

型号认可证数据单

TYPE VALIDATION CERTIFICATE DATA SHEET

编号/No: VTC0194E

版次/Revision: 1

型号/Type: MAKILA 2

衍生型 Variants

MAKILA 2A MAKILA 2A1

批准人/Approved By:

徐超群

日期/Date: 2010 - 9 - 15

本数据单是型号认可证(编号: VTC0194E)的组成部分, 它规定了符合中国民用航空局的适航要求所颁发此型号认可证的产品状态和限制。

This data sheet, which is part of Validation of Type Certificate (No: VTC0194E), prescribes condition and limitation under which the product for which the type certificate was issued meets the airworthiness requirements of the Chinese Civil Aviation Regulation.

型号认可证持有人/Validation of Type Certificate Holder:
TURBOMECA, 64511 Bordes Cedex - France

有效页清单/List of effective pages:

页数/ Pages	1	2	3	4	5	6	7	8
版次/Revision	1	1	1	1	1	1	1	1

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第1部分 概述/Section 1 GENERAL

1. CAAC认可数据单和型号合格证数据单/CAAC Validation Data Sheet and Type Certificate Data Sheet

	中国民用航空局 认可数据单号、版次和颁发日期 CAAC Validation Data Sheet Number, Revision and issuance date	型号合格证数据单号、版次和颁发日期 Type Certificate Data Sheet Number, Revision and issuance date
当前 Current	VTC0194E、1、2010- 9 -15	EASA.E.006、03、05 May, 2008
历史 History	VTC0194E、0、2007-11- 16	EASA.E.006、02、01 June, 2007

2. 类别/Category: 航空发动机/aviation engine

3. 认可当局/Validation Authority: 中国民用航空局 /CAAC

审定当局/Certifying Authority: 欧洲航空安全局/ EASA

申请 EASA 审定日期/EASA Certification Application Date:

MAKILA 2A
2001 年 11 月 30 日

MAKILA 2A1
2007 年 8 月 14 日

EASA 审定日期/EASA Certification Date:

MAKILA 2A
2004 年 7 月 12 日

MAKILA 2A1
2008 年 5 月 5 日

4. 型号合格证持有人/Type Certificate Holder: TURBOMECA

地址/Address: 64511 Bordes Cedex - France

5. 制造厂/Manufacturer: TURBOMECA

6. ETOPS: 不适用/NA

7. CAAC专用要求/CAAC Special Requirements:

明确中国3号喷气燃料使用条件。详见第2部分II.8. 油料（燃油/滑油/添加剂）。

Define the operation condition for the P.R.C. JET fuel No.3. See Section 2 II.8.Fluids (Fuel/Oil/Additives).

第2部分/Section 2

I 审定基础/Certification Basis

1. 适航标准/Airworthiness Standards:

MAKILA 2A	JAR-E 修订 11, 1/11/2001 JAR-E Amendment 11 dated 1 st November 2001
MAKILA 2A1	JAR-E 修订 11, 1/11/2001 JAR-E Amendment 11 dated 1 st November 2001 CS-E, 最初版, 24/10/2003 CS-E, initial issue dated 24 October 2003, paragraphs CS-E 50(f), CS-E 570(b)(2) and CS-E 570(c)(2)

2. 专用条件/Special Conditions (SC):

MAKILA 2A	SC1: 30秒, 2分钟OEI额定值批准专用条件/ Special Conditions for approval of 30-second and 2-minute OEI Ratings SC2: 30分钟 AEO 额定值批准专用条件/ Special Conditions for approval of a 30-minute AEO Rating SC3: 软件和程序逻辑设备批准专用条件/ Special Conditions for approval of Software and Programmable Logic Devices
MAKILA 2A1	SC1: 30秒, 2分钟OEI额定值批准专用条件/ Special Conditions for approval of 30-second and 2-minute OEI Ratings SC2: 30分钟 AEO 额定值批准专用条件/ Special Conditions for approval of a 30-minute AEO Rating

3. 偏离/ Deviations: 无/None

4. 等效安全条款/Equivalent Safety Finding:

MAKILA 2A	-对飞行机组指示滑油滤旁通阻塞- JAR-E 570(a)(4)(ii) and (a)(5)(ii) – Indication to the flight crew of oil filter impending blockage for a filter with a bypass -自OEI训练模式瞬变时30秒OEI额定值的有效性 SC1 – Availability of the 30 second OEI rating during transition from the OEI training mode
MAKILA 2A1	-自OEI训练模式瞬变时30秒OEI额定值的有效性 SC1 – Availability of the 30 second OEI rating during transition from the OEI training mode

5. 环境标准/Environmental Standards:

2007年6月1日验证符合ICAO附件16 (2005年11月修订5) 第II卷第2部第2章

Compliance with the Fuel Venting Provisions of ICAO Annex 16 (Amendment 5, November 2005), Volume II, Part 2, Chapter 2, has been demonstrated on 01 June, 2007.

