

型号认可证数据单

THE VALIDATION DATA SHEET

编号/No: VTC0382E
版次/Revision: 0
型号/Type: Arrano 1 engine series
型别/Model: Arrano 1A

批准人/Approved By:

徐峰

职务/Title: Director General of CAAC-AAD

日期/Date: 2024 年 09 月 26 日

本数据单是型号认可证(编号: VTC0382E)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: VTC0382E), 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:

赛峰直升机发动机,
64510 博尔德, 法国
Safran Helicopter Engines,
64510 Bordes, France

第1部分 概述

Section 1 GENERAL

1. 型号认可证数据单版次信息/ Revision of the The validation data sheet

	型号认可证数据单编号、版次和颁发日期/ The 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	No. VTC0382E, 版次 0, 2024 年 9 月 26 日颁发 No. VTC0382E; Revision 0; Date: 26 September 2024	No.E.095, 版本: 3, 2020 年 12 月 16 日颁发 TCDS No.E.095, Issue : 03, Date: 16 December 2020

注：上表中出口国局方型号合格证数据单信息仅供参考

Note: Above TCDS information of Certification Authority is only for reference.

2. 认可当局/Validation Authority: 中国民用航空局/CAAC
审定当局/Certifying Authority: 欧盟航空安全局/EASA
3. 型号合格证持有人/Type Certificate Holder 赛峰直升机发动机, 64510 博尔德, 法国
Safran Helicopter Engines, 64510, Bordes, France
4. 双发延程飞行/ETOPS: 不适用/NA
5. CAAC专用要求/CAAC Special Requirements: 中华人民共和国国家标准“3 号喷气燃料” (GB 6537)
National Standard of the People's Republic of China
“No.3 Jet Fuel” (GB 6537)
- SC1: Arrano-1A型发动机30分钟AEO额定功率
SC1: Arrano-1A Engine 30-minute AEO Power Rating
- SC2: Arrano-1A型发动机整机最大超转
SC2: Arrano-1A Engine Inadvertent Use of Maximum
Engine Over-speed.
- SC3: Arrano-1A型发动机以APU方式工作
SC3: Arrano-1A Engine Operation in APU Mode

第2部分 数据

Section 2 DATA

1 概述 General

1.1 型号/Type:

ARRANO 1 系列/ ARRANO 1A。该型号被批准用于多发民用旋翼机，其额定值和操作限制如下，旨在符合批准的动力装置安装要求。

ARRANO 1 Series/ ARRANO 1A. This model is approved for use on multi-engine civil rotorcraft at the ratings and within the operating limitations specified below, subject to compliance with the powerplant installation requirements appropriate to approved installations.

1.2 型号合格证持有人/Type Certificate Holder:

赛峰直升机发动机，64510 博尔德，法国

Safran Helicopter Engines, 64510 Bordes, France

DOA 参考编号: EASA.21J.070

DOA reference: EASA.21J.070

1.3 制造商/Manufacturer:

赛峰直升机发动机/Safran Helicopter Engines

1.4 审定申请日期/Certification Application Date:

ARRANO 1A	2012年6月20日 20 June 2012
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1.5 EASA 审定参考日期/EASA Certification Reference Date:

2016年12月30日/30 December 2016

1.6 EASA 审定日期/EASA Certification Date:

ARRANO 1A	2019年6月18日 18 June 2019
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2 审定基础 Certification Basis

2.1 EASA 审定基础/EASA Certification basis

2.1.1 审定标准/Certification Specifications:

CS-E Amendment 4, effective 12 March 2015

2.1.2 专用条件/Special Conditions:

- 30分钟AEO额定功率/Approval of a 30 minute power rating ;
- 以APU方式工作/Operation in 'APU' mode ;
- 瞬态超温、超转与超扭限制批准/Transient over-temperature, over-speed and over-torque limit approval ;

2.1.3 偏离/Deviations:

无/None

2.1.4 等效安全/Equivalent Safety Findings:

无/None

2.1.5 环境保护要求/Environmental Protection Requirements:

CS-34.1 - 燃油排泄/CS-34.1 - Fuel venting

2.2 CAAC 审定基础/CAAC Certification basis

2.2.1 适用适航规章/Applicable airworthiness regulation

中国民航规章第 33 部 R2 版本/CCAR-33R2

2.2.2 专用条件/ Special conditions

专用条件1: Arrano-1A型发动机30分钟AEO额定功率

SC1: Arrano-1A Engine 30-minute AEO Power Rating

专用条件2: Arrano-1A型发动机整机最大超转

SC2: Arrano-1A Engine Inadvertent Use of Maximum Engine Over-speed.

