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## TYPE-CERTIFICATE DATA SHEET

No. E.110

**for Engine**

LEAP-1A & LEAP-1C series engines

**Type Certificate Holder**

CFM International SA

CFM International SA

2, boulevard du Général Martial Valin

75015 Paris

France

For Models:

LEAP-1A23

LEAP-1A24

LEAP-1A24E1

LEAP-1A26

LEAP-1A26CJ

LEAP-1A26E1

LEAP-1A29

LEAP-1A29CJ

LEAP-1A30

LEAP-1A32

LEAP-1A33

LEAP-1A33B2

LEAP-1A35A

LEAP-1C28

LEAP-1C30

LEAP-1C30B1



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## **I. General**

### **1. Type / Models**

LEAP-1A & LEAP-1C	LEAP-1A23, LEAP-1A24, LEAP-1A24E1, LEAP-1A26, LEAP-1A26CJ, LEAP-1A26E1, LEAP-1A29, LEAP-1A29CJ, LEAP-1A30, LEAP-1A32, LEAP-1A33, LEAP-1A33B2, LEAP-1A35A LEAP-1C28, LEAP-1C30, LEAP-1C30B1
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### **2. Type Certificate Holder**

CFM International SA  
2, boulevard du Général Martial Valin  
75015 Paris  
France

Design Organisation Approval No.: EASA.21J.086

### **3. Manufacturers**

Safran Aircraft Engines Production Organisation Approval FR.21G.0007 10 allée du Brévent - CE 1420 - Courcouronnes 91019 Evry Cedex France	GE Production Certification No. 108 One Neumann Way Cincinnati - Ohio 45215 United States of America
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(See note 4)

### **4. Date of Application**

LEAP-1A35A	06 February 2012
LEAP-1A23, LEAP-1A24, LEAP-1A24E1, LEAP-1A26, LEAP-1A26E1, LEAP-1A30, LEAP-1A32, LEAP-1A33, LEAP-1A33B2	24 November 2015
LEAP-1C28, LEAP-1C30, LEAP-1C30B1	01 December 2015
LEAP-1A26CJ, LEAP-1A29, LEAP-1A29CJ	26 July 2017

### **5. EASA Type Certification Date**

LEAP-1A35A	20 November 2015
LEAP-1A23, LEAP-1A24, LEAP-1A24E1, LEAP-1A26, LEAP-1A26E1, LEAP-1A30, LEAP-1A32, LEAP-1A33, LEAP-1A33B2	11 March 2016
LEAP-1C28, LEAP-1C30, LEAP-1C30B1	21 December 2016
LEAP-1A26CJ, LEAP-1A29, LEAP-1A29CJ	30 May 2018



## **II. Certification Basis**

### **1. Reference Date for determining the applicable airworthiness requirements:**

20 November 2012 (3 years prior to initial Type Certification date according to Part 21.A.17)

### **2. EASA Certification Basis**

#### **2.1. Airworthiness Standards**

CS-E amendment 3 (23 December 2010)

#### **2.2. Special Conditions (SC)**

SC1: Fan Blade Containment - Woven Composite Fan Blade

SC2: 30 Seconds Transient Over-Temperature Approval

#### **2.3. Equivalent Safety Findings (ESF)**

ESF1: CS-E 740 Endurance Tests – Alternative Schedule

ESF2: CS-E 840 Rotor Integrity – High Pressure Turbine Stage 2 Rotor Compliance

#### **2.4. Deviations**

None

#### **2.5. Environmental Protection**

LEAP-1A35A	ICAO Annex 16 Volume II, third edition, July 2008, including Amendment 7, 18/08/11, as applicable to turbofan engines. For NOx, the standards in accordance with Part III, Chapter 2, § 2.3.2 e) (CAEP/8) apply
LEAP-1A23, LEAP-1A24, LEAP-1A24E1, LEAP-1A26, LEAP-1A26CJ, LEAP-1A26E1, LEAP-1A29, LEAP-1A29CJ, LEAP-1A30, LEAP-1A32, LEAP-1A33, LEAP-1A33B2, LEAP-1C28, LEAP-1C30, LEAP-1C30B1	ICAO Annex 16 Volume II, third edition, July 2008, including Amendment 8, applicable 01/01/2015, as implemented into EU legislation 05/01/2016. For NOx, the standards in accordance with Part III, Chapter 2, § 2.3.2 e) (CAEP/8) apply



### III. Technical Characteristics

#### 1. Type Design Definition

Engine type is identified by an engine model list including an identification plug reference:

