MINISTRY OF TRANSPORT AND COMMUNICATIONS OF UKRAINE

STATE AVIATION ADMINISTRATION

TYPE CERTIFICATE DATA SHEET No. ТД 0039 (TD 0039)

Issue 01

This Data Sheet which is an integral part of Type Certificate No. ТД 0039 (TD 0039) prescribes conditions and limitation under which the listed engines meet the airworthiness requirements stated in Certification basis mentioned in this Data Sheet.

Engines Models: Arriel 1A, 1A1, 1A2, 1B, 1C, 1C1, 1C2, 1D, 1D1, 1E2, 1S and 1S1

Type Certificate Holder:	**TURBOMECA** 64511 Bordes Cedex - France
Date of application:	
Models Arriel 1B, 1D, 1D1, 1E2:	26.08.2008
Models Arriel 1A, 1A1, 1A2, 1C, 1C1, 1C2, 1S, 1S1:	02.02.2009
Date of Issue 1 of TCDS No. ТД 0039 (TD 0039):	06.10.2009
Manufacturers:	**TURBOMECA** 64511 Bordes Cedex – France Production Organization Approval Certificate: DGAC FR.21G.0036 **TURBOMECA USA** (formerly Turbomeca Engine Corporation), Grand Prairie, Texas USA According to Production Certificate FAA No. 5SW

List of effective pages

Page	1	2	3	4	5	6	7	8	9
Issue	1	1	1	1	1	1	1	1	1

1. Short Description:

Arriel 1 series engine is a turboshaft engine with free turbine installed on a helicopter.
Arriel 1 series engine consist of five moduls:
Module M01 – Shaft, and accessory gearbox (located in front of the engine) rotated by gas generator.
Module M02 – Axial Compressor.
Module M03 – Gas generator with centrifugal compressor, annular combustor and axial 2-stages gas generator turbine.
Module M04 – power (free) turbine which rotates reduction gearbox.
Module M05 – Reduction gearbox located after the engine.

2. Type Design

is defined by the following documents:

2.1. Engines Part Numbers:

Arriel 1A	P/N 0 292 00 505 0
Arriel 1A1	P/N 0 292 00 505 0
Arriel 1A2	P/N 0 292 00 507 0
Arriel 1B	P/N 0 292 00 506 0
Arriel 1C	P/N 0 292 00 514 0
Arriel 1C1	P/N 0 292 00 515 0
Arriel 1C2	P/N 0 292 00 524 0
Arriel 1D	P/N 0 292 00 518 0
Arriel 1D1	P/N 0 292 00 522 0
Arriel 1E2	P/N 0 292 00 532 0 P/N 0 292 00 546 0*
Arriel 1S	P/N 0 292 00 519 0
Arriel 1S1	P/N 0 292 00 525 0

* - with changes for EC145 helicopter model

2.2. Installation Drawing and Manual:

Arriel 1A	292 00930 / 292 00931
Arriel 1A1	
Arriel 1A2	
Arriel 1B	
Arriel 1C	X 292 B0 002 1 / X 292 B0 002 2
Arriel 1C1	
Arriel 1C2	
Arriel 1D	
Arriel 1D1	
Arriel 1E2	X 292 G9 001 1 / X 292 G9 001 2
Arriel 1S	X 292 F9 001 1 / X 292 F9 001 2
Arriel 1S1	

2.3. Operation Manual:

Arriel 1A	292 00 932
Arriel 1A1	
Arriel 1A2	
Arriel 1B	
Arriel 1C	Included to Chapter 5 of Installation Manual
Arriel 1C1	
Arriel 1C2	
Arriel 1D	
Arriel 1D1	
Arriel 1E2	
Arriel 1S	
Arriel 1S1	

2.4. Performance Booklet:

Arriel 1A	Included to Installation Manual
Arriel 1A1	
Arriel 1A2	
Arriel 1B	
Arriel 1C	X 292 B0 001 9
Arriel 1C1	
Arriel 1C2	
Arriel 1D	
Arriel 1D1	
Arriel 1E2	X 292 G9 900 9
Arriel 1S	X 292 F9 900 9
Arriel 1S1	

