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# TYPE-CERTIFICATE DATA SHEET

No. E.031

**for**  
ARRIUS 2F Engines

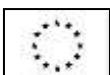
**Type Certificate Holder**

Safran Helicopter Engines

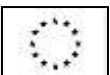
64510 Bordes  
France

For Models:

ARRIUS 2F  
ARRIUS 2R

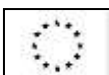


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## I. General

### 1. Type / Model

Model	Installation
ARRIUS 2F	Single-engine helicopters
ARRIUS 2R	

### 2. Type Certificate Holder

Safran Helicopter Engines  
64510 Bordes  
France  
DOA ref: EASA.21J.070

Until July 18 2016: Turbomeca  
After July 18 2016: Safran Helicopter Engines

### 3. Manufacturer

Safran Helicopter Engines  
64510 Bordes  
France

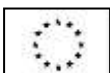
### 4. Date of Application

Model	Application Date
ARRIUS 2F	29 November 1994
ARRIUS 2R	04 April 2013

### 5. EASA Type Certification Date

Model	EASA Certification Date	Note
ARRIUS 2F	22 January 1997	(1)
ARRIUS 2R	15 December 2015	

Note (1): EASA type certification for this model is granted in accordance with article 3 paragraph 1(a) of EU Commission Regulation (EU) 748/2012 based on the DGAC France certification of this product (French Type certificate N° M22) which is hereby replaced.



## II. Certification Basis

### 1. Reference Date for Determining the Applicable Airworthiness Requirements

Model	Reference Date
ARRIUS 2F	29 November 1994
ARRIUS 2R	04 April 2013

### 2. State of Design Authority (EASA) Certification Basis

#### 2.1. Airworthiness Standards

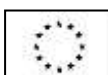
Model	Airworthiness Standards
ARRIUS 2F	JAR-E Change 9 dated 21 <sup>st</sup> October 1994, except Section 4 which is deleted by NPA-E-17 (Orange Paper E/96/1 dated 08 August 1996)
ARRIUS 2R	CS-E Amendment 3, dated 23 <sup>rd</sup> December 2010, except: <ul style="list-style-type: none"> <li>- CS-E 515, for the Centrifugal Compressor Impeller, the Power Turbine Disc, the Power Turbine Shaft where JAR-E515 Change 9, amended by Orange Paper E/96/1 is applied;</li> <li>- CS-E 650 where JAR-E Change 9, dated 21<sup>st</sup> October 1994 for the whole engine is applied;</li> <li>- CS-E 850 where JAR-E Change 9, dated 21<sup>st</sup> October 1994 for the whole engine is applied.</li> </ul>

#### 2.2. Special Conditions (SC)

Model	Special Conditions
ARRIUS 2F	None
ARRIUS 2R	None

#### 2.3. Equivalent Safety Findings

Model	Equivalent Safety Findings
ARRIUS 2F	JAR-E840 – Compressor and Turbine Rotor Integrity Tests
ARRIUS 2R	None



## 2.4. Deviations

Model	Deviations
ARRIUS 2F	JAR-E570 (a)(4)(ii) and (a)(5)(ii) – Oil system
ARRIUS 2R	None

## 2.5. Environmental Protection

Model	Environmental Protection
ARRIUS 2F	Emissions requirement of ICAO Annex 16, Volume II, Part II, issue 2 (Edition 1993)
ARRIUS 2R	CS-34 Amendment 1, dated 29 <sup>th</sup> January 2013 in accordance with CS-E1010 Fuel Venting Environmental protection requirements of ICAO Annex 16, Volume II, Part II, Chapter 2 Amendment 7 effective 17 <sup>th</sup> November 2011

## III. Technical Characteristics

### 1. Type Design Definition

Model	Part Number
ARRIUS 2F	P/N 0 319 00 800 0
ARRIUS 2R	P/N R 319 00 900 0

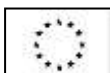
### 2. Description

#### ARRIUS 2F

The ARRIUS 2F engine is a turboshaft engine intended for powering single-engine helicopters. The engine consists of an annular air intake, a centrifugal compressor driven by a single stage turbine, an annular reverse flow combustion chamber, and a single stage free power turbine with through shaft driving a reduction gearbox located at the front. The reduction gear unit also includes the accessory gearbox driven by the gas generator and an oil tank. The fuel control system is Hydro Mechanical.

#### ARRIUS 2R

The ARRIUS 2R is a turboshaft engine intended for powering single-engine helicopters. It consists of an annular air intake, a single stage centrifugal compressor driven by a single stage gas generator turbine, an annular reverse flow combustion chamber, a single stage free turbine with a through shaft driving a reduction gearbox located at the front. The reduction gear unit also includes the accessory gearbox driven by the gas generator. Primary Engine Control System consists of a dual-channel digital Engine Control Unit (ECU), a dual-channel electric actuator and a fuel metering valve. There is also a Back-up Engine Control System consisting of an auxiliary metering valve, an auxiliary electric actuator and the same ECU.