LEAP-1A	Engine model list
LEAP-1A23, LEAP-1A24, LEAP-1A24E1, LEAP-1A26, LEAP-1A26CJ, LEAP-1A26E1, LEAP-1A29, LEAP-1A29CJ, LEAP-1A30, LEAP-1A32, LEAP-1A33, LEAP-1A33B2, LEAP-1A35A	LEAP-1AxxGyy xx denotes model rating yy denotes model configuration group number Refer to the latest revision of CFM Service Bulletin LEAP-1A 72-0220

Model	Engine identification plug reference	Model	Engine identification plug reference
LEAP-1A23	2531M61P54	LEAP-1A29CJ	2531M61P42
LEAP-1A24	2531M61P62	LEAP-1A30	2531M61P06
LEAP-1A24E1	2531M61P58	LEAP-1A32	2531M61P14
LEAP-1A26	2531M61P34	LEAP-1A33	2531M61P22
LEAP-1A26CJ	2531M61P46	LEAP-1A33B2	2531M61P24
LEAP-1A26E1	2531M61P30	LEAP-1A35A	2531M61P02
LEAP-1A29	2531M61P26	-	-

LEAP-1C	Engine model list
LEAP-1C28, LEAP-1C30, LEAP-1C30B1	LEAP-1CxxGyy xx denotes model rating yy denotes model configuration group number Refer to the latest revision of CFM Service Bulletin LEAP-1C 72-0007

Model	Engine identification plug reference	Model	Engine identification plug reference
LEAP-1C28	2531M61P30	LEAP-1C30B1	2531M61P23
LEAP-1C30	2531M61P22	-	-



## 2. Description

Dual rotor, axial flow, high bypass ratio turbofan engine:

- single stage fan, 3-stage low pressure compressor (LPC), 10-stage high pressure compressor (HPC)
- annular combustion chamber
- 2-stage high pressure turbine (HPT), 7-stage low pressure turbine (LPT)
- dual channel full authority digital engine control (FADEC)

The LEAP-1C engine Type Certificate includes the thrust reverser. This thrust reverser is actuated by an Electrical Thrust Reverser Actuation System (ETRAS) including a digital Thrust Reverser Control Unit (TRCU). The left-hand engine thrust reverser includes a translating O-duct SIN 95000, P/N BCL0005-06-0 or BCL0005-04-0, and the right-hand one a translating O-duct SIN 95000, P/N BCL0006-06-0 or BCL0006-04-0.

## 3. Equipment

The engine starter is part of the engine type design. Refer to the engine model list for details.

## 4. Dimensions (mm)

	LEAP-1A..G01	LEAP-1A..G02 and up	LEAP-1C..G01 and up
Length (fan case forward flange to turbine rear frame aft flange)	3328	3328	-
Length (fan cowl hinge beam front to centre vent tube end)	-	-	4505
Width (maximum envelope)	2543	2533	2659
Height (maximum envelope)	2368	2362	2714

## 5. Weight (kg)

Weight of the basic engine, including basic engine equipment, as given in the applicable engine "Installation Manual" document:

	LEAP-1A..G01	LEAP-1A..G02 and up	LEAP-1C..G01	LEAP-1C..G02 and up
With fluids (oil, fuel)	2990	3008	-	-
Without fluids (oil, fuel), including thrust reverser	-	-	3935	3929



## 6. Ratings (daN)

<b>LEAP-1A</b> Take-Off Thrust				
LEAP-1A23	LEAP-1A24 LEAP-1A24E1	LEAP-1A26 LEAP-1A26CJ LEAP-1A26E1	LEAP-1A29 LEAP-1A29CJ	LEAP-1A30 LEAP-1A32 LEAP-1A33 LEAP-1A33B2 LEAP-1A35A
10680	10680	12064	13029	14305

<b>LEAP-1A</b> Maximum Continuous Thrust			
LEAP-1A23	LEAP-1A24 LEAP-1A24E1	LEAP-1A26 LEAP-1A26CJ LEAP-1A26E1 LEAP-1A29 LEAP-1A29CJ	LEAP-1A30 LEAP-1A32 LEAP-1A33 LEAP-1A33B2 LEAP-1A35A
10458	10676	11868	14096

<b>LEAP-1C</b> Take-Off Thrust (daN)			
LEAP-1C28	LEAP-1C30 LEAP-1C30B1	-	-
12998	13714	-	-

<b>LEAP-1C</b> Maximum Continuous Thrust (daN)			
LEAP-1C28	LEAP-1C30 LEAP-1C30B1	-	-
12793	13322	-	-

(See notes 2 and 3)

Engine models which have the same approved ratings in standard static conditions will provide different level of thrust at altitude and/or high temperature conditions. This is controlled by the engine identification plug.





