TYPE-CERTIFICATE DATA SHEET

No. E.001

for
Turboméca Arriel 2 Series Engines

Type Certificate Holder
TURBOMECA
64511 Bordes Cedex
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

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TABLE OF CONTENTS

I. General 5
1. Type/ Model/ Variants 5
2. Type Certificate Holder 5
3. Manufacturer 5
4. Date of Application 5
5. EASA Type Certification Date 6
II. Certification Basis 6
1. State of Design Authority (EASA) Certification Basis 6
1.1. Airworthiness Standards 6
1.2. Special Conditions (SC) 7
1.3. Equivalent Safety Findings 7
1.4. Deviations 7
1.5. Environmental Protection 7
2. Reference Date for determining the applicable airworthiness requirements .....
III. Technical Characteristics 7
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
IV. Operating Limitations 12
1. Temperature Limits 12
2. Speed Limits 13
3. Thrust/Torque Limits 13
4. Pressure Limits 17
4.1 Fuel Pressure 17
4.2 Oil Pressure 18
V. Operating and Service Instructions 18
VI. Notes 19
SECTION: ADMINISTRATIVE 22
I. Acronyms and Abbreviations 22
II. Type Certificate Holder Record 22
III. Change Record 22

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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	

2. Type Certificate Holder

TURBOMECA
64511 Bordes Cedex
France

3. Manufacturer

Same as Type Certificate Holder (see 2. above)

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

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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	

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 Arriel 2B1 Arriel 2B1A	JAR-E Change 9 dated 21 October 1994, Orange Paper E/96/1 dated 08 August 1996
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 Arriel 2C1 Arriel 2S1	JAR-E Change 9 dated 21 October 1994, Orange Paper E/96/1 dated 08 August 1996
Arriel 2C2 Arriel 2S2	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 2E Arriel 2N	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

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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" SC2-C2: Special Condition for certification of HIP/SARM rating
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

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	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	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.

2. Reference Date for determining the applicable airworthiness requirements

14 May 1993

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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

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

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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	

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
OEI-30 sec	30 seconds	704	718	750	735	771	753	750
OEI-2 min	2 minutes	635	646	713	663	699	630	729
OEI Continuous	unlimited	610	616	640	639	659	490	640
30-minute Take-off (1)	30 minutes	n/a	n/a	612	601	601	445	530
Take-off	5 minutes	531	581	612	601	601	445	530
Maximum Continuous	unlimited	531	531	612	592	601	360	426 (2)

Note (1): Also called HIP/SARM in earlier models
Note (2): Function (T0, P0) table, limited to 426 kW

<u>Additional Notes</u>:

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.
- mean swirl angle in the compressor air intake plane between -1.5° and +1.5° for 2N.
- ISA conditions at sea level, on test bed,

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- 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.
- output shaft rotation speed:
  6000 rpm for 2B, 2B1, 2B1A, 2B1B, 2D, 2C, 2C1, 2C2, 2E, 2N ;
  6409 rpm for 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 corresponds to the first torque limits reached between validated mechanical limit and EECU torque limit.

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

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

See Installation Manual

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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	
Arriel 2S1						7.5	7.5
Arriel 2S2						7.5 (1)	
Arriel 2E			5.15			12.0 (2)	
Arriel 2N						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 and 2N: 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					

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

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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 and 2N : 100 g/s at Take-off rating and 98 g/s at Maximum Continuous rating

Arriel 2D, 2E, 2N : 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**	**Arriel 2N**
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**	**Arriel 2C1**	**Arriel 2C2**	**Arriel 2S1**	**Arriel 2S2**	**Arriel 2E**	**Arriel 2N**
OEI-30 sec	1000		996	1000	996	1020	1046
OEI-2 min	941		944	941	944	1001	979
OEI Continuous	912		926	912	926	959	953
30-minute Take-off (1)	n/a		929	912	930	932	954
Take-off	912		929	912	930	932	954
Maximum continuous	877		891	877	893	915	920
Maximum inadvertent overtemperature (< 20 sec)	n/a					959 (2)	979 (2)

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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
< -30°C for Arriel 2C2, 2S2

1.3 Oil temperature

Minimum oil temperature for engine starting :

for oil with a $5x10^{-6}$ m^2/s cinematic viscosity : For engine starting -30°C
For power-up 0°C

for oil with a 3 to $3,9x10^{-6}$ m^2/s cinematic 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 and 2N (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**
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)	

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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
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)
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)
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)
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)
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)
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)

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)

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Transient Speeds	Arriel 2C	Arriel 2C1	Arriel 2C2	Arriel 2S1	Arriel 2S2	Arriel 2E	Arriel 2N
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)

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

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
Stabilised Power on	90.5 % (35 381 rpm)			90.5 % (35 381 rpm)		90.5 % (35 437 rpm)	95.0 % (37200 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): During ground run avoid continuous operation in the range 87.0 % to 90.5 % (34 012 to 35 381 rpm)

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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
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

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

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: 99.9 daNm for unlimited AEO usage, and 119.8 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.

Additional Note : torques showed 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

<u>Minimum fuel pressure :</u>

- Normal operation, i.e. excluding starting phase, the minimum (absolute) pressure is defined for all models except Arriel 2D, 2E and 2N, 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 and 2N: 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)

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Maximum fuel pressure :

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

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

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**	**Arriel 2N**
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 Drawing and 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
Repair 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	*refer to SB and SL directory*				

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**
Installation Drawing and 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
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
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
Repair 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
Service Letters and Service Bulletins	*refer to SB and SL directory*						

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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 and 2N 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 Eurocopter 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. 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

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

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

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8. For Arriel 2C, 2C1, 2C2, 2S1, 2S2, 2E and 2N 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 and 2N.

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:

	All Models, except: Arriel 2B1/2B1B with Modification TU169 (EECU Goodrich EMC101) ; Arriel 2D/2E	**Arriel 2B1/2B1B with:** Modification TU169 (EECU Goodrich EMC101)	**Arriel 2D/2E/2N**
Induced signal susceptibility	DO-160C Section 19, Category Z	DO-160D Section 19, Category Z	DO-160E Section 19, Category ZC
Radio Frequency susceptibility	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
Emission of Radio Frequency energy	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
Lightning induced transient susceptibility	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" document, chapter 5 "Airworthiness Limitations".

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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 Turboméca in France and under licence by Turboméca 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 Turboméca 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 Turboméca 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).

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SECTION: ADMINISTRATIVE

I. Acronyms and Abbreviations

EECU	Electronic Engine Control Unit
HIP	Hovering at Increased Power
JAR-E	Joint Aviation Requirements - Engines
n/a	not applicable
P/N	Part Number
SARM	Search and Rescue Mission

II. Type Certificate Holder Record

N/A

III. Change Record

Issue	Date	Changes	TC issue
Issue 09	2 July 2015	Revised repair manual references and editorial changes	

-END-

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