2.5. Maintenance Manual:

Arriel 1A	292 01 931
Arriel 1A1	X 292 B3 452 1 / X 292 B3 452 2
Arriel 1A2	X 292 A9 452 1 / X 292 A9 452 2
Arriel 1B	X 292 65 452 1 / X 292 65 452 2
Arriel 1C	X 292 B0 452 1 / X 292 B0 452 2
Arriel 1C1	X 292 C3 452 1 / X 292 C3 452 2
Arriel 1C2	X 292 G1 452 1 / X 292 G1 452 2
Arriel 1D	X 292 E5 452 1 / X 292 E5 452 2
Arriel 1D1	X 292 G2 452 1 / X 292 G2 452 2
Arriel 1E2	X 292 M3 452 1 / X 292 M3 452 2
Arriel 1S	X 292 F9 452 1 / X 292 F9 452 2
Arriel 1S1	X292 H4 452 1 / X 292 H4 452 2

2.6. Repair Manual:
X 292 87 500 1 / X 292 87 500 2 – for all Arriel 1 engines models.

2.7. Airworthiness Directives EASA (DGAC) on the date of 10 June, 2009:

Date	AD No.	Engine Models
19/12/1979	79-252 (B)	ARRIEL 1A, 1A1, 1B
19/02/1986	86-29 (B)	ARRIEL 1
07/09/1986	86-147 (B)	ARRIEL 1A, 1A1, 1A2, 1B, 1B2, 1C, 1C1, 1D, 1K
21/03/2001	90-064 (A) R1	ARRIEL 1
18/07/1990	90-105 (B) R1	ARRIEL 1
02/10/1991	91-156 (B) R1	ARRIEL 1B, 1D, 1D1
09/06/1993	92-078 (B) R2	ARRIEL 1
28/09/1994	94-218 (B)	ARRIEL 1
07/10/1998	98-311 (A) R1	ARRIEL 1B, 1D, 1D1
07/10/1998	98-394 (A)	ARRIEL 1
02/12/1998	98-493 (A)	ARRIEL 1
06/03/2002	2002-126 (A)	ARRIEL 1
25/05/2002	2002-258 (A)	ARRIEL 1B, 1D, 1D1
03/08/2002	2002-383(AB)	ARRIEL 1, 1B2, 1E
24/03/2006	2006-0068	Arriel 1
05/01/2007	2007-0002	ARRIEL 1B. 1D. 1D1, modified by TU 202
21/02/2007	2007-0045	ARRIEL 1
14/08/2007	2007-0018R1	ARRIEL 1
17/01/2008	2008-0014	ARRIEL 1 E2, 1S, 1S1
07/01/2009	2009-0002	ARRIEL 1B, 1D, 1D1
18/05/2009	2009-0112	ARRIEL 1B, 1D, 1D1, 2B, 2B1, 2B1A
02/06/2009	2009-0117-E	ARRIEL 1

Notes:

1. All above mentioned airworthiness directives (AD) are mandatory for engines installed on rotorcrafts, registered in Ukraine, unless they are revoked by appropriate AD of Ukrainian State Aviation Administration.
2. In items 2.2 through 2.6 symbol "/" means that on the left of "/" – document in French language, on the right – document in English language In case of conflict of translation the French version shall take precedence.

3. Certification Basis:

Aviation Regulations, Part 33, "Airworthiness Standards: Aircraft Engines" (issue 2, 2003).
Equivalent Safety Finding: AR 33.68 – Ice Protection.

4. Main Performance and Technical Data:

4.1. Engine Power, SHP/kW (see notes 6.1 and 6.2):

Arriel Model	2.5 minute OEI	30 minute OEI	Take-off (up to 5 minute)	Maximum Continuous
1A	652/486	625/466	625/466	577/430
1A1	668/498	644/480	630/470	579/432
1A2	671/500	657/490	630/470	579/432
1B	NA	NA	641/478	590/440
1C	700/522	687/512	660/492	586/437
1C1	721/538 *	705/526	705/526	586/437
1C2	763/569 *	738/550	738/550	632/471
1D	NA	NA	684/510	603/450
1D1	NA	NA	712/531 *	625/466
1E2	708/528 *	708/528 *	708/528 *	692/516
1S	751/560 *	730/544	701/523	701/523
1S1	802/598	789/588	725/541	725/541

* - The power is restricted to the values, indicated above. for providing installation requirements of corresponding rotorcraft.