专用条件3: Arrano-1A型发动机以APU方式工作

SC3: Arrano-1A Engine Operation in APU Mode

2.2.3 等效安全/ Equivalent Level of Safety

无/None

2.2.4 豁免/Exemptions

无/None

2.2.5 环保要求/ Environmental Protection requirements

无/None

3 技术特征/Technical Characteristics

3.1.1 型号设计定义/Type Design Definition:

ARRANO 1A	P/N 0356000010
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3.1.2 描述/Description:

ARRANO 1 系列涡轴发动机由集成了进口导向叶片的环形进气道、由单级高压涡轮驱动的双级离心压气机、回流燃烧室和单级低压涡轮（动力涡轮）和尾喷管组成，此单级低压涡轮驱动位于发动机前部的减速齿轮箱。高压（燃气发生器）轴驱动附件齿轮箱。发动机是由全权限数字电子控制器（FADEC）控制。

The ARRANO 1 series turboshaft engines have an annular inlet integrating inlet guide vanes, a two-stage centrifugal compressor driven by a single-stage high pressure turbine, a reverse flow combustion chamber and a single-stage low pressure turbine (power turbine) driving a reduction gearbox located at the front of the engine and an exhaust pipe. The high pressure (gas generator) shaft drives the accessory gearbox. The engine is controlled by a Full Authority Digital Electronic Control (FADEC).

3.1.3 设备/Equipment:

操作发动机所须的但未包含在发动机型号设计定义中的设备，在安装和使用说明手册中进行了定义。

The equipment necessary to operate the engine and that is not included in the Engine Type Design Definition is defined in the applicable Installation and Operating Manual.

3.1.4 尺寸/Dimensions:

	长度（毫米） Length (mm)	高度（毫米） Height (mm)	宽度（毫米） Width (mm)
ARRANO 1A	1219	817	623.2

3.1.5 干重/Dry Weight:

	重量（配备 EECU）（公斤） Weight (completely equipped with EECU)(kg)
ARRANO 1A	173.5

3.1.6 额定值/Ratings:

3.1.6.1 全发工作（千瓦）/All Engines Operative (kW)

	最大连续 Maximum Continuous	起飞（5 分钟） Take-off (5 minutes)	30分钟AEO 30-minute AEO
ARRANO 1A (1)(2)	738	851	851

3.1.6.2 单发失效（千瓦）One Engine Inoperative (kW)

	连续OEI Continuous OEI	2 分钟 OEI 2-minute OEI	30 秒 OEI 30-second OEI
ARRANO 1A (1)(2)	924	1011	1061

(1) 上述性能值在安装和使用说明手册中有所定义，对应于 N2 109%时的最小值。

The performance values specified above are defined in the Installation and Operating Manual and correspond to minimum values at 109% N2.

(2) 有关详细的性能曲线，请参阅适用的安装和使用说明手册。For detailed performance curves, refer to the applicable Installation and Operating Manual.

3.1.7 控制系统/Control System:

Arrano-1A为双通道发动机电子控制系统。发动机电子控制器P/N号为70QMA01000或后续批准的标准（软件标准包含在发动机电子控制器P/N号中）

ARRANO 1A Dual channel electronic engine control system. Electronic Engine Control Unit (EECU) P/N 70QMA01000 or later approved standard (software standard included in the EECU P/N)

3.1.8 液体（燃油/滑油/添加剂）Fluids (Fuel/Oil/Additives):

请参阅适用的安装和使用说明手册。

Refer to the applicable Installation and Operating Manual.

3.1.9 航空器附件驱动/Aircraft Accessory Drives:

	旋转方向 Rotation direction	转速 Rotation Speed	过载情况下的最大扭矩 Maximum Torque in overload condition	最大静态悬臂力矩 Maximum static cantilever	最大不平衡（ISO 1940） Maximum unbalance (ISO 1940)	剪切轴最大断开扭矩 Shear shaft maximum breakaway torque	最大连续轴功率 ⁽¹⁾ Maximum Continuous shaft power ⁽¹⁾	
		rpm	daN.m	daN.m	G	daN.m	慢车、AEO 和连续Idle, AEO and continuous	2 分钟和 30 秒 OEI /2-min and 30-sec OEI
起动发电机 Starter-Generator	顺时针 CW	11727 (100% N1)	8	2.5	2.5	18	13	13

(1) 瞬态机械功率提取可达 19 kW 持续2分钟，最高可达25 kW持续5秒。

Transient mechanical offtake is allowed up to 19 kW for 2 minutes and up to 25 kW for 5 seconds.

