Maintenance Manual P/N X 298 N7 450 1
- Overhaul Manual P/N X 298 N7 500 2

NOTE 11

The Makila 2A and Makila 2A1 Electronic Control System (ECS) was not approved with any Time Limited Dispatch (TLD). All engine systems and equipments must be functional prior to aircraft take-off.

NOTE 12

The Electronic Control System (ECS) provides a “training” function for training crews in an engine failure situation. For additional information about this function, refer to Installation and Operating Manual.

NOTE 13 Service Bulletins, Overhaul and Maintenance Manuals, which are EASA-approved, are accepted by the ANAC and are considered ANAC-approved unless otherwise noted. These approvals pertain to the type design only.

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