



---

# TYPE-CERTIFICATE DATA SHEET

No. E.001

**for**  
Arriel 2 Series Engines

**Type Certificate Holder**

Safran Helicopter Engines  
64510 Bordes  
France

For Models:

Arriel 2B  
Arriel 2B1  
Arriel 2B1A  
Arriel 2B1B  
Arriel 2D  
Arriel 2C  
Arriel 2C1  
Arriel 2C2  
Arriel 2S1  
Arriel 2S2  
Arriel 2E  
Arriel 2N  
Arriel 2H  
Arriel 2L2



Intentionally left blank



## TABLE OF CONTENTS

<b>I. General</b> .....	<b>4</b>
1. Type/ Model/ Variants .....	4
2. Type Certificate Holder .....	4
3. Manufacturer .....	4
4. Date of Application.....	5
5. EASA Type Certification Date .....	5
<b>II. Certification Basis</b> .....	<b>6</b>
1. State of Design Authority (EASA) Certification Basis.....	6
1.1. Airworthiness Standards .....	6
1.2. Special Conditions (SC).....	6
1.3. Equivalent Safety Findings .....	7
1.4. Deviations .....	7
1.5. Environmental Protection .....	7
2. Reference Date for determining the applicable airworthiness requirements .....	7
<b>III. Technical Characteristics</b> .....	<b>8</b>
1. Type Design Definition.....	8
2. Description.....	8
3. Equipment .....	8
4. Dimensions .....	8
5. Dry Weight.....	9
6. Ratings .....	9
7. Control System .....	10
8. Fluids (Fuel, Oil, Coolant, Additives) .....	10
9. Aircraft Accessory Drives .....	11
10. Maximum Permissible Air Bleed Extraction .....	12
<b>IV. Operating Limitations</b> .....	<b>12</b>
1. Temperature Limits .....	12
1.1 Gas generator exhaust temperature (T45) limits .....	12
1.2 Fuel temperature .....	13
1.3 Oil temperature.....	13
2. Speed Limits.....	14
2.1 Gas generator speed (N1) .....	14
2.2 Power turbine speed (N2).....	15
3. Thrust/Torque Limits .....	17
4. Pressure Limits .....	18
4.1 Fuel Pressure .....	18
4.2 Oil Pressure .....	19
<b>V. Operating and Service Instructions</b> .....	<b>19</b>
<b>VI. Notes</b> .....	<b>20</b>
<b>SECTION: ADMINISTRATIVE</b> .....	<b>25</b>
I. Acronyms and Abbreviations .....	25
II. Type Certificate Holder Record .....	25
III. Change Record .....	25



## I. General

### 1. Type/ Model/ Variants

Type: Arriel 2

Model	Installation
Arriel 2B	Single-engine helicopters
Arriel 2B1	
Arriel 2B1A	
Arriel 2B1B	
Arriel 2D	
Arriel 2C	Twin-engine helicopters
Arriel 2C1	
Arriel 2C2	
Arriel 2S1	
Arriel 2S2	
Arriel 2E	
Arriel 2N	
Arriel 2H	
Arriel 2L2	

### 2. Type Certificate Holder

Safran Helicopter Engines  
64510 Bordes  
France

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

### 3. Manufacturer

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



#### 4. Date of Application

Model	Application Date
Arriel 2B	09 December 1996
Arriel 2B1	03 June 1998
Arriel 2B1A	07 June 2002
Arriel 2B1B	14 June 2010
Arriel 2D	26 May 2008
Arriel 2C	09 December 1996
Arriel 2C1	10 September 1997
Arriel 2C2	12 January 1999
Arriel 2S1	14 May 1993
Arriel 2S2	04 December 2003
Arriel 2E	30 June 2010
Arriel 2N	13 September 2012
Arriel 2H	05 March 2015
Arriel 2L2	26 April 2016

#### 5. EASA Type Certification Date

Model	EASA Certification Date	Note
Arriel 2B	01 December 1997	(1)
Arriel 2B1	15 November 2000	(1)
Arriel 2B1A	11 December 2003	(1)
Arriel 2B1B	10 February 2011	
Arriel 2D	16 May 2011	
Arriel 2C	29 August 1997	(1)
Arriel 2C1	08 December 1998	(1)
Arriel 2C2	05 July 2002	(1)
Arriel 2S1	26 April 1996	(1)
Arriel 2S2	06 December 2005	(1)
Arriel 2E	17 December 2012	
Arriel 2N	11 December 2014	
Arriel 2H	05 April 2018	
Arriel 2L2	28 May 2021	

**Note (1):** EASA type certification for these models is granted in accordance with Article 3 paragraph 1(a) of EU Commission Regulation (EU) 748/2012, based on the DGAC France certification of these products (French Type Certificate N° M19).