3.1.10 引气提取/Bleed Extraction:

供直升机使用的 P3 引气提取受 P3 引气限制器截面的限制。国际标准大气海平面起飞功率状态下，最大允许引气量为 205 克/秒。

The P3 air bleed extraction for helicopter use is limited by the section of the P3 extraction restrictor. The maximum possible extraction is 205 g/s and corresponds to Take-Off power at ISA Sea Level conditions.

有关详细信息，请参阅适用的安装和使用说明手册。

Refer to the applicable Installation and Operating Manual for further details.

4 操作限制/Operational Limitations

4.1 温度限制/Temperature limits

4.1.1 燃气发生器排气温度（T45）限制/Gas generator exhaust temperature (T45) limits

启动时/On start-up:

	无限期 For an unlimited duration	最大过热 Maximum overtemperature
ARRANO 1A	800°C	850°C

在 APU 模式下/In APU mode:

	不限时 For an unlimited duration
ARRANO 1A	665°C

在飞行中，所有发动机都运行时/In flight, All Engine Operative:

	起飞（5 分钟） Take-off(5 minutes)	30分钟AEO 30-minute AEO	最大连续 Maximum Continuous	AEO 瞬态（20 秒） AEO transient (20 seconds)
ARRANO 1A ⁽¹⁾	912°C	912°C	886°C	934°C

在飞行中，一台发动机不工作时/In flight, One Engine Inoperative:

	30 秒 OEI 30-second OEI	2 分钟 OEI 2-minute OEI	连续OEI Continuous OEI
ARRANO 1A	991°C	957°C	914°C

4.1.2 燃油温度（发动机进口）/Fuel temperature (Engine inlet)

		最低燃油温度 运转、启动和重启包线 Minimum fuel temperature Operating, starting and restart envelope	最高燃油温度 Maximum fuel temperature
ARRANO 1A ⁽¹⁾⁽²⁾⁽³⁾⁽⁴⁾⁽⁵⁾⁽⁶⁾	普通燃油 Normal Fuels	-45°C和适用燃油标准中定义的冰点温度之间的最高温度 The highest temperature between -45°C and Freezing point temperature defined for the applicable fuel standard	+57°C

(1) 有关普通燃油使用的详细定义和限制，请参阅安装和使用说明手册。 /Refer to the Installation and Operating Manual for detailed definition and limitations of normal fuels usage.

(2) ARRANO 1A发动机批准使用替代燃料。请参阅安装和使用说明手册，了解替代燃料使用的详细定义和限制。/Replacement fuels are authorized on ARRANO 1A engine. Refer to Installation and Operating Manual for detailed definition and limitations of replacement fuels usage.

(3) ARRANO 1A 发动机批准使用应急燃料，APU 模式除外。有关应急燃料使用的详细定义和限制，请参阅安装和使用说明手册。/Emergency fuels are authorized on ARRANO 1A engine, except for APU mode.

Refer to Installation and Operating Manual for detailed definition and limitations of emergency fuels usage.

(4) 对于某些燃料，最低燃料温度在低于-30°C的温度下必须强制使用防冰添加剂。有关详细信息，请参阅安装和使用说明手册。/The minimum fuel temperature is subject, for certain fuels, to mandatory use of anti-icing additive for temperatures below -30°C. Refer to the Installation and Operating Manual for further details.

(5) 批准的添加剂清单在《安装和使用说明手册》中定义。/List of authorized additives is defined in the Installation and Operating Manual.

(6) 《安装和使用说明手册》中定义了普通、替代和应急燃料的工作环境、起动和重起动包线。 Climatic operating, starting, and restarting envelopes of normal, replacement and emergency fuels are defined in the Installation and Operating Manual.

4.1.3 滑油温度/Oil temperature

	起动时的最低油温 Minimum oil temperature for starting	最高油温 Maximum oil temperature
ARRANO 1A ⁽¹⁾	-36°C for 5 cSt -45°C for 3 cSt	115°C

(1) 详细的滑油温度限制，请参阅安装和使用说明手册。/Refer to Installation and Operating Manual for detailed oil temperature limitations

4.2 最大/最小转速 Maximum / Minimum Speeds:

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

100% N1 = 44 139 rpm

飞行中和 APU 模式最小转速/In-flight and APU mode minimum speeds:

	慢车模式 ⁽¹⁾ IDLE mode ⁽¹⁾	动力涡轮锁定的慢车状态 IDLE with PT locked	APU 模式 APU mode	飞行模式 ⁽²⁾ FLIGHT mode ⁽²⁾
ARRANO 1A	57%	57%	59.8%	69.8%

(1) 此转速对应于慢车模式下，N2 = 80%时的最小稳定 N1 速度。/This speeds corresponds to the minimum stabilized N1 speed in IDLE mode with N2 = 80%.