6. CAAC 认可审定基础 / CAAC Validation Basis

CAAC接受EASA的审定基础为认可审定基础

CAAC accept EASA certification basis as validation basis

II 技术特性/Technical Characteristics

1. 型号设计定型/Type Design Definition:

MAKILA 2A	P/N 0 298 00 519 0
MAKILA 2A1	P/N 0 298 00 521 0

2. 描述/Description:

Makila 2 型发动机是涡轮轴发动机, 包括轴流式进气道, 由两级涡轮驱动的三级轴流式压气机和一级离心式压气机, 带有离心燃油喷嘴的环形燃烧室, 和两级动力涡轮。由燃气发生器驱动的附件传动装置位于发动机的前部, 驱动各个发动机附件。一个排气管及后功率输出轴。

The MAKILA 2 engines consist of an annular air intake, a gas generator, a two stage axial power turbine, an exhaust pipe and rear power transmission off-take. The gas generator has a three stage axial compressor and a single stage centrifugal compressor, driven by a two stage axial turbine, and an annular combustion chamber with centrifugal fuel injection. An accessory drive located at the front and driven by the gas generator powers the engine accessories.

3. 设备/Equipment:

除火警探测器外, 所有发动机安装所需设备包含在型号设计定义中。如需详细情况请参考相关安装手册。

All equipment required for engine operation, except fire detectors, is included in the engine Type Design Definition. For additional details, refer to the relevant Installation Manual.

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4. 尺寸/Dimensions:

尺寸 Dimension	(m)
总长/Overall Length	2.115
总高/Overall height	0.668
宽 (包括排气管)/ Width(including exhaust pipe)	0.785

5. 干重/Dry Weight:

278.9 kg-0/+1% (包括FADEC) / (including FADEC)

6. 额定值/Rating:

额定值 Rating	最大持续时间 Maximum duration	功率Power(kw)	
		2A	2A1
OEI-30 sec	30 sec	1758	1776
OEI-2 min	2 min	1660	1668
OEI Continuous	不限制/Unlimited	1573	1608
AEO 30 minutes	30 min	1303	1303
Take off	5 min	1303	1303
Maximum Continuous	不限制/Unlimited	1303	1303

注1:下列条件定义了上述相应的性能参数最小值

Note 1: The performance values specified above correspond to minimum values defined under the following conditions.

—试车台在海平面国际标准大气温度条件下/ISA conditions at sea level, on test bed

—发动机安装有试验台进气和主排气管/ engine equipped with a test bed air intake and primary exhaust pipe

—在压气机进气平面中平均涡流角小于或等于0.5°/mean swirl angle in the compressor air intake plane less than or equal to

0.5°

—没有用户引气/ no customer air bleed

—选择OEI模式/ OEI mode selected

—除了发动机运转必须的没有任何附件的功率提取/ no power drawn by any accessories other than those required for engine operation

—输出轴旋转速度: 22962rpm/ output shaft rotation speed: 22962rpm

—燃油的最低热值: 43136 kJ/kg/ fuel Low Heat Value: 43136 kJ/kg

注2: 由最先达到的限制值限定声明的功率: 发动机热力参数限制或发动机机械参数限制或为了保护直升机主齿轮箱而施加的DECU扭矩限制。

Note 2: Declared Power are limited by the first reached limit: either by engine thermal limits or engine mechanical limits or

DECU torque limit implemented to protect the main gearbox of the helicopter.

7. 控制系统/Control System

全功能数字式电子控制器, 没有人工备份

Full Authority Digital Electronic Control (FADEC) without manual backup.

8. 油料 (燃油/滑油/添加剂) /Fluids (Fuel/Oil/Additives):

见安装手册/see Installation Manual

9. 航空器附件驱动/Aircraft Accessory Drives:

没有/no-one

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10. 引气Bleed Extraction

对于航空器使用的P3引气，在标准海平面条件下的最大流量为

P3 air bleed for aircraft use, maximum flow rate at standard sea level conditions:

-220 g/s 在 OEI 连续额定值时/ 220 g/s at OEI Continuous rating,

-210 g/s 在最大连续额定值时/ 210 g/s at Maximum Continuous rating.