### 3. Equipment

#### ARRIUS 2F

Engine equipment is specified by the applicable Type Design Definition.  
Starter-generator has to be supplied by the aircraft manufacturer.

#### ARRIUS 2R

Engine equipment is specified by the applicable Type Design Definition.  
Starter-generator and aircraft free wheel unit have to be supplied by the aircraft manufacturer.

### 4. Dimensions

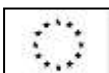
Model	Overall Length (m)	Overall Height (m)	Overall Width (m)
ARRIUS 2F	1.168	0.674	0.488
ARRIUS 2R	0.934	0.676	0.553

### 5. Dry Weight

Model	Dry Weight (kg)
ARRIUS 2F	104
ARRIUS 2R	119.9

### 6. Ratings

Ratings – Power (kW)	Maximum duration	ARRIUS 2F				ARRIUS 2R	
		without Tf39 (*)		with Tf39 (*)		With torque and fuel flow limitations	Without torque and fuel flow limitations
		With torque and fuel flow limitations	Without torque and fuel flow limitations	With torque and fuel flow limitations	Without torque and fuel flow limitations		
Take-Off	5 minutes	322	376	376	376	352	389
Maximum Continuous	unlimited	322	335	335	335	323	355



#### ARRIUS 2F:

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

- ISA conditions at sea level, on test bed
- Engine equipped with a test bed air flow measurement intake plenum and a test bed exhaust jet pipe
- No air bleed
- No power drawn by any accessories other than those required for engine operation
- Power off-take speed = 6 000 rpm constant
- Usual Fuel Heating Value = 43 136 kJ/kg
- Alternative Fuel Heating Value = 43 500 kJ/kg

\* See note 4 paragraph VI.

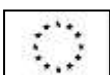
#### ARRIUS 2R:

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

- Neither pressure drop nor heating, nor swirl, at engine inlet plane 1 (see Installation / Operating Manual §2.2 for reference plane definition)
- Atmospheric humidity used for performance calculation: Humidity Mixing Ratio = 0.0069 (65% at sea level 15°C)
- Engine equipped with a test bed air flow measurement intake plenum and a test bed exhaust jet pipe
- No back pressure downstream of the test bed exhaust pipe plane 7
- No air bleed
- No electrical power off-take
- No power drawn by any accessories other than those required for engine operation
- Output shaft rotation speed 100% = 5 610 rpm constant
- Fuel Heating Value = 43 136 kJ/kg
- No fuel flow limit

### 7. Control System

Model	Control System
ARRIUS 2F	Hydro Mechanic with manual backup mode
ARRIUS 2R	Dual-channel electronic engine control system with auxiliary fuel metering back-up control





## 8. Fluids (Fuel, Oil, Coolant, Additives)

Refer to applicable Installation / Operating Manual.

## 9. Aircraft Accessory Drives

Model	Rotation direction	Starter-generator Output				
		Rotation speed (rpm)	Maximum torque in overload (N.m)	Maximum static overhang (N.m)	Fuse shaft breakaway torque (N.m)	Maximum Continuous Mechanical Power (kW)
ARRIUS 2F	CW	12 334	25	25	77	5.7
ARRIUS 2R	CW	12 334	25	25	95	6.9

At 100% N1

For further details, see Installation Manual

Additional note:

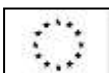
The rotation direction of the engine rotors is indicated with respect to viewing the engine from its rear end.

## 10. Maximum Permissible Air Bleed Extraction

At Take-off, at ISA conditions on ground:

Model	Maximum Permissible Air Bleed Extraction
ARRIUS 2F	Two ports used
	On one port maximum air flow 70 g/s
	On the other port maximum air flow 40 g/s with Tf39 (*)
	Maximum total bleed air flow 70 g/s without Tf39 (*) 110 g/s with Tf39 (*)
ARRIUS 2R	Two ports used
	On one port maximum air flow 70 g/s
	Maximum total bleed air flow 80 g/s on the two ports

(\*): see note 4 paragraph VI



## IV. Operating Limitations

### 1. Temperature Limits

#### 1.1. Gas Generator Exhaust Temperature (T45) Limits

T45 on start-up (°C)	ARRIUS 2F	ARRIUS 2R
For an unlimited duration	800	800
Maximum overtemperature (< 10 sec)	870	870

T45 in-flight (°C)	ARRIUS 2F	ARRIUS 2R
Take-off	870	865
Maximum continuous	830	829
Maximum inadvertent overtemperature	900 (< 5 sec)	882 (< 20 sec)