## II. Certification Basis

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

#### 1.1. Airworthiness Standards

Model	Airworthiness Standards
Arriel 2B	JAR-E Change 9 dated 21 October 1994, Orange Paper E/96/1 dated 08 August 1996
Arriel 2B1	
Arriel 2B1A	
Arriel 2B1B	JAR-E Change 9 dated 21 October 1994, Orange Paper E/96/1 dated 08 August 1996, CS-E 570(b)(2) and CS-E 570(c)(2) of CS-E Amendment 2 dated 18 December 2009
Arriel 2D	JAR-E Change 9 dated 21 October 1994, Orange Paper E/96/1 dated 08 August 1996 Orange Paper E/97/1 dated 30 December 1997, JAR-E 740 and E 745 of JAR-E Change 10 dated 15 August 1999, CS-E 50 (d) and (f), and CS-E 1030 of CS-E Amendment 1 dated 10 December 2007, CS-E 570 of CS-E Amendment 2 dated 18 December 2009
Arriel 2C	JAR-E Change 9 dated 21 October 1994, Orange Paper E/96/1 dated 08 August 1996
Arriel 2C1	
Arriel 2S1	
Arriel 2C2	JAR-E Change 9 dated 21 October 1994, Orange Paper E/96/1 dated 08 August 1996, Orange Paper E/97/1 dated 30 December 1997
Arriel 2S2	
Arriel 2E	JAR-E Change 9 dated 21 October 1994, Orange Paper E/96/1 dated 08 August 1996, Orange Paper E/97/1 dated 30 December 1997, JAR-E 745 of JAR-E Change 10 dated 15 August 1999, JAR-E 820 of JAR-E Amendment 11 dated 1 November 2001, JAR-E 20, JAR-E 25, JAR-E 30, JAR-E 40, JAR-E 50, JAR-E 60, JAR-E 140 (d)(3), JAR-E 170, JAR-E 690, JAR-E 730, JAR-E 740, JAR-E 830 and JAR-E 920 of JAR-E Amendment 12 dated 1 May 2003 CS-E 50 (d) and (f), and CS-E 1030 of CS-E Amendment 1 dated 10 December 2007 CS-E 570 of CS-E Amendment 2 dated 18 December 2009
Arriel 2N	
Arriel 2H	
Arriel 2L2	

#### 1.2. Special Conditions (SC)

Model	Special Conditions
Arriel 2B, 2B1, 2B1A, 2B1B	None
Arriel 2D	SC1: Approval of Turboshaft 30-minute Take-off Power Rating
Arriel 2C	SC1 to SC12: Special Conditions for approval of the 30-Second, 2-minute and Continuous OEI ratings
Arriel 2C1	
Arriel 2S1	SC1 to SC12: Special Conditions for approval of the 30-Second, 2-minute and Continuous OEI ratings SC13 to SC15: Special conditions for approval of the HIP/SARM rating
Arriel 2C2	SC1-C2: Special Conditions for certification of "30 second and 2 minutes OEI ratings"
Arriel 2S2	
Arriel 2E	SC1: Approval of Turboshaft 30-minute Take-off Power Rating
Arriel 2N	SC1: Approval of Turboshaft 30-minute Take-off Power Rating SC2: 30-second OEI Transient Over-torque
Arriel 2H	SC1: Approval of Turboshaft 30-minute Take-off Power Rating
Arriel 2L2	SC1: Approval of Turboshaft 30-minute Take-off Power Rating



### 1.3. Equivalent Safety Findings

Model	Equivalent Safety Findings
Arriel 2B, 2B1, 2B1A, 2B1B	JAR-E 740 Endurance test
Arriel 2C, 2S1, 2C2, 2S2, 2E, 2N, 2D, 2H	none
Arriel 2C1	JAR-E 80, E740 "Dual channel control system endurance"

### 1.4. Deviations

Model	Deviations
Arriel 2B, 2B1, 2B1A	JAR-E 570 (a)(4)(ii) and (5)(ii) - Indication to the flight crew
Arriel 2B1B, 2D, 2E, 2N, 2H	none
Arriel 2C, 2C1, 2S1, 2C2, 2S2	JAR-E 570 (a)(4)(ii) and (5)(ii) - Indication to the flight crew

### 1.5. Environmental Protection

Model	Environmental Protection Requirements
Arriel 2B, 2B1, 2B1A	Fuel venting provisions of ICAO Annex 16, vol II, Part 2, Chapter 2 (Edition 1993)
Arriel 2B1B, 2D	Environmental protection requirements of ICAO Annex 16 Volume II, Part II, Chapter 2 Amendment 6 effective 20 November 2008, as applicable to turboshaft engines.
Arriel 2C, 2C1, 2S1, 2C2	Fuel venting provisions of ICAO Annex 16, vol II, Part 2, Chapter 2 (Edition 1993)
Arriel 2S2	Environmental protection requirements of 21A.18(b) of Regulation (EC) 1702/2003
Arriel 2E	Environmental protection requirements of ICAO Annex 16 Volume II, Part II, Chapter 2 Amendment 6 effective 20 November 2008, as applicable to turboshaft engines.
Arriel 2N	Environmental protection requirements of ICAO Annex 16 Volume II, Part II, Chapter 2 Amendment 7 effective 17 November 2011, as applicable to turboshaft engines.
Arriel 2H	CS-E 1010 of CS-E Amendment 1 dated 10 December 2007 iaw CS-34.1 Amendment 1 dated 23 January 2013 <sup>(1)</sup>
Arriel 2L2	CS-E 1010 of CS-E Amendment 1 dated 10 December 2007 iaw CS-34.1 Amendment 2 dated 12 January 2016 <sup>(1)</sup>

<sup>(1)</sup> The requirements posted therein are identical to the environmental protection requirements applied in the Arriel 2N certification.

## 2. Reference Date for determining the applicable airworthiness requirements

14 May 1993



### III. Technical Characteristics

#### 1. Type Design Definition

Model	Part Number
Arriel 2B	0 292 00 534 0
Arriel 2B1	0 292 00 541 0
Arriel 2B1A	0 292 00 547 0
Arriel 2B1B	0 292 00 005 0
Arriel 2D	0 292 00 002 0
Arriel 2C	0 292 00 536 0
Arriel 2C1	0 292 00 539 0
Arriel 2C2	0 292 00 542 0
Arriel 2S1	0 292 00 531 0
Arriel 2S2	0 292 00 545 0
Arriel 2E	0 292 00 001 0
Arriel 2N	0 292 00 006 0
Arriel 2H	0 292 00 009 0
Arriel 2L2	0 292 00 011 0

#### 2. Description

The Arriel 2 engine is a turboshaft engine consisting of an axial air intake, an axial compressor and a centrifugal compressor driven by a single stage turbine, a combustion chamber, and a single stage power turbine driving a reduction gearbox located at the rear. An accessory drive gearbox, driven by the gas generator, is located at the front. Mounts are part of the engine type definition. Starter-generator is not part of the engine type definition.