对于航空器使用的P24引气(仅在直升机主齿轮箱润滑系统失效的情况下)，在标准海平面条件下的最大流量为

P24 air bleed for aircraft use (only in case of failure of the helicopter main gear-box lubricating system) Maximum flow rate at standard sea level conditions:

-20 g/s 在最大连续额定值时/20 g/s at Maximum Continuous rating.

对于更多的详细情况，见安装手册/ For further detail, see Installation Manual.

III 使用限制/Operational Limitations

1. 温度限制/Temperature limits:

1.1 标准的燃气发生器排气温度 (T45) /Measured Gas temperature (T45)

启动 on start-up:

	无限制时间 For an unlimited duration	最大超温 Maximum overtemperature (< 5 s)	最大超温 Maximum overtemperature (< 2 s)
MAKILA 2A	780°C	830°C	840°C
MAKILA 2A1	780°C	830°C	840°C

空中 in flight:

	OEI 连续 Continuous OEI	AEO 30分钟 30-minute AEO	起飞 Take-off	最大连续 Max Continuous
MAKILA 2A	799°C	796°C	796°C	749°C
MAKILA 2A1	814°C	801°C	801°C	754°C

1.2 燃油温度/Fuel temperature

最大温度/Maximum temperature: 正常燃油/Normal fuels (F34, F35) : + 50°C

发动机启动时的最低温度/Minimum temperature for engine starting: -30°C

燃油温度低于0°C时必须使用防冰添加剂/ Use of anti-icing additive is mandatory for fuel temperature below 0°C

1.3 滑油温度/Oil temperature

发动机启动时最低滑油温度/Minimum oil temperature for engine starting: -30°C for oil with a 5×10^{-6} m²/s kinematic viscosity

加速时最低滑油温度/Minimum oil temperature for power-up: 10°C for oil with a 5×10^{-6} m²/s cinematic viscosity

最大滑油温度/Maximum oil temperature: 120 °C

2. 最大/最小转速/Maximum / Minimum Speeds:

2.1 燃气发生器转速 (N1) /Gas generator speed (N1)

100% N1=33200 rpm

最大稳定转速/Maximum stabilized speed:

额定值Rating	转速Speed % (rpm)	
	2A	2A1
OEI 30 sec	102.24 (33 943)	102.09% (33895 rpm)
OEI 2 min	100.68 (33 425)	100.30% (33302 rpm)
OEI continuous	99.33 (32 977)	99.42% (33008 rpm)

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AEO 30 Minutes	99.18(32 927)	98.75% (32786 rpm)
Take off	99.18 (32 927)	98.75% (32786 rpm)
Max Continuous	96.85 (32 155)	96.45% (32022 rpm)

所有发动机工作最大瞬时 ($\leq 20s$) 超速/Maximum transient overspeed All Engine Operative:

MAKILA 2A	100.68% (33425 rpm)
MAKILA 2A1	100.30% (33302 rpm)

2.2 动力涡轮转速 (N2) /Power turbine speed (N2)

100% N2 =22962 rpm

在非限制时期慢车模式下批准的限值/Limit values authorized in IDLE mode for an unlimited duration:

稳态最小/Minimum stabilized: 45% (21355 rpm)

稳态最大/Maximum stabilized: 106% (24340 rpm)

在非限制时期飞行模式下批准的限值/Limit values authorized in FLIGHT mode for an unlimited duration:

稳态最小/Minimum stabilized: 93% (21355 rpm)

稳态最大 (所有其他额定值) /Maximum stabilized (all other ratings) : 106% (24340 rpm)

最大稳态 30 秒 OEI/Maximum stabilized 30-sec OEI: 104.5% (23995rpm)

瞬态最小/Minimum transient (20 s): 80% (18370 rpm)

瞬态最大/Maximum transient (20 s):111% (25488 rpm)

3. 限制: Torque limits (m.daN)

运行过程中发动机输出轴上的最大扭矩/maximum torque on engine output shaft during operation :

额定值 Rating	扭矩 torque (N.m)
	MAKILA 2
OEI 30 sec	933
OEI 2 min	933
OEI continuous	933
AEO 30 Minutes	551
Take off	551
Max Continuous	551

所有发动机运转时的最大超扭/Max over-torque ($<20 s$), all engines operating: 933N.m

注 1: 上述显示的扭矩相当于发动机扭矩限制, DECU 扭矩限制以保护直升机的主齿轮箱。

Note 1: Torques showed above corresponds to engine torque limit. A DECU limit may be implemented to protect the main gearbox of the helicopter.