#### 1.2. Fuel Temperature

Maximum temperature: see Installation Manual Chapter 6.1.1.1

Minimum temperature for engine starting: s see Installation Manual Chapter 6.1.1.1

For definition of normal and restricted use fuels, see Installation Manual Chapter 6.1.1.1

Use of anti-icing additive for fuel temperature:

< -15°C for ARRIUS 2F  
< -20°C for ARRIUS 2R

#### 1.3. Oil Temperature

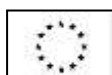
Minimum oil temperature depending on kinematic viscosity for starting:

For ARRIUS 2F

For 5 mm<sup>2</sup>/s and 3,9 mm<sup>2</sup>/s oil:  
-30°C  
For 3 mm<sup>2</sup>/s oil:  
-50°C

For ARRIUS 2R

For 5 mm<sup>2</sup>/s and 4 mm<sup>2</sup>/s oil:  
-30°C  
For 3 mm<sup>2</sup>/s oil:  
-50°C



Minimum oil temperature depending on kinematic viscosity for power application:

For ARRIUS 2F

- For 5 mm<sup>2</sup>/s and 3,9 mm<sup>2</sup>/s oil:
  - +10°C in transient condition
  - +50°C in continuous operation
- For 3 mm<sup>2</sup>/s oil:
  - +0°C in transient condition
  - +50°C in continuous operation

For ARRIUS 2R

- For 5 mm<sup>2</sup>/s and 4 mm<sup>2</sup>/s oil:
  - +10°C in transient condition
  - +50°C in continuous operation
- For 3 mm<sup>2</sup>/s oil:
  - +0°C in transient condition
  - +50°C in continuous operation

Maximum oil temperature:

110°C

## 2. Speed Limits

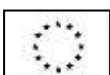
### 2.1. Gas Generator Speed (N1)

100% N1 = 54 117 rpm

Minimum stabilised N1 speed	ARRIUS 2F	ARRIUS 2R
Minimum stabilised N1 speed	63% (34 094 rpm)	

Maximum stabilised N1 speed	ARRIUS 2F	ARRIUS 2R
Take-off	101.2% (54 768 rpm)	101.4% (54 872 rpm)
Maximum continuous	99.7% (53 956 rpm)	99.9% (54 066 rpm)

Transient speeds	ARRIUS 2F	ARRIUS 2R
Maximum inadvertent overspeed (< 20 sec)	103.6% (56 065 rpm)	



## 2.2. Power Turbine Speed (N2)

100% N2 = 44 009 rpm for ARRIUS 2F

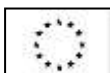
100% N2 = 42 014 rpm for ARRIUS 2R

Maximum N2 speed Flight mode	ARRIUS 2F	ARRIUS 2R
Continuous	104% (45 770 rpm)	105% (44 114 rpm)
Maximum inadvertent transient overspeed (< 20 sec)	110% (48 410 rpm)	112% (47 055 rpm)

Minimum N2 speed Flight mode	ARRIUS 2F	ARRIUS 2R
Continuous	92% (40 488 rpm)	94% (39 493 rpm)
Maximum inadvertent transient overspeed (< 20 sec)	90% (39 608 rpm)	92% (38 653 rpm)

## 3. Thrust / Torque Limits

Maximum torque (N.m)	ARRIUS 2F	ARRIUS 2R
Take-off	650	600
Maximum continuous	600	550
Maximum inadvertent overtorque	752 (< 20 s)	660 (< 5 s)



#### 4. Pressure Limits

##### 4.1. Fuel Pressure

Refer to applicable Installation / Operating Manual Chapter 6.1.1.1.

For ARRIUS 2R:

- Within starting or relight phase and above 2000m altitude, a prime pump is necessary. This shall maintain a relative pressure equal to or greater than 25 kPa.
- The maximum fuel system inlet pressure is 110 kPa relative to atmospheric pressure.

##### 4.2. Oil Pressure

Oil Pressure (differential)	ARRIUS 2F	ARRIUS 2R
Minimum: (kPa)	170	* See Installation Manual
Maximum (kPa)	1500	1500

\* The Minimum Oil Pressure for the ARRIUS 2R is a function of N1. Refer to the Installation Manual.

#### 5. Oil Capacity, Consumption Limit

	ARRIUS 2F	ARRIUS 2R
Maximum oil tank volume (l)	4.9	see note 5 paragraph VI
Minimum oil tank volume (l)	3	
Consumption limit (l/h)	0.3	0.3

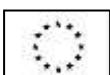
Refer to Installation / Operational Manual

#### 6. Installation Assumptions

Refer to Installation / Operational Manual

#### 7. Time Limited Dispatch

The engines have not been approved for Time Limited Dispatch (in accordance with CS-E1030 for ARRIUS 2R).