The Arriel 2 engine is controlled by an electronic engine control system, featuring a single or dual channel with standard or optional mechanical back-up depending on the model (see section III.7).

#### 3. Equipment

Equipment is included in Type Design Definition

#### 4. Dimensions

Model	Length (m)	Height (m)	Width (m)
Arriel 2B	1.181	0.616	0.498
Arriel 2B1	1.140	0.616	0.491
Arriel 2B1A			
Arriel 2B1B			
Arriel 2D	1.177	0.616	0.500
Arriel 2C	1.181	0.616	0.498
Arriel 2C1	1.015	0.576	0.498
Arriel 2C2			
Arriel 2S1	1.539	0.715	0.504
Arriel 2S2			0.497
Arriel 2E	1.182	0.616	0.508
Arriel 2N	1.201	0.634	0.498
Arriel 2H	1.201	0.617	0.500
Arriel 2L2	1.201	0.633	0.500





## 5. Dry Weight

Model	Dry Weight (Kg)	Note
Arriel 2B	134.0	(1)
Arriel 2B1	132.2	
Arriel 2B1A	129.2	(2)
Arriel 2B1B	132.2	(1)
Arriel 2D	132.9	(2)
Arriel 2C	131.0	
Arriel 2C1	129.2	
Arriel 2C2	131.5	
Arriel 2S1	131.2	
Arriel 2S2	131.0	
Arriel 2E	139.2	
Arriel 2N	134.0	
Arriel 2H	135.0	
Arriel 2L2	135.0	

Note (1): Free wheel is under helicopter responsibility, and weight includes free wheel assembly

Note (2): Free wheel is under helicopter responsibility, but weight does not include free wheel assembly

## 6. Ratings

Ratings – Power (kW)	maximum duration	Arriel 2B	Arriel 2B1	Arriel 2B1A	Arriel 2B1B	Arriel 2D
30-minute Take-off (1)	30 minutes	n/a	n/a	n/a	n/a	598
Take-off	5 minutes	557	557	501	557	598
Maximum Continuous	unlimited	543	543	501	543	598

Ratings – Power (kW)	maximum duration	Arriel 2C	Arriel 2C1	Arriel 2C2	Arriel 2S1	Arriel 2S2	Arriel 2E	Arriel 2N	Arriel 2H	Arriel 2L2
OEI-30 sec	30 seconds	704	718	750	735	771	753	750	704	809
OEI-2 min	2 minutes	635	646	713	663	699	630	729	635	729
OEI Continuous	unlimited	610	616	640	639	659	490	640	610	672
30-minute Take-off (1)	30 minutes	n/a	n/a	612	601	601	445	530	495	602
Take-off	5 minutes	531	581	612	601	601	445	530	495	602
Maximum Continuous	unlimited	531	531	612	592	601	360	426 (2)	460.5	501

Note (1): Also called HIP/SARM in earlier models

Note (2): Function (T0, P0) table, limited to 426 kW



#### Additional Notes:

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

- mean swirl angle in the compressor air intake plane less than or equal to 0.5° for all models except Arriel 2N, 2H and 2L2.
- mean swirl angle in the compressor air intake plane between -1.5° and +1.5° for Arriel 2N, 2H and 2L2.
- ISA conditions at sea level, on test bed,
- engine equipped with a test bed air intake and primary exhaust pipe,
- no air bleed,
- no power drawn by any accessories other than those required for engine operation,
- no installation losses,
- output shaft rotation speed:
  - 6000 rpm for Arriel 2B, 2B1, 2B1A, 2B1B, 2D, 2C, 2C1, 2C2, 2E, 2N, 2H;
  - 6004.6 rpm for Arriel 2L2;
  - 6409 rpm for Arriel 2S1, 2S2.
- fuel Low Heat Value : 43 136 kJ/kg

Declared powers are limited by the first reached limit: either by thermal or mechanical limits.

For Take-Off, 30-minute Take-off and Maximum Continuous, the mechanical limits correspond to:

- the first torque limits reached between validated mechanical limit and EECU torque limit for all variants but Arriel 2E;
- the validated mechanical limit of the engine for Arriel 2E.

#### 7. Control System

Model	Control System
Arriel 2B	Single channel electronic engine control system with manual backup control
Arriel 2B1, 2B1A, 2B1B	Dual channel electronic engine control system with optional auxiliary back-up control
Arriel 2D	Dual channel electronic engine control system with auxiliary back-up control
Arriel 2C	Single channel electronic engine control system with manual backup
Arriel 2C1, 2C2	Dual channel electronic engine control system with optional auxiliary back-up control
Arriel 2S1	Single channel electronic engine control system with manual backup control
Arriel 2S2	Dual channel electronic engine control system with auxiliary back-up control
Arriel 2E	Dual channel electronic engine control system
Arriel 2N	Dual channel electronic engine control system
Arriel 2H	Dual channel electronic engine control system
Arriel 2L2	Dual channel electronic engine control system

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

See Installation Manual



## 9. Aircraft Accessory Drives

Starter-generator Output									
Model	Rotation direction	Rotation speed (rpm)	Maximum Torque in overload (daNm)	Maximum static overhang (daNm)	Fuse shaft breakaway torque (daNm)	Maximum Permanent Shaft Power (kW)			
						Twin engine	OEI situation		
Arriel 2B, 2B1, 2B1A, 2B1B	CW	11330	5.0	2.5	9.5	7.5	n/a		
Arriel 2D			5.15			9.0			
Arriel 2C, 2C1	CW	11 330	5.0	2.5	9.5	3.5	5.0		
Arriel 2C2						5.0		5.0	
Arriel 2S1						7.5	7.5		
Arriel 2S2			7.5 (1)	7.5					
Arriel 2E			5.15					12.0 (2)	
Arriel 2N								9.0 (2)	
Arriel 2H								12.0 (2)	
Arriel 2L2								9.0 (2)	

Note (1): for Arriel 2S2: refer to Installation Manual and Airworthiness Limitation Section of the Maintenance Manual for specific instructions relative to OEI counting in certain flight conditions

Note (2): for Arriel 2E, 2N, 2H and 2L2: Refer to Installation and Operating Manual for detailed power shaft extraction in case of failure.