4.2. Main dimensions, mm:

Arriel Models	Length	Width	Height
1A, 1A1	1120	410	600
1A2	1120	410	610
1B	1210	440	600
1C	1170	410	610
1C1, 1C2	1170	470	610
1D	1260	490	610
1D1	1200	470	610
1E2	1190	490	700
1S, 1S1	1540	490	790

4.3. Dry Weight, kg:

Arriel 1A	Arriel 1A1	Arriel 1A2	Arriel 1B	Arriel 1C	Arriel 1C1	Arriel 1C2
111	111	116.5	114.5	116.5	118.6	119
Arriel 1D	Arriel 1D1	Arriel 1E2	Arriel 1S	Arriel 1S1		
122.5	122	125	126.75	130		

"NA" means: "Not applicable"

4.4. Control system:

Hydromechanical Fuel Control Unit (See Installation/Operation Manual)

4.5. Fuels, Oils and Additives:

Approved fuels and additives:	According to Installation/Operation Manual and EASA.E.C.01838 document (for Ukrainian fuels)
Approved oils:	According to Installation/Operation Manual

5. Operating limitations:

5.1. Gas generator speed (N_1), %:

Arriel Model	2.5 minute OEI	30 minute OEI	Take-off (up to 5 minutes)	Maximum Continuous	Transient (5 second limit)	Transient (20 second limit)
1A	101.7	100.4*	100.4*	98*	105.5	NA
1A1	102.2	100.9	100.4*	98*	105.5	NA
1A2	102.2	101.4	100.4	98	105.5	NA
1B	NA	NA	100.4*	98*	105.5	NA
1C	102.7	101*	100	97.5	105.5	NA
1C1	102.7	100.8	100.8	97	105.5	NA
1C2	103.4*	102*	102*	98.2*	NA	107.5
1D	NA	NA	100.8	98	105.5	NA
1D1	NA	NA	101.9*	98	107.5	103.1**
1E2	103.3*	102*	102*	100.3*	NA	107.5
1S	102.7*	101*	100	100	NA	105.35
1S1	102.7*	102.2*	100	100	NA	105.35

* - with NG de-rating law as function of outside temperature (and altitude for: 1S, 1S1, 1D1, 1C2, 1E2). See Installation/Operation Manual.
** - allowed on helicopters equipped with digital avionics VEMD (Vehicle and Engine Monitoring Display).

Notes:
- NG 100% = 51800 rpm – for all models except Arriel 1S and 1S1;
- NG 100% = 52110 rpm – for models Arriel 1S and 1S1.
- Minimum speed: 67% for all models except Arriel 1E2 (63%).

5.2. Power (free) turbine speed (N_2), %:

	Arriel Model				
	1A/1A1/1A2/1B	1C/1C1/1C2/1D/1D1	1E2	1S	1S1
Maximum stabilized	113.5	108.5	108	108	102.07
Maximum transient (5 second limit)	120.5	120.5	120	118.9	112.34
Minimum transient (5 second limit)	86	86	85.6	84.8	80.2

Notes:
N_2 100% means:
- 39635 rpm for free turbine shafts of Arriel 1A/1A1/1A2/1B non-modified TU 77;
- 41420 rpm for free turbine shafts of Arriel 1A/1A1/1A2/1B modified TU 77 and Arriel 1C/1C1/1C2/1D/1D1;
- 41981 rpm for free turbine shafts of Arriel 1S;
- 44421 rpm for free turbine shafts of Arriel 1S1;
- 41586 rpm for free turbine shafts of Arriel 1E2.

5.3. Temperature Limits:

5.3.1. Max Turbine Gas Temperature (t_4), °C:

	Arriel Model						
	1A/1A1/ 1A2	1B	1C	1C1	1C2	1D	1D1
Take-off (up to 5 minutes)	810	810	835	845	845	845	845
Maximum Continuous	775	775	785	775	775	795	795
30 minute OEI	810	NA	835	845	845	NA	NA
2.5 minute OEI	840	NA	860	865	885	NA	NA
Overtemperature at starting	840	840	860	865	865	865	865
Transient (up to 20s)					920**		870*

	Arriel Model		
	1E2	1S	1S1
Take-off (up to 5 minutes)	845	845	845
Maximum Continuous	845	845	845
30 minute OEI	845	845	868
2.5 minute OEI	885	885	885
Overtemperature at starting	865	865	865
Transient (up to 20s)	920**	920**	920**

* - allowed on helicopters equipped with digital avionics VEMD;
** - only when reaching the 2.5 minute OEI rating, see Installation/Operation Manual.