(2) 此转速对应于飞行模式下，N2 = 100%时的最小稳定 N1 速度。/This speeds corresponds to the minimum stabilized N1 speed in FLIGHT mode with N2 = 100%.

飞行中最高转速，所有发动机运行/In-flight maximum speeds, All Engine Operative:

	起飞 (5 分钟) Take-off(5 minutes)	30分钟AEO 30-minute AEO	最大连续 Maximum Continuous	AEO 瞬态 (20 秒) AEO transient (20 seconds)
ARRANO 1A	104%	104%	103%	105.5%

飞行中最高转速，一台发动机不工作/In-flight maximum speeds, One Engine Inoperative:

	30 秒 OEI 30-second OEI	2 分钟 OEI 2-minute OEI	连续OEI Continuous OEI
ARRANO 1A	107.8%	105.6%	104.5%

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

动力驱动时的 100% N2 = 7 939 rpm

100% N2 = 7 939 rpm on the power drive.

飞行中最小转速/In-flight minimum speeds:

	稳态/Stabilised	瞬态 (20 秒) Transient (20 seconds)
ARRANO 1A	90%	70%

仅在 APU 模式和发动机起动时允许涡轮锁定状态下运转。

Operation with turbine locked is only authorized in APU mode and for engine starting.

飞行中最大转速/In-flight maximum speeds:

	稳态/Stabilised
ARRANO 1A	109%

备注: ARRANO 1A 型号已完成 115% 的最大偶发超转验证。根据 CS-E 830, 这对应最大 N2 偶发超转 20 秒的情况, 已经验证无须发动机下发或维修 (仅消除故障)。

Note: A Maximum Inadvertent Overspeed of 115% has been certified for the ARRANO 1A model. This corresponds to the maximum N2 speed for which inadvertent occurrence of up to 20 seconds has been demonstrated not to require rejection of the engine from service or maintenance action (other than to correct the cause) according CS-E 830.

4.3 扭矩限制/Torque Limits:

最大扭矩, 所有发动机工作状态/Maximum torque, All Engine Operative:

	起飞 (5 分钟) (1) Take-off (5 minutes) (1)	30分钟AEO (1) 30-minute AEO(1)	最大连续 (1) Maximum Continuous(1)	AEO 瞬态(20 秒) (2) AEO transient (20 seconds)(2)
ARRANO 1A	940 N.m	940 N.m	816 N.m	940 N.m

最大扭矩, 一台发动机不工作/Maximum torque, One Engine Inoperative:

	30 秒 OEI 30-second OEI	2 分钟 OEI 2-minute OEI	连续OEI Continuous OEI
ARRANO 1A (2)	1327 N.m	1176 N.m	1033 N.m

(1) 对于 AEO 额定值, 上述扭矩值对应于发动机验证的最大扭矩。 For AEO ratings, torque values presented above correspond to the maximum torque validated for the engine.

(2) 对于 OEI 额定值和 AEO 瞬态 20s, 发动机扭矩值受直升机通过 ARINC 框架发送到 EECU 的扭矩封顶值的限制, 以保护直升机主减速器。上面给出的值对应于 EECU 为每个额定功率所限制的扭矩范围的最大值。有关详细信息, 请参阅安装和使用说明手册。 For OEI ratings and AEO transient 20s, engine torque values are limited by torque toppings sent by the helicopter on ARINC frame to the EECU in order to protect the helicopter main gearbox. Values presented above correspond to the maximum value of the torque topping range authorized by the EECU for each power rating. For further details refer to

Installation and Operating Manual.

4.4 压力限制/Pressure Limits:

4.4.1 滑油压力/Oil pressure

发动机运行的正常滑油压力介于 400 kPa（相对压力）和 900 kPa（相对压力）之间。

Normal oil pressure for engine operation is between 400 kPa (relative pressure) and 900 kPa (relative pressure).

最低和最高水平报警值是N1和油温的函数。/Minimum and Maximum levels warnings are functions of N1 and oil temperature.

4.4.2 燃油压力（发动机进口）/Fuel pressure (Engine inlet)

有关基于大气条件和燃油规格的燃油压力的详细信息，请参阅安装和使用说明手册。Detailed information about fuel pressures depending on atmospheric conditions and fuel specifications are provided in the Installation and Operating Manual.