Fan Cooler Drive Output							
Model	Rotation direction	Rotation speed (rpm)	Maximum Torque in overload (daNm)	Maximum static overhang (daNm)	Fuse shaft breakaway torque (daNm)	Maximum Permanent Shaft Power (kW)	
						Twin engine	OEI situation
Arriel 2C2	CCW	11 452	1.0	1.5	10.0	1.5	1.5
Arriel 2S1, 2S2		12 253					
Arriel 2N		11470	1.5	0.251			
Arriel 2H							
Arriel 2L2							

Additional Notes:

CW: clockwise

CCW: counter clockwise

The rotation direction of the power drives for the accessories is indicated considering the power drive seen from the outside.

The rotation direction of the engine rotors is indicated with respect to viewing the engine from its rear end. For further details see Installation Manual



## 10. Maximum Permissible Air Bleed Extraction

P3 air bleed for aircraft use. Maximum flow rate at standard sea level conditions:

All Models except Arriel 2D, 2E, 2N, 2H and 2L2: 100 g/s at Take-off rating and 98 g/s at Maximum Continuous rating,

Arriel 2D, 2E, 2N, 2H and 2L2: 150 g/s at Maximum Continuous, Take-Off and 30-minute Take-off ratings.

For further details, see Installation Manual.

## IV. Operating Limitations

### 1. Temperature Limits

#### 1.1 Gas generator exhaust temperature (T45) limits

on start-up :

T45 (°C)	Arriel 2B	Arriel 2B1	Arriel 2B1A	Arriel 2B1B	Arriel 2D
for an unlimited duration	750				
maximum overtemperature (< 10 s)	865				840

T45 (°C)	Arriel 2C	Arriel 2C1	Arriel 2C2	Arriel 2S1	Arriel 2S2	Arriel 2E, 2N, 2H and 2L2
for an unlimited duration	750					760
maximum overtemperature (< 10 s)	865		840	865	840	840

in flight :

T45 (°C)	Arriel 2B	Arriel 2B1	Arriel 2B1A	Arriel 2B1B	Arriel 2D
30-minute Take-off (1)	n/a				962
Take-off	915			924	962
Maximum continuous	849				918
Maximum inadvertent overtemperature (< 20 sec)	941				994



T45 (°C)	Arriel 2C and 2C1	Arriel 2C2	Arriel 2S1	Arriel 2S2	Arriel 2E	Arriel 2N	Arriel 2H	Arriel 2L2
OEI-30 sec	1000	996	1000	996	1035	1046	1047	1024
OEI-2 min	941	944	941	944	1016	979	980	1002
OEI Continuous	912	926	912	926	974	953	954	940
30-minute Take-off (1)	n/a	929	912	930	947	954	955	940
Take-off	912	929	912	930	947	954	955	984
Maximum continuous	877	891	877	893	930	920	921	912
Maximum inadvertent overtemperature (< 20 sec)	n/a				974 (2)	979 (2)	980 (2)	1002 (2)

Note (1): Also called HIP/SARM in earlier models;

Note (2): all engines operating.

## 1.2 Fuel temperature

Maximum temperature: see Installation Manual.

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

Minimum temperature for engine starting: see Installation Manual.

Use of anti-icing additive for fuel temperature:

< -20°C for Arriel 2B, 2B1, 2B1A, 2B1B, 2C, 2D, 2C1, 2S1, 2E, 2N, 2H, 2L2

< -30°C for Arriel 2C2, 2S2

## 1.3 Oil temperature

Minimum oil temperature for engine starting:

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

For engine starting	-30°C
For power-up	0°C

For oil with a 3 to  $4.9 \times 10^{-6}$  m<sup>2</sup>/s kinematic viscosity:

For engine starting	-45°C	for 2B, 2B1, 2B1A, 2B1B
	-50°C	for all other models
For power-up	-10°C	

Maximum oil temperature:

115°C for all Models except Arriel 2D, 2E, and 2N.

117°C for Arriel 2D, 2E, 2N, 2H and 2L2 (measured at a different location from other Models)



## 2. Speed Limits

### 2.1 Gas generator speed (N1)

100 % N1 = 52 110 rpm

Minimum stabilised N1 speed

Minimum Stabilised N1 Speed	Arriel 2B	Arriel 2B1	Arriel 2B1A	Arriel 2B1B	Arriel 2D
IDLE mode speed range	67 % to 68 % (34 914 to 35 435 rpm)				
FLIGHT mode (manual control mode)	62% (32 308 rpm)				

Minimum Stabilised N1 Speed	Arriel 2C	Arriel 2C1	Arriel 2C2	Arriel 2S1	Arriel 2S2	Arriel 2E	Arriel 2N	Arriel 2H	Arriel 2L2
IDLE mode speed range	67 % to 68 % (34 914 to 35 435 rpm)			48 % to 52 % (25 013 to 27 097 rpm)		62 % (32 308 rpm)			
FLIGHT mode (manual control mode)	62 % (32 308 rpm)			62 % (32 308 rpm)		62 % (32 308 rpm)			

Maximum stabilised N1 speed

Maximum Stabilised N1 Speed	Arriel 2B	Arriel 2B1	Arriel 2B1A	Arriel 2B1B	Arriel 2D
30-minute Take-off (1)	n/a				101.87% (53 086 rpm)
Take-off	101.24 % (52 756 rpm)				101.87% (53 086 rpm)
Maximum continuous	97.24 % (50 672 rpm)				99.88% (52 050 rpm)