5.3.2. Oil inlet temperature, °C:
- minimum for starting: between minus 55 °C and minus 40 °C, according to oil specification, see Installation/Operation Manual.
- minimum for power application: minus 10 °C with 3 and 3.9 cst oils, 0 °C with 5 cst oil.
- maximum operating: 110 °C for Arriel 1A/1A1/1A2/1B
  115 °C for Arriel 1C/1C1/1C2/1D/1D1/1E2/1S/1S1

5.3.3. Fuel inlet temperature, °C:
According to Installation/Operation Manual

5.4. Pressure Limits:

5.4.1. Fuel Pressure:
According to Installation/Operation Manual

5.4.2. Oil Pressure, kg/sm^2:

- min for 70% < N1 < 85%: 1.94 – for models Arriel 1A/1A1/1A2/1B
  1.33 – for models Arriel 1C/1C1/1C2/1D/1D1/1E2/1S/1S1
- min for N1 ≥ 85%: 2.85 – for models Arriel 1A/1A1/1A2/1B
  1.84 – for models Arriel 1C/1C1/1C2/1D/1D1/1E2/1S/1S1
- maximum: 9.18 – for models Arriel 1A/1A1/1A2/1B
  5.1 – for models Arriel 1C/1C1/1C2/1D/1D1/1E2/1S/1S1

5.5. Max Torque Limits, m.daN:

	Arriel Model					
	1A/1A1/1A2/1B	1C/1C1/1E2	1C2	1D/1D1	1S	1S1
2.5 minute OEI	83	87.7	87.5	83	87.9	113
20 second	87.7	98.6	105	91.5	118.4	132.2

5.6. Max permissible air bleed (P2) for helicopter use at standard see level: 100 g/s at Take-off (See detail in Installation/Operation Manual)

5.7. Aircraft Accessories Installation Limitations: See Installation/Operation Manual.

5.8. Other Limitations:
For other limitations see Installation/Operation Manual

6. Notes:

6.1. Engine powers correspond to minimum values defined under the following conditions:

- Static, sea level standard conditions (15°C, 1013 hPa)
- Engines equipped with calibrated test bed air intake N°6.202.81.719.0
- Use of following exhaust pipe:
  - Arriel 1A/1A1/1A2/1C: 0.292.80.869.0
  - Arriel 1B/1D: 0.292.80.870.0
  - Arriel 1C1/1C2/1D1/1E2/1S1: 0.292.80.871.0
- No air bleed,
- No power drawn by any accessories other than those required for engine operation.
- Fuel Low Heat Value : 43 136 kJ/kg
- Output shaft rotation speed :

5976 rpm, Arriel 1A, 1A1, 1A2, 1B, 1C, 1C1, 1C2, 1D, 1D1
6000 rpm, Arriel 1E2
6057 rpm, Arriel 1S
6409 rpm, Arriel 1S1

6.2. Ratings declared for Arriel 1A/1A1/1A2/1B/1C/1C1/1D correspond to the minimum power ratings for new engines. For overhauled engines in operation, a performance decrement function to the operation time since overhaul have to be done, up to 2 % for 3000 operating hours.
Ratings declared for Arriel 1C2/1D1/1S/1S1/1E2 correspond to the minimum power ratings for aged engines.
See Installation/Operation Manual for detailed information.

6.3. The protection of the engine against strike / ingestion of foreign matter other than rain is to be ensured by the powerplant installation on the aircraft.

6.4. The engines operation in icing conditions is proved on condition that AS 365C/C1/C2, AS 365N/N1/N2, AS 350B/B1/B2, BK 117C1, BK 117C2 (EC 145), S76 A+/C+/C++ helicopters inlet devices are installed for which safe engine operation in icing condition has been established, and provided that the helicopter operation in known icing condition is prohibited.

6.5. Arriel 1A, 1A1, 1A2, 1C, 1C1, 1C2, 1E2, 1S and 1S1 engines are installed on twin-engines helicopters.
Arriel 1B, 1D and 1D1 engines are installed on single-engine helicopters.