



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-1A26E1
LEAP-1A30
LEAP-1A32
LEAP-1A33
LEAP-1A33B2
LEAP-1A35A



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I. General

1. Type / Models

| | |
|---------|--|
| LEAP-1A | LEAP-1A23, LEAP-1A24, LEAP-1A24E1, LEAP-1A26, LEAP-1A26E1, LEAP-1A30, LEAP-1A32, LEAP-1A33, LEAP-1A33B2, LEAP-1A35A |
|---------|--|

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 |
|--|--|

(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 |

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 |

II. Certification Basis

1. Reference Date for determining the applicable airworthiness requirements:

20 November 2012 (3 years prior to 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. NOx Standard in accordance with CAEP/8. |
| LEAP-1A23, LEAP-1A24, LEAP-1A24E1, LEAP-1A26, LEAP-1A26E1, LEAP-1A30, LEAP-1A32, LEAP-1A33, LEAP-1A33B2 | ICAO Annex 16 Volume II, third edition, July 2008, including Amendment 8, 14/7/14, as applicable to turbofan engines |

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-1A26E1, LEAP-1A30, LEAP-1A32, LEAP-1A33, LEAP-1A33B2, LEAP-1A35A | LEAP-1AxxG01* LEAP-1AxxG02* LEAP-1AxxG03* *xx Denotes Model Rating |

| LEAP-1A | Engine identification plug reference | LEAP-1A | Engine identification plug reference |
|-------------|--------------------------------------|-------------|--------------------------------------|
| LEAP-1A23 | 2531M61P54 | LEAP-1A30 | 2531M61P06 |
| LEAP-1A24 | 2531M61P62 | LEAP-1A32 | 2531M61P14 |
| LEAP-1A24E1 | 2531M61P58 | LEAP-1A33 | 2531M61P22 |
| LEAP-1A26 | 2531M61P34 | LEAP-1A33B2 | 2531M61P24 |
| LEAP-1A26E1 | 2531M61P30 | LEAP-1A35A | 2531M61P02 |



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)

3. Equipment

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

4. Dimensions (mm)

| | LEAP-1AxxG01 | LEAP-1AxxG02 LEAP-1AxxG03 | Reserved |
|---|--------------|------------------------------|----------|
| Length (fan case forward flange to turbine rear frame aft flange) | 3328 | 3328 | - |
| Width (maximum envelope) | 2543 | 2533 | - |
| Height (maximum envelope) | 2368 | 2362 | - |

5. Weight (kg)

| | LEAP-1AxxG01 | LEAP-1AxxG02 LEAP-1AxxG03 | Reserved |
|---|--------------|------------------------------|----------|
| Weight of the basic engine, including basic engine equipment and fluids (oil, fuel) | 2990 | 3008 | - |

6. Ratings

| LEAP-1A - Take-Off Thrust | | | |
|---------------------------|--------------------------|--------------------------|--|
| LEAP-1A23 | LEAP-1A24 LEAP-1A24E1 | LEAP-1A26 LEAP-1A26E1 | LEAP-1A30 LEAP-1A32 LEAP-1A33 LEAP-1A33B2 LEAP-1A35A |
| 10680 daN | 10680 daN | 12064 daN | 14305 daN |



| LEAP-1A - Maximum Continuous Thrust | | | |
|-------------------------------------|--------------------------|--------------------------|--|
| LEAP-1A23 | LEAP-1A24 LEAP-1A24E1 | LEAP-1A26 LEAP-1A26E1 | LEAP-1A30 LEAP-1A32 LEAP-1A33 LEAP-1A33B2 LEAP-1A35A |
| 10458 daN | 10676 daN | 11868 daN | 14096 daN |

(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 | Reserved |
|---|------------|--|----------|
| Factory Loadable Software P/N | 2500M34P03 | 2500M34P03 | - |
| Application Software P/N | 2590M00P02 | 2590M00P03 | - |
| Health Monitoring Software P/N | 2590M01P01 | 2590M01P01 | - |
| Pressure Sub Systems (PSS) Software P/N | 2474M65P05 | 2474M65P05 | - |

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

Oil: Refer to the latest revision of CFM Service Bulletin LEAP-1A 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 |

CCW = counter-clockwise when facing the gearbox drive pad



10. Maximum Permissible Air Bleed Extraction

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

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

**N1K = Temperature corrected fan rotor speed.

It is not allowed to extract air from 4th and 10th 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 |
| Minimum for acceleration to take-off power: | 10 |
| 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: 4137 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

The engine is not approved for ETOPS capability in accordance with CS-E 1040.



V. Operating and Service Instructions

| Manuals | LEAP-1A | Reserved |
|---|--|----------|
| Turbofan Engine Installation Manual (EIM) | LEAP-1AxxG01: CRL-2106a Issue 1 (IM.20) LEAP-1AxxG02: CRL-2106a_1 Issue 1 (IM.20.1) LEAP-1AxxG03: CRL-2106a_2 Issue 1 (IM.20.2) | - |
| Installation Drawing | LEAP-1AxxG01: CRL-2107a LEAP-1AxxG02: CRL-2107a_1 LEAP-1AxxG03: CRL-2107a_2 | - |
| Specific Operating Instructions (SOI) | CRL-2105a Revision 1 (GEK 131717) | - |

Or later approved Issues or Revisions

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



SECTION: ADMINISTRATIVE

I. Acronyms and Abbreviations

n/a

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, 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-1AxxG02 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-1AxxG03 (Certificate 10058742). Snecma becomes Safran Aircraft Engines. | 11 March 2016 |
| | | | |
| | | | |

-END-