Note (1): Also called HIP/SARM in earlier models



Maximum Stabilised N1 Speed	Arriel 2C	Arriel 2C1	Arriel 2C2	Arriel 2S1	Arriel 2S2	Arriel 2E	Arriel 2N	Arriel 2H	Arriel 2L2
OEI-30 sec	105.6 % (55 051 rpm)	105.52 % (54 986 rpm)	106.05 % (55 265 rpm)	105.8 % (55 156 rpm)	105.89 % (55 178 rpm)	105.90 % (55 186 rpm)	107.48 % (56010 rpm)		106.55 % (55524 rpm)
OEI-2 min	102.1 % (53 192 rpm)	101.95 % (53 126 rpm)	102.24 % (53 275 rpm)	102.4 % (53 386 rpm)	102.38 % (53 348 rpm)	104.54 % (54 480 rpm)	103.40 % (53884 rpm)		105.12 % (54778 rpm)
OEI Continuous	100.9 % (52 571 rpm)	100.76 % (52 506 rpm)	101.26 % (52 764 rpm)	101.2 % (52 756 rpm)	101.28 % (52 776 rpm)	101.90 % (53 102 rpm)	102.32 % (53320 rpm)		101.90 % (53100 rpm)
30-minute Take-off (1)	n/a	n/a	101.86 % (53 079 rpm)	101.2 % (52 756 rpm)	101.88 % (53 089 rpm)	100.78 % (52 518 rpm)	102.61 % (53472 rpm)		101.90 % (53100 rpm)
Take-off	101.1 % (52 660 rpm)	101.27 % (52 776 rpm)	101.86 % (53 079 rpm)	101.2 % (52 756 rpm)	101.88 % (53 089 rpm)	100.78 % (52 518 rpm)	102.61 % (53472 rpm)		104.15 % (54272 rpm)
Maximum continuous	98.9 % (51 520 rpm)	99.09 % (51 637 rpm)	99.64 % (51 922 rpm)	99.1 % (51 616 rpm)	99.71 % (51 959 rpm)	98.96 % (51 572 rpm)	100.91 % (52583 rpm)		100.95 % (52603 rpm)

Note (1): Also called HIP/SARM in earlier models

#### Transient speeds

Transient Speeds	Arriel 2B	Arriel 2B1	Arriel 2B1A	Arriel 2B1B	Arriel 2D
Maximum inadvertent over-speed (< 20 sec)	102.3 % (53 312 rpm)				102.97% (53 658 rpm)

Transient Speeds	Arriel 2C	Arriel 2C1	Arriel 2C2	Arriel 2S1	Arriel 2S2	Arriel 2E	Arriel 2N	Arriel 2H	Arriel 2L2
Transfer from IDLE to FLIGHT mode	n/a			52 % to 62 % (27 097 to 32 308 rpm) Note (1)		n/a			
Maximum inadvertent over-speed (< 20 sec)	102.3 % (53 312 rpm)			102.3 % (53 312 rpm) Note (2)	102.98 % (53 661 rpm) Note (2)	101.90 % (53 102 rpm) Note (2)	103.40 % (53884 rpm) Note (2)		105.12 % (54778 rpm) Note (2)

Note (1): avoid continuous operation in this range

Note (2): all engines operating

## 2.2 Power turbine speed (N2)

100 % N2 = 39 095 rpm for all Models except Arriel 2D, 2E, 2N, 2H and 2L2.

100 % N2 = 39 158 rpm for Arriel 2D, 2E, 2N, 2H and 2L2.



Minimum N2 speed – Flight mode

Minimum N2 Speed – Flight Mode	Arriel 2B	Arriel 2B1	Arriel 2B1A	Arriel 2B1B	Arriel 2D
Stabilised Power on	90.5 % (35 381 rpm)				90.5 % (35 437 rpm)
Stabilised Power off	85.0 % (33 230 rpm)				85 % (33 284 rpm)
Transient (< 20 sec)	68.0 % (26 584 rpm)				68 % (26 627 rpm)
Notes	(1)	(1)	(1) & (2)	(1)	n/a

Note (1): During ground run avoid continuous operation in the range 87.0 % to 90.5 % (34 012 to 35 381 rpm)

Note (2): Minimum automatic auxiliary backup mode exit threshold is 96.71 % (37 809 rpm) for 2B1A

Minimum Speed – Flight Mode	Arriel 2C	Arriel 2C1	Arriel 2C2	Arriel 2S1	Arriel 2S2	Arriel 2E	Arriel 2N	Arriel 2H	Arriel 2L2
Stabilised Power on	90.5 % (35 381 rpm)			90.5 % (35 381 rpm)		90.5 % (35 437 rpm)	95.0 % (37 200 rpm)		90.5 % (35 437 rpm)
Stabilised Power off	85.0 % (33 230 rpm)					85 % (33 284 rpm)			
Transient (< 20 sec)	68.0 % (26 584 rpm)					68 % (26 627 rpm)			
Note	(1)								

Note (1): During ground run avoid continuous operation in the range 87.0 % to 90.5 % (34 012 to 35 381 rpm)

Maximum N2 speed – Flight mode

Maximum N2 Speed – Flight Mode	Arriel 2B	Arriel 2B1	Arriel 2B1A	Arriel 2B1B	Arriel 2D
Stabilised	108.5 % (42 418 rpm)				108.48 % (42 477 rpm)
Maximum inadvertent over-speed (< 20 sec) Power on	109.0 % (42 613 rpm)				108.8 % (42 613 rpm)
Maximum inadvertent over-speed (< 20 sec) Power off	121.0 % (47 305 rpm)				119.0 % (46 598 rpm)
Note	n/a	(1)			

