



**TYPE CERTIFICATE DATA SHEET Nº EM-2016T06**

Type Certificate Holder:

**CFM INTERNATIONAL S.A.**

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France

EM-2016T06-00

Sheet 01

LEAP-1A35A, LEAP-1A33,

LEAP-1A33B2, LEAP-1A32,

LEAP-1A30, LEAP-1A26,

LEAP-1A26E1, LEAP-1A24,

LEAP-1A24E1, LEAP -1A23

19 September 2016

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Engines of models described herein conforming with this data sheet, which is part of Type Certificate No. 2016T06, meet the minimum standards for use in certificated aircraft in accordance with pertinent aircraft data sheets and applicable portions of the Brazilian Aeronautical Regulations provided they are installed, operated, and maintained as prescribed by the approved manufacturer's manuals and other instructions.

**TYPE**

High bypass turbofan engine, with: coaxial front fan/booster driven by a multi-stage low pressure turbine; a multi-stage compressor; two-stage high pressure turbine; annular pre swirl combustor, and a full authority digital engine control (FADEC).

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**RATINGS**

(See Note 1)

**MODELS**

LEAP-1A35A, LEAP-1A33, LEAP-1A33B2 and LEAP-1A32

Static Thrust, at sea level, daN (lb.)	LEAP-1A35A	LEAP-1A33	LEAP-1A33B2	LEAP-1A32
- Takeoff - 5 min	14 305 (32 160)	--	--	--
- Maximum Continuous	14 096 (31 690)	--	--	--
Flat Rating Ambient Temp., °C (°F)				
- Takeoff - 5 min	30 (86)	--	--	--
- Maximum Continuous – static	25 (77)	--	--	--

**MODELS**

LEAP-1A30, LEAP-1A26 and LEAP-1A26E1

Static Thrust, at sea level, daN (lb.)	LEAP-1A30	LEAP-1A26	LEAP-1A26E1
- Takeoff - 5 min	14 305 (32 160)	12 064 (27 120)	--
- Maximum Continuous	14 096 (31 690)	11 868 (26 680)	--
Flat Rating Ambient Temp., °C (°F)			
- Takeoff - 5 min	30 (86)	44 (111)	49 (120)
- Maximum Continuous – static	25 (77)	--	--

**MODELS**

LEAP-1A24, LEAP-1A24E1 and LEAP-1A23

Static Thrust, at sea level, daN (lb.)	LEAP-1A24	LEAP-1A24E1	LEAP-1A23
- Takeoff - 5 min	10 680 (24 010)	--	--
- Maximum Continuous	10 676 (24 000)	--	10 458 (23 510)
Flat Rating Ambient Temp., °C (°F)			
- Takeoff - 5 min	45 (113)	55 (130)	45 (113)
- Maximum Continuous – static	25 (77)	--	--

<b>ENGINE CONFIGURATION</b>	LEAP-1A35A	LEAP-1A33	LEAP-1A33B2	LEAP-1A32
- FADEC ECU (P/N)	2500M34	--	--	--
- FADEC Software (P/N)	2590M00			
	and	--	--	--
	2590M01			
- FADEC Identification Plug (P/N)	2531M61P02	2531M61P22	2531M61P24	2531M61P14
	LEAP-1A30	LEAP-1A26	LEAP-1A26E1	
- FADEC ECU (P/N)	2500M34	--	--	
- FADEC Software (P/N)	2590M00			
	and	--	--	
	2590M01			
- FADEC Identification Plug (P/N)	2531M61P06	2531M61P34	2531M61P30	
	LEAP-1A24	LEAP-1A24E1	LEAP-1A23	
- FADEC ECU (P/N)	2500M34	--	--	
- FADEC Software (P/N)	2590M00			
	and	--	--	
	2590M01			
- FADEC Identification Plug (P/N)	2531M61P62	2531M61P58	2531M61P54	

**IGNITION SYSTEM** The Leap-1A is equipped with two ignition exciters, two ignition leads and two igniter plugs.

**COMPONENTS AND CONFIGURATION** For details of components included in the Type Design Definition, refer to the Installation Manual.