4.5 安装假设/Installation Assumptions:

请参阅适用的安装和使用说明手册。

Refer to the applicable Installation and Operating Manual.

4.6 限时派遣/Time Limited Dispatch:

ARRANO 1A 已获准用于限时派遣。每个可派遣状态的最长周期在《维护手册》的适航限制章节中予以明确。TLD 可派遣的故障构型在《安装和使用说明手册》中定义。ARRANO 1A has been approved for Time Limited Dispatch. The maximum rectification period for each dispatchable state is specified in the Airworthiness Limitations Section of the Maintenance Manual. The TLD dispatchable fault configurations are defined in the Installation and Operating Manual.

5. 操作和服役指南/Operational and Service Instructions

手册 Manuals	安装和使用说明手册 Installation and Operating Manual	性能手册 Performance Brochure
ARRANO 1A	X3561A0022	X3561A0012

持续适航文件 Instructions for Continued Airworthiness	维护手册 Maintenance Manual	大修手册 Overhaul Manual	维护手册排故书 Maintenance Manual Trouble Shooting Book	服务信函和 服务通告 Service Letters and Service Bulletins
ARRANO 1A	X3561A4602	X3561A5002	X3561A4612	参见服务信函 和服务通告目 录 Refer to the SB and SL directory

6 备注/Notes

1. ARRANO 1A 发动机按 CS-E 780 适航要求审定，仅当按照安装和使用说明手册中的要求安装使用时才能确保在结冰条件下安全运行。ARRANO 1A engine is certified according to Airworthiness requirements of CS-E 780 for satisfactory operation in icing conditions only when installed in accordance with the Installation and Operating Manual.
2. ARRANO 1A 未经吞冰雹和吞鸟审定。/ARRANO 1A is not certified for hail and bird ingestion.
3. 直升机需要对ARRANO 1A发动机进行外来物（含鸟类）、水、雪、冰雹和冰的防护；具体要求在《安装和使用说明手册》中明确。直升机进气道的设计需要满足对瞬时吸入过量的冰、雪和水的防护，最大可吸入量在《安装和使用说明手册》中明确。 Helicopter requirements for protection of ARRANO 1A against foreign object (including bird), water, snow, hail and ice ingestion are defined in the Installation and Operating Manual. The helicopter air intake design shall be such as to prevent instantaneous ingestion of ice, snow and water in excess of maximum quantities defined in the Installation and Operating Manual.
4. ARRANO 1A EECU 应安装在指定火区之外及可能导致过热条件的区域之外。相应的安装假设在安装和使用说明手册中定义。ARRANO 1A EECU shall be installed outside of a designated fire zone and outside of a zone that might lead to overheat conditions. Corresponding installation assumptions are defined in the Installation and Operating Manual.
5. ARRANO 1A EECU 具有 OEI TRAINING（单发失效训练）模式，用于训练机组人员处理发动机失效事件。有关更多详细信息，请参阅适用的安装和使用说明手册。ARRANO 1A EECU features an OEI TRAINING mode for training crews in the event of engine failure. Refer to the applicable Installation and Operating Manual for additional details.
6. ARRANO 1A EECU 软件已根据 DO-178B 指南对 A 级软件的要求进行了验证。 The ARRANO 1A EECU software has been validated in accordance with the requirements of DO-178B guidelines for a level A software.
7. ARRANO 1A 的工作/起动/再起动力包线在安装和使用说明手册中明确。The operating / starting / relight envelopes of ARRANO 1A are provided in the Installation and Operating Manual.
8. ARRANO 1A EECU 完成了环境验证，包括 EMI 和 HIRF，详见安装和使用说明手册。 Qualified environmental conditions of the ARRANO 1A EECU, including EMI and HIRF, are detailed in the Installation and Operating Manual.
9. ARRANO 1A 配有动力涡轮超转停车装置。有关更多详细信息，请参阅安装和使用说明手册。ARRANO 1A is equipped with a power turbine overspeed shutdown device. Refer to the Installation and Operating Manual for additional details.
10. 欧洲航空安全局批准的持续适航文件适航限制章节在《发动机维护手册》和《大修手册》第 5 章“适航限制”章节中。The EASA approved Airworthiness Limitations Section of the Instructions for Continued Airworthiness is published in the Engine Maintenance Manual and Overhaul Manual documents, chapter 5 “Airworthiness Limitations”.

11. ARRANO 1A 发动机具有 APU 模式功能。APU模式的使用条件在《安装和使用说明手册》中定义。
ARRANO 1A engine has APU mode capability. Use conditions of APU mode are defined in Installation and Operating Manual.

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