Note (1): Maximum automatic auxiliary backup mode exit threshold: 115.0 % (44 960 rpm) for 2B1 and 2B1B, 103.19 % (40 342 rpm) for 2B1A, 115.0 % (45 032 rpm) for 2D





Maximum N2 Speed – Flight Mode	Arriel 2C	Arriel 2C1	Arriel 2C2	Arriel 2S1	Arriel 2S2	Arriel 2E	Arriel 2N	Arriel 2H	Arriel 2L2
Stabilised	108.5 % (42 418 rpm)					108.3 % (42 418 rpm)	108.39 % (42445 rpm)		
Maximum inadvertent over-speed (< 20 sec) Power on	109.0 % (42 613 rpm)				112.0 % (43 719 rpm)	119.0 % (46 598 rpm)			-
Maximum inadvertent over-speed (< 20 sec) Power off	121,0 % (47 305 rpm)					119.0 % (46 598 rpm)			

### 3. Thrust/Torque Limits

Maximum torque on shaft during operation at N2 minimum stabilized speed:

Maximum Torque (daNm)	Arriel 2B	Arriel 2B1	Arriel 2B1A	Arriel 2B1B	Arriel 2D (2)
30-minute Take-off (1)	n/a				96.0
Take-off	91.3				96.0
Maximum continuous	91.3				96.0
Maximum inadvertent over-torque (<20 sec)	132.2				134.2

Note (1): Also called HIP/SARM in earlier models.

Note (2): Automatic auxiliary backup mode exit threshold: 91.3 daNm for 2B1 & 2B1B, 71.4 daNm for 2B1A, 101.8 daNm for 2D.

Maximum Torque (daNm)	Arriel 2C	Arriel 2C1	Arriel 2C2	Arriel 2S1 and 2S2	Arriel 2E	Arriel 2N	Arriel 2H	Arriel 2L2
OEI-30 sec	116.8	118.7	119.3	120.3	119.8	119.3	112.1	128.6
OEI-2 min	107.3	107.9	116.0	113.2	100.3	116.0	101.1	116
OEI Continuous	103.0	101.55	101.8	102.5	78.0	101.8	97.1	106.8
OEI-30 sec transient maximum torque (<10s) in case of under N2	n/a					129.8	n/a	n/a
30-minute Take-off (1)	n/a		97.3	92.5	70.8	84.4	78.8	95.7
Take-off	92.5		97.3	92.5	70.8	84.4	78.8	95.7
Maximum continuous	92.5		97.3	92.5	57.3	67.8	73.3	79.7
Maximum inadvertent over-torque (<20 sec)	132.2			143.0	116.0	92.8 106.9	84.5	99.4
Note	(2)			n/a	(3)	(4)(5)(6) (7)	(8)	

Note (1): Also called HIP/SARM in earlier models.

Note (2): For Arriel 2C, 2C1, 2C2, torque limit of 121.9 daNm has been validated for unlimited continuous OEI usage with no specific maintenance actions.

Note (3): For Arriel 2E, the following torque limits have been validated with no specific maintenance actions: 95.7 daNm for unlimited AEO usage, and 106.9 daNm for unlimited continuous OEI usage.



- Note (4): For Arriel 2N, the following torque limits have been validated with no specific maintenance action: 99.9 for unlimited AEO usage, and 116.2 daNm for unlimited continuous OEI usage.
- Note (5): For Arriel 2N, an OEI 30-second torque limit of 128.8 daNm has been validated and a maximum transient torque of 142.3 daNm, in case of under-N2 in OEI 30-second rating has been validated for a maximum duration of 10s. Therefore, the 10 second duration limit of this OEI 30-second transient maximum torque applies above 128.8 daNm, up to 142.3 daNm.
- Note (6): For Arriel 2N, maximum continuous torque is a function (T0, P0) table, limited to 67.8 daNm.
- Note (7): For Arriel 2N, maximum inadvertent over-torque (<20 sec) is 92.8 daNm for nominal N2 and 106.9 daNm in case of under N2.
- Note (8): For Arriel 2H, a torque limit of 999 Nm has been validated for unlimited AEO continuous usage with no specific maintenance action; as a consequence, the 20 second duration limit of the AEO maximum transient torque applies above 999 Nm, up to 1,162 Nm.

Additional Note: torques shown above correspond to the first reached torque limit between the validated engine torque limit and EECU torque law limit at minimum N2 stabilised.

## 4. Pressure Limits

### 4.1 Fuel Pressure

#### Minimum fuel pressure :

- In normal operation, i.e. excluding starting phase, the minimum (absolute) pressure is defined for all models except Arriel 2D, 2E, 2N and 2H, by the highest of the following conditions:
  - 20 kPa absolute,
  - 35 % of atmospheric pressure,
  - 7 kPa above the vapour pressure of the fuel used,
  - Fuel pressure corresponding to a vapour volume over liquid volume ratio of 0.30.

For Arriel 2D, 2E, 2N, 2H and 2L2: Refer to Installation / Operating Manual.

- During starting phase or at relight (relative pressure):
- For all models except 2S2: 25kPa relative pressure (i.e. 25 kPa below atmospheric pressure),
- For Arriel 2S2: 20kPa relative pressure (i.e. 20 kPa below atmospheric pressure).

#### Maximum fuel pressure:

Less than or equal to 150 kPa (relative pressure), in all operating phases, for all Models except Arriel 2D, 2E, 2N, 2H and 2L2.

Less than or equal to 180 kPa (relative pressure), in all operating phases, for Arriel 2D, 2E, 2N, 2H and 2L2.