**FUEL TYPE** Approved fuel conforming to GE Specification D50TF2, Classes A, C, D, and E. Primary fuel is D50TF2 Class-A (Jet A) with other fuels listed being acceptable alternates. No fuel control adjustment is required when changing from primary to alternate fuels. Use of aviation gasoline and D50TF2 Class-B, Wide-Cut Distillate (Jet B or JP-4) is not authorized.

Refer to the latest revision of CFM Service Bulletin LEAP-1A S/B 73-0001 for a list of fuels specifically approved for LEAP-1A engine.

**OIL TYPE** Synthetic type conforming to GE Specification D50TF1, Type I and Type II Refer to the latest revision of CFM Service Bulletin LEAP-1A S/B 79-0001 for a list of oil specifically approved for the LEAP-1A engine.

**TEMPERATURE LIMITS** For engine indicated turbine gas temperature limits, see Note 2.

**PRESSURE LIMITS** For fuel and oil pressure limits, see Note 3.

**ROTOR SPEEDS** For engine rotational speed limits, see Note 12.

**AIR BLEED** For maximum permissible air bleed extraction, see Note 13

**DIMENSIONS AND WEIGHT**

	LEAP-1AG01	LEAP-1AG02	LEAP-1AG03
LENGTH, mm (in.)			
Fwd. fan case flange to TRF aft flange	3 328 (131.0)	3 328 (131.0)	3 328 (131.0)
WIDTH, mm (in.)			
Maximum Envelope	2 543 (100.1)	2 533 (99.7)	2 533 (99.7)
HEIGHT, mm (in.)			
Maximum Envelope	2 368 (93.2)	2 362 (93.0)	2 362 (93.0)
WEIGHT, kg (lb.)			
Not to exceed	2 990 (6 591)	3 008 (6 632)	3 008 (6 632)

**CENTER OF GRAVITY**

Applicable to all models

Engine only, nominal weight, mm. (in.)

Station (Axial) 5 400 (212.6)

*– HPC case fwd flange = 5080mm (200 in)*

Waterline 2 514.6 (99.0)

Buttline 2 484.1 (97.8)

**IMPORT REQUIREMENTS**

Each engine imported separately and/or spare parts must be accompanied by an Airworthiness Certificate for Export and/or an Airworthiness Approval Tag, respectively, issued by FAA or EASA (or a third country authority, in case of used engine imported from such country), attesting that the particular engine and/or parts were submitted to the governmental quality control before delivery and they are in conformity with the ANAC-approved type design. The ANAC type design corresponds to the FAA or EASA - approved type design, as stated in ANAC report number V.33-1079-00 dated 19 September 2016 or further revisions. (See Note 10).

**CERTIFICATION BASIS**

- RBAC 33, corresponding to 14 CFR Part 33, effective 01 February 1965, as amended by 33-1 through 33-33, inclusive;
- RBAC 34, corresponding to 14 CFR Part 34, effective 23 October 2013, amendment 5A, inclusive (see Note 14 for further information about certification basis for fuel venting and exhaust emissions);
- ICAO Annex 16, Vol.II, Amendment 7(CAEP/8), for emissions.
- Equivalent Level of Safety (ELOS) findings, raised by FAA:
  - No. LEAP1A1C-2014-TC-01-P-11 to 14 CFR 33.27(c): High Pressure Shaft Loss-of-Load.
- Special Condition, raised by FAA:
  - No. 33-015-SC: Fan Blade Special Condition

<u>Model</u>	<u>Application</u>	<u>Issued TC</u>
LEAP-1A35A	08 April 2016	19 September 2016
LEAP-1A33	08 April 2016	19 September 2016
LEAP-1A33B2	08 April 2016	19 September 2016
LEAP-1A32	08 April 2016	19 September 2016
LEAP-1A30	08 April 2016	19 September 2016
LEAP-1A26	08 April 2016	19 September 2016
LEAP-1A26E1	08 April 2016	19 September 2016
LEAP-1A24	08 April 2016	19 September 2016
LEAP-1A24E1	08 April 2016	19 September 2016
LEAP-1A23	08 April 2016	19 September 2016

**PRODUCTION BASIS**

Production Certificate No. 108 for engines produced in the United States by General Electric under license from CFM International, S.A. (See Note 10).