4. 限制/Pressure Limits:

4.1 滑油压力/oil pressure

最小相对滑油压力/Minimum relative oil pressure: 160 kPa

最大相对滑油压力/Maximum relative oil pressure: 600 kPa

4.2 燃油压力 Fuel pressure

最小燃油压力/Minimum fuel pressure:

— 正常工作不包括起动阶段和再起动阶段, 下列条件的最大值规定了最小(绝对)压力

Normal operation, i.e. excluding starting phase, the minimum (absolute) pressure is defined by the highest of the following conditions:

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	在发动机进气时最小绝对燃油压力/Minimum absolute fuel pressure at engine inlet (kpa)	
	从慢车(含)到起飞功率(不含)/From idle included to Take -off power excluded	从起飞功率(含)到 OEI 30 秒(含)/From Take -off power included to OEI 30s included
-2000ft	64	42
0 ft	51	34
5000 ft	47	31
10000 ft	35	22

—在起动或再起动阶段，燃油压力不会少于 25Kpa (相对压力)；

- During starting or relight, the fuel pressure shall not be less than 25 kpa (relative pressure)

最大燃油压力/Maximum fuel pressure:

在所有的运行阶段小于或等于 150 kPa (相对压力)

Less than or equal to 150 kPa (relative pressure), in all operating phase

5. 安装保证 Installation Assumptions:

见安装/操作手册 see Installation/Operating Manual

6. 派遣限制 Dispatch Limitation:

所有发动机系统在飞机起飞前必须是功能完好的。当任意系统或设备不工作时 MAKILA 2A 和 MAKILA 2A1 型发动机不可现时派遣。

All engine systems and equipment must be functional prior to aircraft take-off. MAKILA 2A and MAKILA 2A1 engines are not herein approved for Time Limited Dispatch with any systems or equipment inoperative.

IV 操作和服务说明/Operational and Service Instructions

	安装手册 Installation Manual	性能手册 Performance Brochure	维修手册 Maintenance Manual	大修手册 Overhaul Manual
MAKILA 2A	X 298 N7 001 2	X 298 N7 002 9	X 298 N7 450 1	X 298 N7 500 2
MAKILA 2A1	X 298 N7 001 2	X 298 U3 001 9	X 298 N7 450 1	X 298 N7 500 2

服务信函和服务通告，参考SL和SB索引。

操作说明在安装手册中第15章。

For Service Letters and Service Bulletins, refer to the SB and SL directory.

Operating Instructions are provided in Chapter 15 of the Installation Manual.

V 注释/Notes

注 1: MAKILA 2 系列发动机本身没有进行除雨、水和雪/碎冰之外的在适航规章中定义的外物吸入试验。因此，发动机防止外物的保护必须由飞机制造厂商来进行评估，该评估在相关直升机动力安装批准之前 (JAR-E 800(e)(3))。

Note 1: The MAKILA 2 series engines on their own have not been submitted to the foreign object ingestion tests defined by the airworthiness regulation, except for rain, water and snow/slush. Consequently, protection against foreign objects must be assessed by the aircraft manufacturer prior to approval of the powerplant installation of the helicopter concerned (JAR-E 800(e)(3)).

注 2: 电子控制单元不能被安装在指定火区，安装条件规定在安装手册中。

Note 2: The electronic control unit must not be installed in a designated fire zone. The installation conditions are defined in the relevant Installation Manual.

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注 3: 对于机组在发动机失效情况的训练, 电子控制系统提供了“训练”功能, 这一功能的特性参考安装手册。

Note 3: The electronic control system provides a "TRAINING" function for training crew in an engine failure situation. Refer to the Installation Manual for the characteristics of this function.

注 4: 已经生效的发动机控制系统软件依据 RTCA/DO-178B, level A

Note 4: The engine control system software has been validated in accordance with the requirements of RTCA/DO-178B, Level A.

注 5: 在安装手册中提供了使用和启动包线。

Note 5: The operating / starting envelope is provided in the Installation Manual.

注 6: 电磁干扰/闪电 (详细参考安装手册)

Note 6: EMI / lightning (Refer to Installation Manual for details.)

根据下列规范检验了已认可的级别/Validated levels has been tested according to the following standards:

- 感应信号的敏感性/Induced signal susceptibility: DO-160D section 19, Category Z
- 无线电频率的敏感性/Radio Frequency Susceptibility: DO-160D section 20, Category Y+ additional requirements;
- 发射无线电频率的能量/Emission of Radio Frequency Energy: DO-160D section 21, Category H+ additional requirements;
- 闪电感应的瞬时敏感性/Lightning induced transient susceptibility: DO-160D section 22.(see installation Manual for details)

注 7: 动力涡轮超速关断设备作为选装设备。

Note 7: Power turbine overspeed shut-down device, is available as an option.

---完/END---