#### 4.2 Oil Pressure

Pressure Limits (kPa)	Arriel 2B	Arriel 2B1	Arriel 2B1A	Arriel 2B1B	Arriel 2D
Minimum Oil Pressure	110				(1)
Maximum Oil Pressure	600				(1)
Normal Operating Range	200 to 600				(1)

Pressure Limits (kPa)	Arriel 2C	Arriel 2C1	Arriel 2C2	Arriel 2S1	Arriel 2S2	Arriel 2E, 2N, 2H and 2L2
Minimum Oil Pressure	110		170	110	170	(1)
Maximum Oil Pressure	600					(1)
Normal Operating Range	200 to 600					(1)

Note (1): Refer to relevant Installation / Operating Manuals

#### V. Operating and Service Instructions

Document	Arriel 2B	Arriel 2B1	Arriel 2B1A	Arriel 2B1B	Arriel 2D
Installation and Operating Manual (1)	X 292 M0 001 2	X 292 N5 001 2	X 292 P4 001 2	X 292 N5 001 2	X 292 R1 001 2
Performance Brochure	X 292 M5 001 9	X 292 N5 002 9	X 292 P4 001 9	X 292 U5 001 9	AA049088
Maintenance Manual	X 292 M5 450 2	X 292 N5 450 2	X 292 P4 450 2	X 292 P6 450 2	X 292 R1 450 2
Overhaul Manual	X 292 R1 500 2	X 292 R1 500 1		X 292 R1 500 2	X 292 R1 500 2
Service Letters and Service Bulletins	<i>refer to SB and SL directory</i>				

Note (1): Operating Instructions are provided in Installation Manual Chapter 15



Document	Arriel 2C	Arriel 2C1	Arriel 2C2	Arriel 2S1	Arriel 2S2	Arriel 2E	Arriel 2N	Arriel 2H	Arriel 2L2
Installation and Operating Manual (1)	X 292 M1 001 2	X 292 N4 001 2	X 292 N6 404 1	X 292 L0 001 1	X 292 P5 001 2	X 292 R2 001 2	X 292 N2 001 2	X 292 2H 002 2	X 292 2L 001 2
Performance Brochure	X 292 M1 001 9	X 292 N4 002 9	X 292 N6 002 9	X 292 L0 001 9	X 292 P5 001 9	AA056554	AA070304	AA099838	X 292 2L 001 9
Maintenance Manual	X 292 M1 450 2	X 292 N4 450 2	X 292 N6 450 2	X 292 L0 301 2	X 292 P5 451 2	X 292 R2 300 2	X 292 N2 450 2	X 292 2H 450 2	X 292 2L 450 2
Overhaul Manual	X 292 R1 500 2	X 292 R1 500 2	X 292 N6 500 2	X 292 R1 500 2	X 292 R1 500 2	X 292 R1 500 2	X 292 R1 500 2	X 292 R1 500 2	X 292 R1 500 2
Service Letters and Service Bulletins	<i>refer to SB and SL directory</i>								

Note (1): Operating Instructions are provided in Installation Manual Chapter 15.

## VI. Notes

1. Arriel 2B, 2B1, 2B1A, 2B1B, 2D installation is approved for single-engine application only.
2. Arriel 2C, 2C1, 2C2, 2S1, 2S2, 2E, 2N, 2H and 2L2 installation is approved for multi-engine application only
3. Air intake:
  - 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.
  - A protective grid as defined in the Installation and Operating Manual shall be installed to limit the ingestion of foreign matters in the engine.
4. The Arriel 2B, 2B1, 2B1A, 2D are not approved for operation in icing conditions with Airbus Helicopters AS 350 B3 / EC130 sand filter P/N 704 A 41 650 010.
5. The Arriel 2B1A capability to operate in icing conditions (JAR E 780) has been addressed only when fitted with helicopter air intake reference Z11 MB1-6860-0 for the inlet duct and Z11 MB1-6850-30 for the inlet screen.
6. Operation in icing conditions
  - 6.1 The Arriel 2E is validated in icing conditions according to engine Airworthiness requirements with the following Aircraft air intake and inlet Part Numbers (P/N):



- Intake protection outer LH assy P/N 117-602351
- Intake protection inside RH assy P/N 117-602401
- Intake protection inside LH assy P/N 117-602371
- Intake protection outer RH assy P/N 117-602421
- Air inlet LH P/N D710M1010801
- Air inlet RH P/N D710M2010801.

6.2 The Arriel 2N is validated in icing conditions according to engine Airworthiness requirements with the following Aircraft air intake (P/N):

- Air intake sleeve P/N 365 A54 5022
- Air intake screen P/N 365 A24 1067.02 & 03
- Air intake assembly (cowl, seal and duct) P/N 365 A24 0110.06 & 07.

6.3 The Arriel 2H is assumed to be installed in a helicopter not approved for Flight In Known Icing conditions. The Engine is validated to operate under ice forming conditions according to the engine Airworthiness requirements only with the following helicopter air intake parts (including the protective grid):

Air intake parts	Part numbers
MGB removable cowling, including the forward air intake – left side and right side	Z9-365A24-0110-04
	Z9-365A24-0110-05
Backward air intake	Z9-365A54-5022-00
Protective grid – left side and right side	Z9-365A24-1067-00
	Z9-365A24-1067-01
Inflatable sealing	704A39821.013

6.4 The Arriel 2L2 is certified in icing conditions according to engine Airworthiness requirements with the following Aircraft air intake EC155B1 (P/N) or equivalent:

- Air intake sleeve P/N 365 A54 5022.01
- Air intake screen P/N 365 A24 1067.04 & 05
- Air intake assembly (cowl, seal and duct) P/N 365 A24 0110.06 & 07.

## 7. Fire and local events

7.1 The EECU (as well as the EDR for Arriel 2D, 2E, 2N, 2H and 2L2) must not be installed in a dedicated fire zone. The installation conditions are defined in the Installation Manual.

7.2 In particular for Arriel 2H:

- The EECU and the EDR must not be installed in a flammable fluid leakage zone with an ignition source from aircraft components; nor must they be installed in a zone that might lead to overheat conditions.



