

## 型号认可证数据单

TYPE VALIDATION CERTIFICATE DATA SHEET

编号/No: VTC0194E

版次/Revision: 0

型号/Type: MAKILA 2

衍生型 Variants

MAKILA 2A

批准人/Approved By:

日期/Date: 2007-11-16

周凯施

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总局的适航要求所颁发此型号认可证的产品的状态和限制。

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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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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

|               | 中国民用航空总局认可数据单号、版次和颁发日期<br>CAAC Validation Data Sheet Number, Revision and<br>issuance date | 型号合格证数据单号、版次和颁发日期<br>Type Certificate Data Sheet Number, Revision and<br>issuance date |
|---------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 当前<br>Current | VTC0194E、0、2007-11-16                                                                      | EASA.E.006、02、01 June, 2007                                                            |
| 历史<br>History | 无<br>NONE                                                                                  | 不适用<br>NA                                                                              |

### 2. 类别/Category: 航空发动机/aviation engine

### 3. 认可当局/Validation Authority: 中国民用航空总局/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 |

EASA 审定日期/EASA Certification Date:

|                 |
|-----------------|
| MAKILA 2A       |
| 2004 年 7 月 12 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:

JAR-E修订11, 1/11/2001

JAR-E Amendment 11 dated 1/11/2001

#### 2. 专用条件/Special Conditions (SC):

-SC1: 30秒、2分钟OEI额定值批准专用条件/Special Conditions for approval of the 30-second, 2-minutes OEI ratings

-SC2: 30分钟 AEO 额定值批准专用条件/Special Conditions for approval of a 30 minutes AEO ratings

-SC3: 软件和程序逻辑设备批准专用条件/Special Conditions for approval the Software and Programmed Logic Devices (PLD)

#### 3. 豁免/Exemptions: 无/None

#### 4. 等效安全条款/Equivalent Safety Finding:

-对飞行机组指示滑油滤旁通阻塞- JAR-E 570(a) (4) (ii) and (a) (5) (ii)

JAR-E 570(a) (4) (ii) and (a) (5) (ii)-Indication to the flight crew of impending blockage for oil filter with a by-pass

-自OEI训练模式瞬变时30秒OEI额定值的有效性

SC1-Availability of 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:

P/N 0 298 00 5190

#### 2. 描述/Description:

Makila 2A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，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。

The Makila 2A engine is a turboshaft engine consisting of an axial air intake, three stages of axial compressor and a centrifugal compressor driven by two stages of turbine, a combustion chamber, and two stages of power turbine. An accessory drive located at the front and driven by the gas generator drives the various engine accessories.

#### 3. 设备/Equipment:

除火警探测器以外，包含在型号设计定义中

Included in Type Design Definition except fire detectors

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4. 尺寸/Dimensions:

| 尺寸 Dimension                             | (m)   |
|------------------------------------------|-------|
| 总长/Overall Length                        | 2115  |
| 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          |
| OEI-30 sec         | 30 sec                  | 1758        |
| OEI-2 min          | 2 min                   | 1660        |
| OEI Continuous     | 不限制/Unlimited           | 1573        |
| AEO 30 minutes     | 30 min                  | 1303        |
| Take off           | 5 min                   | 1303        |
| Maximum Continuous | 不限制/Unlimited           | 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DECU停止。

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

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

#### 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: 780℃

-最大超温/Maximum over temperature (<5 s): 830℃

-最大超温/Maximum over temperature (<2 s): 840℃

空中 in flight:

- OEI 连续/OEI continuous: 799℃

- AEO 30分钟/AEO 30 minutes: 796℃

- 起飞/Take-off: 796℃

-最大连续/Max Continuous: 749℃

##### 1.2 燃油温度/Fuel temperature

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

禁止使用其他燃油/Use of other fuels is forbidden.

发动机起动时的最低温度/Minimum temperature for engine starting: -30℃

F35燃油温度低于0℃时必须使用防冰添加剂/Use of anti-icing additive is mandatory with F35 for fuel temperature below 0℃

##### 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℃ for oil with a  $5 \times 10^{-6}$  m<sup>2</sup>/s kinematic viscosity

加速时最低滑油温度/Minimum oil temperature for power-up: 10℃ for oil with a  $5 \times 10^{-6}$  m<sup>2</sup>/s cinematic viscosity

最大滑油温度/Maximum oil temperature: 120℃

#### 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              |
| OEI 30 sec     | 102.24 (33 943) |
| OEI 2 min      | 106.68 (33 425) |
| OEI continuous | 99.33 (32 977)  |

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|                |                |
|----------------|----------------|
| AEO 30 Minutes | 99.18( 32 927) |
| Take off       | 99.18 (32 927) |
| Max Continuous | 96.85 (32 155) |

所有发动机工作最大瞬时 ( $\leq 20s$ ) 超速/Maximum transient overspeed All Engine Operative: 100.68% (33425rpm)

## 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) |
|----------------|-----------------|
|                | 2A              |
| 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, 没有 DECU 扭矩规则停止以保护直升机的主齿轮箱。

Note 1: Torques showed above corresponds to engine torque limit without DECU torque law stop implemented o protect the Main Gear Box 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:

一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 staring 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:

派遣起飞时不允许控制系统 失效或设备失效，除非批准的 MMEL 允许。

Take-off in dispatchable configuration with control system failure or equipment failure is not allowed, except if included in an approved MMEL.

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

| 文件/Document                                                                             | 2A                                                                                                                     |
|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| 安装图纸和手册/Installation Drawing and Manual                                                 | X 298 N 70012                                                                                                          |
| 安装手册第 15 章提供了操作说明/Operating Instructions are provided in Installation Manual Chapter 15 | X 298 N 70012                                                                                                          |
| 性能手册/Performance Brochure                                                               | X 298 N 70029                                                                                                          |
| 维护手册/Maintenance Manual                                                                 | X 298 N 74501                                                                                                          |
| 修理手册/Repair Manual                                                                      | 尚未颁发，必须在 Turbomeca 进行修理直到具备修理手册/Not issued yet, Repair must be performed at Turbomeca until repair manual availability |
| 服务信函和服务通告/Service letters and Service Bulletins                                         | 参考 SB 和 SL 索引/Refer to SB and SL directory                                                                             |

## V 注释/Notes

注 1: Makila 2A 发动机的使用限于应用于多发旋翼航空器。

Note 1: The operation of the Makila 2A engine is restricted to multi-engine helicopter applications.

注 2: 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。

Note 2: The engine on its own has not been submitted to foreign objects ingestion tests defined by the airworthiness regulation, other than rain, water and snow/slush ice. Consequently, protection against foreign objects must be assessed by the aircraft manufacture prior to approval of the powerplant installation of the helicopter concerned.

注 3: 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 3:** The electronic control unit must not be installed in a dedicated fire zone. The installation conditions are defined in the Installation Manual.

注 4: 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 4:** 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 5: 已经生效的 EECU 软件依据 DO 178 A, level 1,

**Note 5:** The software of the EECU has been validated according to DO 178 A, level 1.

注 6: 在安装手册中提供了使用和启动包线。

**Note 6:** The operating / starting envelope is provided in the Installation Manual.

注 7: 电磁干扰/闪电 (详细参考安装手册)

**Note 7:** 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 8: 动力涡轮超速关断设备作为选装设备。

**Note 8:** Power turbine overspeed shut-down device, is available as an option.

----完/END----