Production Certification No. FR.21G.0007 dated December 17th, 2009 for engines produced in France by Snecma under license from CFM International, S.A

**NOTES****NOTE 1**

Engine ratings are based on calibrated stand performance under the following conditions:

Takeoff thrust is nominally independent of ambient temperature (flat rated) up to ambient temperature of: Std + 15°C (30°C, 86°F) for all models, except as noted above.

Maximum continuous thrust is nominally independent of ambient temperature (flat rated) up to ambient temperature of Std. + 10°C (25°C, 77°F) for all models

- Sea level static, standard day: 101.325 kPA Pressure (14.696 psia); 15°C temperature (59°F)
- Zero customer bleed or customer horsepower extraction
- Ideal inlet, 100% ram recovery
- Production aircraft flight cowling
- Production instrumentation
- Fuel lower heating value of 18,400 BTU/lb

**THRUST SETTING PARAMETER**

Power setting, power checks and control of engine thrust output in all operations is to be based on CFM International engine charts referring to fan speed. Fan speed sensors are included in the engine assembly for this purpose.

**NOTE 2****TEMPERATURE LIMITS:**

- Indicated Turbine Exhaust Gas Temperature, °C (°F):

Takeoff - 5 minutes:	1 060 (1 940)
Maximum continuous:	1 025 (1 877)
Max Transient (30 sec.):	1 065 (1 949)
Ground Starts:	750 (1 382)
Inflight Starts	875 (1 607)

- Fuel Pump Inlet Temperature, °C (°F):

Maximum	55 (131)
Maximum (Cold Start)*	- 54 ( - 65.2) *Or the relevant fuel freezing point, whichever is higher

<b>NOTE 2</b> <b>(cont.)</b>	- Oil Temperature, °C (°F):	
	Maximum	
	Continuous Operation	140 (284)
	Transient (15 minutes)	155 (311)
	Minimum (Cold Start)	- 29 ( - 20)

**NOTE 3** FUEL AND OIL PRESSURE LIMITS:- Fuel Pressure Limits (measured at engine pump inlet):

## Aircraft Boost Pump Operative

The minimum pressure at the engine fuel pump inlet with aircraft boost pumps operative is true vapor pressure plus 5 psia (32.4 kPa). The maximum vapor to liquid ratio at the engine fuel pump inlet with aircraft boost pumps operative is zero.

## Aircraft Boost Pump Inoperative

The engine fuel system operation is restricted with the aircraft boost pumps inoperative as outlined in the LEAP-1A Installation Manual.

- Oil Pressure Limits:

- The minimum pressure limit at idle is 17.4 psid (120.0 kPa) and varies up to 29 psid (200.0 kPa) at redline.
- The maximum pressure is limited during cold starts by a 420.5 psid (2900 kPa differential) pressure-relief valve.