- The helicopter fire shut-off valve must be installed outside of the zone affected by the control system local events so that a local event cannot affect both the control system and the fire shut-off valve at the same time.
  - The cabin air bleed shut-off device must be installed outside of the zone affected by the control system local events so that a local event cannot affect both the control system and the cabin air bleed shut-off device at the same time.
8. For Arriel 2C, 2C1, 2C2, 2S1, 2S2, 2E, 2N, 2H, and 2L2 the electronic control system provides a "TRAINING" function for training crews in an engine failure situation. Refer to the Installation Manual for the characteristics of this function.
  9. The software of the EECU has been validated according to DO 178 A, level 1 for all Models except Arriel 2D, 2E and 2N, and DO 178 B, level A for the Arriel 2D, 2E, 2N, 2H and 2L2.
  10. The operating / starting / relight envelope is provided in the Installation Manual.
  11. EMI / Lightning (Refer to Installation Manual for details)  
Validated levels have been tested according to the following standards:

	<b>All Models, except:</b> Arriel 2B1/2B1B with Modification TU169 (EECU Goodrich EMC101) ; Arriel 2D, 2E, 2N, 2H	<b>Arriel 2B1/2B1B with:</b> Modification TU169 (EECU Goodrich EMC101)	<b>Arriel 2D, 2E, 2N, 2H, 2L2</b>
<b>Induced signal susceptibility</b>	DO-160C Section 19, Category Z	DO-160D Section 19, Category Z	DO-160E Section 19, Category ZC
<b>Radio Frequency susceptibility</b>	DO-160C Section 20.4, Category Y ; MIL STD 461C - CS01, CS02, CS06, RS02, RS03	DO-160D Section 20, Category Y	Conducted : DO-160E, Section 20, Category G extended as per relevant Installation/Operating Manuals Radiated : DO-160E Section 20, Category L
<b>Emission of Radio Frequency energy</b>	DO-160C Section 21, Category Z ; MIL STD 461C - CE01, CE03, CE07, RE02	DO-160D Section 21, Category H	DO-160E, Section 21, Category H extended as per relevant Installation/Operating Manuals
<b>Lightning induced transient susceptibility</b>	DO-160C Section 22	DO-160D Section 22	DO-160E, Section 22



12. For Arriel 2S1 and 2S2, the power turbine overspeed shut-down device, previously available as an option, is now part of the basic Type Design and has been fitted to all the delivered engines.

13. The EASA approved Airworthiness Limitations Section of the Instructions for Continued Airworthiness is published in the applicable Engine Maintenance Manual and Overhaul Manual documents, chapter 5 "Airworthiness Limitations".

14. Time Limited Dispatch and Dispatch Configuration Analysis

14.1 Time Limited Dispatch:

The engine has not been approved for Time Limited Dispatch in accordance with CS-E 1030.

14.2 Dispatch Configuration Analysis:

All Models except Arriel 2S1, 2D, 2E and 2N:

All engine systems and equipment must be functional prior to aircraft take-off. Any engine system or equipment the failure of which would occur in flight shall be replaced or repaired prior to commencement of next flight.

Arriel 2S1: Engine manufacturer dispatch recommendations for equipment of Arriel 2S1 turboshaft engine are listed in Installation Manual §15.

Arriel 2D, 2E, 2N: Engine Dispatch Configuration analysis have been performed and are referenced in the relevant Installation Manuals.

15. Arriel 2S1 and Arriel 2S2 engines are assembled by Safran Helicopter Engines in France and under licence by Safran Helicopter Engines USA (formerly Turboméca Engine Corporation) in the USA. Engines assembled in France have an identification plate in accordance with the regulations applicable in France.

16. Conversion from non-civil use:

This note is applicable to the following variants:

Case 1: Arriel 2B, 2B1, 2B1A, 2C, 2C1, 2C2, 2S1, 2S2 engines originally assembled by Safran Helicopter Engines and having previously been used by an operator engaged in military, customs, police or similar services, and not under the control of a civil Authority.

Case 2: The Arriel 2CPM is a military variant of the Arriel 2C, known to be installed on, but not limited to, a military helicopter. Arriel 2C engines can be created by converting Arriel 2CPM engines.

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 the following Safran Helicopter Engines Mandatory Service Bulletins:

Case 1: A292 72 2817 version B (or any subsequent approved issue).



Case 2: A292 72 2819 version A (or any subsequent approved issue).





## SECTION: ADMINISTRATIVE

### I. Acronyms and Abbreviations

AEO	All Engine Operative
EDR	Engine Data Recorder
EECU	Electronic Engine Control Unit
EMI	Electromagnetic Interference
HIP	Hovering at Increased Power
ISA	International Standard Atmosphere
JAR-E	Joint Aviation Requirements – Engines
LH	Light Hand
n/a	not applicable
OEI	One Engine Inoperative
P/N	Part Number
P0	Ambient pressure
P3	Centrifugal compressor outlet pressure
RH	Right Hand
SARM	Search and Rescue Mission
SB	Service Bulletin
SL	Service Letter
T0	Ambient temperature
TC	Type Certificate

### II. Type Certificate Holder Record

Until 18 July 2016: Turbomeca

After 18 July 2016: Safran Helicopter Engines

### III. Change Record

Issue	Date	Changes	TC issue
Issue 09	2 July 2015	Revised repair manual references and editorial changes	
Issue 10	01 August 2016	Name change from Turbomeca to Safran Helicopter Engines	01 August 2016
Issue 11	05 April 2018	Add Arriel 2H variant characteristics Add requirements for variants equipped with an EDR Add clarification on Arriel 2E declared power Editorial changes	05 April 2018
Issue 12	26 February 2021	Arriel 2E, revised Operating Limits for T45 with associated Torque limits	26 February 2021
Issue 13	28 May 2021	Add Arriel 2L2 variant characteristics	28 May 2021

-END-