## 7. Control System

The software is part of the engine Type Design – At initial certification:

	LEAP-1A35A	LEAP-1A23, -1A24, -1A24E1, -1A26, -1A26E1, -1A30, -1A32, -1A33, -1A33B2	LEAP-1A26CJ, -1A29, -1A29CJ
Factory Loadable Software P/N	2500M34P03	2500M34P03	2500M34P03 2500M34P04 2500M34P05 2500M34P06 2500M34P08
Application Software P/N	2590M00P02	2590M00P03	2590M00P07
Health Monitoring Software P/N	2590M01P01	2590M01P01	n/a
Prognostic Health Management P/N	n/a	n/a	2784M64P01
Open Multimedia Applications Platform P/N	n/a	n/a	2590M01P05 2590M01P06
Pressure Sub Systems (PSS) Software P/N	2474M65P05	2474M65P05	2474M65P05

	LEAP-1C28, -1C30, -1C30B1	-	-
Factory Loadable Software P/N	2500M35P03 2500M35P04	-	-
Application Software P/N	2590M02P01	-	-
Health Monitoring Software P/N	2590M03P01	-	-
Pressure Sub Systems (PSS) Software P/N	2474M65P05	-	-
TRCU Operating Software P/N	According to SCI SK-0000492539-16	-	-
TRCU Application Software P/N	262074891-0230	-	-

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

Fuel and fuel additives: Refer to the latest revision of CFM Service Bulletin LEAP-1A S/B 73-0001 and CFM Service Bulletin LEAP-1C S/B 73-0001.

Oil: Refer to the latest revision of CFM Service Bulletin LEAP-1A S/B 79-0001 and CFM Service Bulletin LEAP-1C S/B 79-0001.



## 9. Aircraft Accessory Drives

LEAP-1A						
Component	Rotation direction	Speed ratio / HP rotor	Max. power or max. torque	Max. shear torque (m.daN)	Max. weight (wet) (kg)	Max. overhung moment (m.daN)
Electrical generator	CCW	0.462	129 kW	106.2	65	11.3
Hydraulic pump	CCW	0.211	14.7 m.daN	48	17.5	2.3

LEAP-1C						
Component	Rotation direction	Speed ratio / HP rotor	Max. power or max. torque	Max. shear torque (m.daN)	Max. weight (wet) (kg)	Max. overhung moment (m.daN)
Electrical generator	CCW	1.066	151 kW	86.6	65.2	13.9
Hydraulic pump	CW	0.203	14 m.daN	40.7	15.4	1.98

CW = clockwise when facing the gearbox drive pad

CCW = counter-clockwise when facing the gearbox drive pad

## 10. Maximum Permissible Air Bleed Extraction

LEAP-1A and LEAP-1C		
Bleed location	LP rotor speed	Airflow limit
Bypass duct	Above minimum idle	2 % of secondary airflow
HPC 4 <sup>th</sup> stage	Above minimum idle	9.97% of primary airflow*
HPC 7 <sup>th</sup> stage	Below 2314 rpm N1K**	2.9% of primary airflow
	Above 2314 rpm N1K**	2.45% of primary airflow
HPC 10 <sup>th</sup> stage	Above minimum idle	15% of primary airflow

\*Absolute maximum. Refer to the LEAP-1A Installation Manual for detailed HPC 4<sup>th</sup> stage bleed schedule.

\*\*N1K = Temperature corrected fan rotor speed.

It is not allowed to extract air from 4<sup>th</sup> and 10<sup>th</sup> stages simultaneously.



## **IV. Operating Limitations**

### **1. Temperature Limits**

#### **1.1. Exhaust Gas Temperature (°C):**

The Exhaust Gas Temperature (EGT=T48) is measured at the low pressure turbine inlet.

Maximum Exhaust Gas Temperature (Indicated):

- Take-Off: 1060
- Maximum Continuous: 1025
- Ground Start: 750
- Inflight Start: 875

All models are certified for a transitory exhaust gas temperature (EGT) exceedance at take-off of 5°C, during 30 seconds maximum. Refer to the applicable "Specific Operating Instructions" document.