**NOTE 4** ACCESSORY DRIVE CHARACTERISTICS

- ELECTRICAL (IDG)*	
Rotation Direction <sup>+</sup>	CCW
Speed ratio to core**	0.462
Pad Rating kW (HP)	129 (173)
Shear Torque N.m (in.lb)	106 (938)
Maximum overhung moment (wet) N.m (in.lb)	113 (1000)



**NOTE 4**  
**(cont.)****- HYDRAULIC PUMP\***

Rotation Direction	CCW
Speed ratio to core**	0.211
Pad Rating kW N.m (in.lb)	147 (1301)
Shear Torque N.m (in.lb)	480 (4249)
Maximum overhung moment (wet) N.m (in.lb)	23 (204)

\* *Airframer Supplied Hardware*

+ CCW = *COUNTERCLOCKWISE (looking at the Pad)*

\*\* *100% core speed = 16,645 RPM*

**NOTE 5****ENGINE MODEL CHARACTERISTICS:**

The models shown on this TCDS have the following general characteristics:

LEAP-1A35A	A321neo Configuration, with additional takeoff thrust at high altitude conditions..
LEAP-1A33	Same as LEAP-1A30, except for higher thrust rating.
LEAP-1A33B2	Same as LEAP-1A33, except for additional pilot-selected takeoff thrust capability.
LEAP-1A32	Same as LEAP-1A30, except for higher thrust rating.
LEAP-1A30	A321neo Configuration.
LEAP-1A26	A320neo Configuration
LEAP-1A26E1	Same as LEAP-1A26, except for extended ambient temperature takeoff thrust capability.
LEAP-1A24	Same as LEAP-1A23, except for higher thrust rating.
LEAP-1A24E1	Same as LEAP-1A24, except for extended ambient temperature takeoff thrust capability.
LEAP-1A23	A319neo Configuration.

**NOTE 6****COMPATIBLE SYSTEM ASSEMBLIES**

**THRUST REVERSER**

The LEAP-1A engine is approved for use with the Aircelle thrust reverser system: P/N BDL0011-12-0 for the left hand thrust reverser half; and P/N BDL0051-12-0 for the right hand thrust reverser half.

**NOTE 7****SPECIAL REQUIREMENTS****ETOPS**

LEAP-1A engine models are not eligible for Extended Twin Engine Operations (ETOPS) operation at this time.

**TIME LIMITED DISPATCH CRITERIA**

Criteria pertaining to the dispatch and maintenance requirements for the engine control systems are specified in the airworthiness limitation section of the LEAP-1A Engine Shop Manual (LEAP-1A-05-17-00), which defines the various configurations and maximum operating intervals.

A control system reliability monitoring program has been established with LEAP, as a contingency of the dispatch criteria approval, to ensure that overall engine control system and specific component failure rates do not exceed the maximum values permitted by the reliability analysis.

**NOTE 8****SPECIAL OPERATING PROCEDURES****Negative G Operation**

During negative g operation only, it is permissible to operate below minimum oil pressure (17.4 psid) for a maximum of 14 seconds. See LEAP-1A Specific Operating Instruction Manual, GEK 131717.

**Minimum Flight Idle**

The minimum permissible idle in flight is a non-adjustable limit, preset into the EEC Control schedule. Flight idle is engaged based on thrust lever position and operating conditions as specified in the LEAP-1A Specific Operating Instructions Manual, GEK 131717.

**Takeoff Time Limit**

The normal 5 minute takeoff rating may be extended to 10 minutes for engine out contingency, as specified in the LEAP-1A Specific Operating Instructions Manual, GEK 131717.

**Icing Operation**

For operation in icing conditions; requirements, limitations, and notes are specified in the LEAP-1A Specific Operating Instructions Manual, GEK 131717.

**NOTE 9** ICA: Installation Manuals, Specific Operating Instructions, Engine Shop Manuals, Service Bulletins, Overhaul and Maintenance Manuals, Repair Manuals, Vendor Manuals, and Design Changes which contain a statement that the document is EASA approved or approved under authority of DOA No. EASA.21J.086 are accepted by the ANAC and considered ANAC approved. Repair data and related instructions are considered ANAC approved or accepted as applicable. These approvals pertain to the type design only.