## V. Operating and Service Instructions

Manuals		
Document	ARRIUS 2F	ARRIUS 2R
Installation and Operating Manual (1)	X 319 L6 001 2	X 319 R5 003 2
Performance Brochure	Without Tf39 (2) Usual fuels: X 319 L6 002 9 Alternative fuels: X 319 L6 004 2  With Tf39 (2) Usual fuels: X 319 L6 005 9 Alternative fuels: X 319 L6 006 9	X 319 R5 001 2

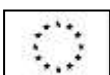
Instructions for Continued Airworthiness (ICA)		
Document	ARRIUS 2F	ARRIUS 2R
Maintenance Manual	X 319 L6 301 2	X 319 R5 460 2
Overhaul Manual	X 319 L6 501 2	
Service Letters and Service Bulletins	As published by SAFRAN HELICOPTER ENGINES	

Note (1) Operating Instructions are provided in Installation Manual.

Note (2) see note 4 paragraph VI.

## VI. Notes

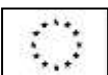
1. The ARRIUS 2F is approved to be fitted to rotorcraft only where the installation precludes ingestion of foreign objects (as defined in JAR-E790 (c) and JAR-E800) from entering the engine inlet.
2. The ARRIUS 2F (without the aircraft air inlet) meet the JAR requirement for operation in icing conditions within the envelope defined in JAR29 Appendix C.
3. The EASA approved Airworthiness Limitations Section of the Instructions of Airworthiness is published in the applicable "Engine Maintenance Manual, Chapter 5, "Airworthiness Limitations".
4. Tf39 is a major non-significant modification. The purpose of this modification is to adjust the Fuel Control Unit maximum flow in order to avoid torque limitations when operating with JP4 fuel. A consequence is that the maximum air flow extracted can be increased up to flow rate of 110 g/s (at Take-off power rating under standard ground conditions) when Tf39 is embodied.
5. For ARRIUS 2R, the oil tank is not part of the type design, it shall be supplied by aircraft manufacturer taking into account the conditions for installation of the oil tank as described in the Installation Manual (Chapter 11 and 12).
6. The ARRIUS 2R is approved to be fitted to rotorcraft only where the installation precludes ingestion of hailstone and birds (as defined in CS-E 790 (a)(d) and CS-E 800) from entering the engine inlet.



7. Conversion from a non-civil use:

This note is applicable to the Arrius 2F – 2R engines originally assembled by TURBOMECA or SAFRAN HELICOPTER ENGINES and previously operated by an operator not under the control of a Civil Authority (military, paramilitary, etc.).

The compliance of such engines with the European rules enabling issuance of an aircraft standard certificate of airworthiness must be checked. Their configuration, including design changes and repairs, does not necessarily conform to the type definition approved by EASA, and it is possible that in operation they have exceeded the limits approved by EASA. Before a standard certificate of airworthiness is issued to an aircraft in which such engines are installed, an EASA Form 1 must be issued for these engines. This requires incorporation of SAFRAN HELICOPTER ENGINES Mandatory Service Bulletin 319 72 4838.



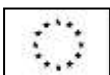
## VII. Section: Administrative

### 1. Acronyms and Abbreviations

CCW	Counter clockwise
CRI	Certification Review Item
CS	Certification Specification
CS-E	Certification Specification for Engines
CW	Clockwise
DGAC	Direction Générale de L'Aviation Civile (French Civil Aviation Authority)
DOA	Design Organisation Approval
EASA	European Union Aviation Safety Agency
ECU	Engine Control Unit
EU	European Union
ICAO	International Civil Aviation Organisation
ISA	International Standard Atmosphere
JAR	Joint aviation Requirements
JAR-E	Joint Aviation Requirement for Engines
N1	Gas Generator Speed
N2	Power Turbine Speed
NPA	Notice of Proposed Amendment
P/N	Part Number
rpm	Rotation per minute
SB	Service Bulletin
SC	Special Conditions
SL	Service Letter
T45	Gas Generator Exhaust Temperature
TC	Type Certificate
TCDS	Type Certificate Data Sheet

### 2. Type Certificate Holder Record

Until July 18 2016 Turbomeca  
After July 18 2016 Safran Helicopter Engines





### 3. Change Record

Issue	Date	Changes	TC issue
Issue 01	15 December 2015	Initial Issue	Initial Issue, 15 December 2015
Issue 02	01 August 2016	Name Change from Turbomeca to Safran Helicopter Engines	01 August 2016
Issue 03	24 October 2016	Administrative Update	
Issue 04	15 March 2019	Change of the reference of Manuals (EASA Major Change Approval 10068685)	
Issue 05	7 July 2020	Change of the Arrius 2R Engine Ratings (EASA Major Change Approval 10073727)	

-END-