#### **1.2. Oil Temperature (°C)**

Minimum for starting: minus29 (LEAP-1A engines not compliant with LEAP-1A S/B 72-0034, S/B 72-0035, S/B 72-0036 and LEAP-1C..G01)

Minimum for starting: minus40 (LEAP-1A engines compliant with LEAP-1A S/B 72-0034, S/B 72-0035, S/B 72-0036 and LEAP-1C..G02 and up)

Minimum for acceleration to take-off power: 19

Maximum steady state: 140

Maximum transient (15 minutes): 155

#### **1.3. Fuel Inlet Temperature (°C)**

Maximum steady state: 55

#### **1.4. Engine Equipment Temperatures:**

Refer to the applicable engine "Installation Manual" document for engine equipment steady state and transient skin temperature limits.

### **2. Speed Limits**

#### **2.1. Maximum Rotational Speeds (rpm=revolutions per minute):**

Low pressure rotor (N1): 3894 (101 % - 100 % N1 is defined as 3856 rpm)

High pressure rotor (N2): 19391 (116.5 % - 100 % N2 is defined as 16645 rpm)

### **3. Pressure Limits**

#### **3.1. Fuel Pressure:**

Minimum: 345 hPa (differential pressure)

Maximum (LEAP-1A): 4137 hPa (differential pressure)

Maximum (LEAP-1C): 3800 hPa (differential pressure)

When the engine is running, the fuel pressure at the engine pump inlet must be kept 345 hPa above the true vapour pressure of the fuel with a zero vapour/liquid ratio under normal operating conditions.



### 3.2. Oil Pressure:

Minimum at Idle conditions: 1200 hPa (differential pressure)

Minimum at Maximum Continuous conditions: 2000 hPa (differential pressure)

When the engine is running, the oil pressure varies with the rotational speed of the HP rotor (Refer to the applicable engine "Installation Manual" document). Deliberate operation of the engine with oil pressure below minimum is prohibited. However, aircraft "negative g" manoeuvres may cause temporary oil supply interruption. Under "negative g" operating conditions only, it is permissible to operate the engine below the minimum oil pressure for a maximum of 14 seconds before engine shutdown is required.

### 4. Time Limited Dispatch (TLD)

The engine is approved for Time Limited Dispatch in accordance with CS-E 1030. The maximum rectification period for each dispatchable state is specified in the applicable "Engine Shop Manual" document, chapter 5 "Airworthiness Limitations".

### 5. ETOPS Capability

**LEAP-1A:** When compliant with CFM Service Bulletin LEAP-1A 71-0006, the LEAP-1A engine is approved for ETOPS capability in accordance with CS-E 1040 amendment 3 by EASA Certificate 10062224 dated 16 June 2017 for a Maximum Approved Diversion Time of 180 minutes at maximum continuous thrust plus 15 minutes at hold thrust. ETOPS does not require any special engine limitation, marking, placard, or configuration other than as instructed by the Service Bulletin. This approval does not constitute an approval to conduct ETOPS operations.

**LEAP-1C:** The LEAP-1C engine is not approved for ETOPS capability in accordance with CS-E 1040.

## V. Operating and Service Instructions

Manuals - LEAP-1A	Refer to the latest revision of CFM Service Bulletin LEAP-1A 72-0220	
Turbofan Engine Installation Manual (EIM)	LEAP-1A..G01:	CRL-2106a (IM.20)
	LEAP-1A..G02 and up:	CRL-2106a_3 (IM.20.3)
Installation Drawing	LEAP-1A..G01:	CRL-2107a
	LEAP-1A..G02 and up:	CRL-2107a_x
Specific Operating Instructions (SOI)	LEAP-1A:	CRL-2105a (GEK 131717)

Manuals - LEAP-1C	Refer to the latest revision of CFM Service Bulletin LEAP-1C 72-0007	
Turbofan Engine Installation Manual (EIM)	LEAP-1C..G01:	CRL-2106c (IM.22)
	LEAP-1C..G02 and up:	CRL-2106c_x (IM.22.1)
Installation Drawing	LEAP-1C..G01:	CRL-2107c
	LEAP-1C..G02 and up:	CRL-2107c_x
Specific Operating Instructions (SOI)	LEAP-1C:	CRL-2105c (GEK 131718)



Instructions for Continued Airworthiness (ICA)	LEAP-1A	LEAP-1C
Maintenance Manual	See Aircraft Maintenance Manual (AMM)	See Aircraft Maintenance Manual (AMM)
Fault Isolation Manual	See Aircraft Fault Isolation Manual (FIM)	See Aircraft Fault Isolation Manual (FIM)
Engine Shop Manual (ESM)	SM.20	SM.22
Standard Practices Manual (SPM)	SPM.25	SPM.25
Consumable Product Manual (CPM)	CPM.25	CPM.25
Non Destructive Test Manual (NDTM)	NDTM.25	NDTM.25
Components Maintenance Manuals (CMM)	As published by CFM	As published by CFM
Service Bulletins (S/B)	As published by CFM	As published by CFM

## **VI. Notes**

**1.** The EASA approved Airworthiness Limitations Section of the Instructions for Continued Airworthiness is published in the applicable "Engine Shop Manual" document, chapter 5 "Airworthiness Limitations".