**NOTE 10** IMPORT REQUIREMENTS

The type certificate holder, CFM International, S.A., is a company established and jointly owned by Snecma of France and the General Electric Company for the certification, sale, and support of CFM56 & LEAP series engines. The LEAP-1A engine series is a product line designed to power the Airbus A319neo/320neo/321neo aircraft. With respect to the benefits of type certification for production, General Electric and Snecma function as licensees of CFM International, S.A.

All LEAP-1A engines will be assigned serial numbers sequentially, with the three-digit prefix "598-", regardless of engine final assembly location. The location of final assembly can be inferred from the engine manufacturer, which will be identified on the engine nameplate, along with the date of production. Engines produced in the United States by GE are identical to and fully interchangeable with engines produced in France by Snecma.

Modules, assemblies, or parts produced in France are eligible for use in engines produced to this type certificate provided an airworthiness approval certificate (EASA Form 1 – Authorized Release Certificate or JAA Form 1) issued by Snecma under authority of European Aviation Safety Agency (EASA) Production Certificate No. FR.21G.0007 is attached to the item or invoice covering shipment of items.

**NOTE 11** CRITICAL ENGINE PARTS

Life limits established for critical engine parts are published in the ALS section of Chapter 05 of the LEAP-1A Engine Shop Manual, ESM.20.

**NOTE 12** MAXIMUM PERMISSIBLE ENGINE ROTOR SPEEDS

SPOOL	RPM	%
Low pressure rotor (N1)	3894	101.0
High pressure rotor (N2)	19 391	116.5

**NOTE 13** MAXIMUM PERMISSIBLE BLEED AIR EXTRACTION

LOCATION	TEMPERATURE CORRECTED FAN SPEED	FLOW LIMIT
HPC Stage 4	All speeds above minimum idle.	9.97% core airflow*
HPC Stage7	Above 2314 RPM	2.45% core airflow

HPC Stage10	Below 2314 RPM	2.9% core airflow
Bypass Duct	All speeds above minimum idle.	15.0% of core airflow
	All speeds above minimum idle.	2 % of secondary airflow

*\*Absolute maximum. Refer to the LEAP-1A Installation Manual, for detailed Stage 4 bleed schedule.*

**NOTE 14****EXHAUST EMISSIONS AND FUEL VENTING**

The following emissions standards promulgated in 14 CFR Part 34, Amendment 5A, effective October 23, 2013, and 40 CFR Part 87, effective October 31, 2012, have been complied with for the LEAP-1A35A.

- Fuel Venting Emission Standards: 14 CFR 34.10(a) and 34.11 ; in addition, 40 CFR 87.10(a) and 87.11.
- Smoke Number (SN) Emission Standards: 14 CFR 34.21 (e)(2); in addition, 40 CFR 87.23(c)(1).
- Carbon Monoxide (CO) Emission Standards: 14 CFR 34.21(d)(1)(ii); in addition, 40 CFR 87.23(c)(1).
- Hydrocarbons (HC) Emission Standards: 14 CFR 34.21(d)(1)(i); in addition, 40 CFR 87.23(c)(1).
- Oxides of Nitrogen (NOx) Emission Standards: 14 CFR 34.23(b)(1); in addition, 40 CFR 87.23(c)(3).

In addition to the FAA's finding of compliance based on the certification requirements defined in this TCDS, the engine manufacturer has declared that the ICAO emissions standards identified in Annex 16, Volume II, Third Edition, Part III, Chapter 2, Section 2.2.2 for SN, Section 2.3.2 for CO and HC, Section 2.3.2.e.3 for NOx (also known as CAEP/8), and Part II Chapter 2 for fuel venting have also been demonstrated.

**NOTE 17**

Service Bulletins, Structural Repair Manuals, Vendor Manuals, and Engine Maintenance Manuals, with contain a statement that the document is FAA-approved, are acceptable by the ANAC and are considered ANAC-approved unless otherwise noted. These approvals pertain to the type design only.


**MÁRIO IGAWA**

**Gerente Geral de Certificação de Produto Aeronáutico  
(Manager, Aeronautical Product Certification Branch)**