**2.** Engine ratings are based on calibrated test stand performance, and performance calculations are based on accepted parameter correction methods documented in the "Production Test Requirements" document. These calculations assume the following conditions:

- Sea level corner point conditions as defined in the "Production Test Requirements";
- No aircraft accessory loads or air extraction;
- No anti-icing; no inlet distortion; no inlet screen losses; and 100% ram recovery;
- Production engine inlet and production exhaust system.

**3.** The take-off thrust, with the associated limits, shall not be used continuously more than 5 minutes. The duration may be extended to 10 minutes in case of engine failure in multi-engine aircraft. If the duration exceeds 5 minutes, this shall be recorded in the engine log book.

**4.** The type certificate holder, CFM International, is a company jointly owned by Safran Aircraft Engines (France) and GE (USA). CFM International is responsible for the certification program, the sale and the customer support activities. With respect to the benefits of type certification for production of certified engines, Safran Aircraft Engines and GE act as licensees of CFM International. The engine final assembly location is recorded on the engine identification plate. Engines produced by GE (USA) are identical to, and fully interchangeable with, engines produced by Safran Aircraft Engines (France).

**5.** The LEAP-1A engine is approved for use with 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. The LEAP-1C engine Type Certificate includes the thrust reverser.



**SECTION: ADMINISTRATIVE**

**I. Acronyms and Abbreviations**

n/a	Not applicable
P/N	Part number
S/B	Service Bulletin
SIN	Significant Item Number

**II. Type Certificate Holder Record**

n/a

**III. Change Record**

TCDS Issue	Date	Changes	TC issue date
Issue 01	20 November 2015	Initial issue with LEAP-1A35A model	Initial Issue, 20 November 2015
Issue 02	11 March 2016	Addition of LEAP-1A23, LEAP-1A24, LEAP-1A24E1, LEAP-1A26, LEAP-1A26E1, LEAP-1A30, LEAP-1A32, LEAP-1A33, and LEAP-1A33B2 models	Amended, 11 March 2016
Issue 03	11 July 2016	Following approval of SOI CRL-2105a/Rev. 2 and EIM CRL-2106a_1 Issue 2/Rev.1 (certificate 10058275), correction of LEAP-1A LEAP-1A..G02 engine weight, amendment of minimum oil temperature for starting and for acceleration to take-off power, correction of note 5. Introduction of model list LEAP-1A..G03 (certificate 10058742). Snecma becomes Safran Aircraft Engines.	11 March 2016
Issue 04	21 December 2016	Addition of LEAP-1C28, LEAP-1C30, and LEAP-1C30B1 models. Amendment of minimum oil temperature for starting and for acceleration to take-off power (certificate 10059856).	Amended, 21 December 2016
Issue 05	16 June 2017	Introduction of model list LEAP-1A..G04 (certificate 10061124) and model list LEAP-1A..G05 (certificate 10061530). LEAP-1A engine ETOPS capability approval (certificate 10062224). Amendment of note 4. Addition of note 6.	21 December 2016
Issue 06	02 November 2017	Introduction of model list LEAP-1A..G06 (certificate 10063050 R1) and model list LEAP-1A..G07 (certificate 10063617).	21 December 2016
Issue 07	30 May 2018	Addition of LEAP-1A26CJ, LEAP-1A29, and LEAP-1A29CJ models. Correction of the Environmental Protection requirements. New LEAP-1C thrust reverser translating O-duct P/N (certificate 10063756). Update of LEAP-1A..G07 Installation Drawing (certificate 10064843).	Amended, 30 May 2018



TCDS Issue	Date	Changes	TC issue date
Issue 08	02 May 2019	Introduction of model list LEAP-1C..G03 (certificate 10069455 - refer to LEAP-1C S/B 72-0007). Removal of note 6 and other TCDS amendments following the publication of LEAP-1A S/B 72-0220 and LEAP-1C S/B 72-0007.	30 May 2018

-END-

