Civil Aviation Authority
United Kingdom

TYPE-CERTIFICATE DATA SHEET

UK.TC.E.00076

for

LEAP-1B series engines

Type Certificate Holder

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

Model(s):

LEAP-1B21
LEAP-1B23
LEAP-1B25
LEAP-1B27
LEAP-1B28
LEAP-1B28B1
LEAP-1B28B2
LEAP-1B28B2C
LEAP-1B28B3
LEAP-1B28BBJ1
LEAP-1B28BBJ2

Issue:	01
Date of issue:	28 June 2024

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Section 1 General (All Models)

I. General

This Type-Certificate Data Sheet (TCDS) is the concise definition of the type-certificated product accepted and or approved by the CAA in the UK for the affected types and models.

This TCDS includes:

1. Details of the type design that affect the TCDS that have been approved or accepted by the CAA in the UK from 01 January 2021.

2. Details of the type design that affected the TCDS and were approved or accepted by EASA before 01 January 2021, and were incorporated into EASA.E.115 at Issue 07 dated 31 October 2019 and are therefore accepted by the UK under Article 15 of Annex 30 of the UK-EU Trade and Cooperation Agreement.

Section 2

I. General

1. Type / Variant or Model

LEAP-1B	LEAP-1B21, LEAP-1B23, LEAP-1B25, LEAP-1B27, LEAP-1B28, LEAP-1B28B1, LEAP-1B28B2, LEAP-1B28B2C, LEAP-1B28B3, LEAP-1B28BBJ1, LEAP-1B28BBJ2

2. Type Certificate Holder

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

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

3. Manufacturer

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 at EASA (Certificating Authority)

LEAP-1B28, LEAP-1B28B2	09 May 2013
LEAP-1B25, LEAP-1B27, LEAP-1B28B1, LEAP-1B28B3	31 May 2016
LEAP-1B21, LEAP-1B23, LEAP-1B28B2C, LEAP-1B28BBJ1, LEAP-1B28BBJ2	09 October 2017

5. Type Certification date at EASA (Certificating Authority)

LEAP-1B28, LEAP-1B28B2	04 May 2016
LEAP-1B25, LEAP-1B27, LEAP-1B28B1, LEAP-1B28B3	17 February 2017
LEAP-1B21, LEAP-1B23, LEAP-1B28B2C, LEAP-1B28BBJ1, LEAP-1B28BBJ2	30 May 2018

6. Date of Application at CAA (Validating Authority)

Model	Application Date
LEAP-1B28, LEAP-1B28B2 LEAP-1B25, LEAP-1B27, LEAP-1B28B1, LEAP-1B28B3 LEAP-1B21, LEAP-1B23, LEAP-1B28B2C, LEAP-1B28BBJ1, LEAP-1B28BBJ2	11th April 2023

7. Type Certification date at CAA (Validating Authority)

Model	Certification Date
LEAP-1B28, LEAP-1B28B2 LEAP-1B25, LEAP-1B27, LEAP-1B28B1, LEAP-1B28B3 LEAP-1B21, LEAP-1B23, LEAP-1B28B2C, LEAP-1B28BBJ1, LEAP-1B28BBJ2	28 June 2024

II. Certification Basis

1. Reference Date for determining the applicable airworthiness requirements:

09 May 2013

2. State of Design Airworthiness Authority Type Certification Data Sheet Number

EASA.E.115

3. State of Design Airworthiness Authority Certification Basis

Refer to TCDS EASA.E.115

4. UK CAA 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

4.3 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

4.4 Deviations
None

4.5 Environmental Protection

Model	Environmental Protection Requirements
LEAP-1B21, LEAP-1B23, LEAP-1B25, LEAP-1B27, LEAP-1B28, LEAP-1B28B1, LEAP-1B28B2, LEAP-1B28B2C, LEAP-1B28B3, LEAP-1B28BBJ1, LEAP-1B28BBJ2	CS-34 Amendment 4 as adopted by CAA ORS9 Decision No.36 (applicable from 20 December 2023), meeting the requirement of ICAO Annex 16 Volume II, Amendment 10 applicable 1 January 2021. o NOx standard in accordance with ICAO Annex 16 Volume II, Part III, Chapter 2, § 2.3.2 e)2)i) (CAEP/8). o HC, CO standards in accordance with ICAO Annex 16 Volume II, Part III, Chapter 2, §2.3.2. o Maximum nvPM mass concentration levels in compliance with Part III, Chapter 4, paragraph 4.2.2.1. nvPM mass and number emissions in compliance with Part III, Chapter 4, paragraph 4.2.2.2 a) 1) and 4.2.2.2 b) 1) (CAEP/11 In-Production standard.

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-1B21, LEAP-1B23, LEAP-1B25, LEAP-1B27, LEAP-1B28, LEAP-1B28B1, LEAP-1B28B2, LEAP-1B28B2C, LEAP-1B28B3, LEAP-1B28BBJ1, LEAP-1B28BBJ2	LEAP-1BxxGyy xx denotes model rating. yy denotes model configuration group number Refer to the latest revision of CFM Service Bulletin LEAP-1B 72-0187

Model	Engine identification plug reference	Model	Engine identification plug reference
LEAP-1B21	2531M61P02	LEAP-1B23	2531M61P06
LEAP-1B25	2531M61P10	LEAP-1B27	2531M61P18
LEAP-1B28	2531M61P26	LEAP-1B28B1	2531M61P27
LEAP-1B28B2	2531M61P28	LEAP-1B28B2C	2531M61P24
LEAP-1B28B3	2531M61P29	LEAP-1B28BBJ1	2531M61P14
LEAP-1B28BBJ2	2531M61P30	-	-

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), 5-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

	LEAP-1B
Length (fan case forward flange to turbine rear frame aft flange)	3147
Width (maximum envelope)	2421
Height (maximum envelope)	2256

5. Dry Weight (kg)

Weight of the dry engine, including basic engine equipment, will not exceed 2780 kg

6. Ratings (daN)

LEAP-1B Take-Off Thrust				
LEAP-1B21	LEAP-1B23	LEAP-1B25	LEAP-1B27 LEAP-1B28B2C LEAP-1B28BBJ2	LEAP-1B28 LEAP-1B28B1 LEAP-1B28B2 LEAP-1B28B3 LEAP-1B28BBJ1
11127	11524	11915	12471	13041

LEAP-1B Maximum Continuous Thrust				
LEAP-1B21	LEAP-1B23	LEAP-1B25	LEAP-1B27 LEAP-1B28B2C LEAP-1B28BBJ2	LEAP-1B28 LEAP-1B28B1 LEAP-1B28B2 LEAP-1B28B3 LEAP-1B28BBJ1
10700	11126	11547	12131	12762

(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-1B28 LEAP-1B28B2	LEAP-1B25 LEAP-1B27 LEAP-1B28B1 LEAP-1B28B3	LEAP-1B21 LEAP-1B23 LEAP-1B28B2C LEAP-1B28BBJ1 LEAP-1B28BBJ2
Factory Loadable Software P/N	2474M64P03	2474M64P04	2474M64P04 2474M64P05
Pressure Sub Systems (PSS) Software P/N	2474M65P06	2474M65P06	2474M65P06
Application Software AS1, AS2, AS4 (P2020) P/N	2628M86P02	2628M86P06	2628M86P10
Application Software AS3 (PHM) P/N	2628M87P02	2628M87P06	2628M87P10
Application Software (AML) P/N	2697M83P01	2697M83P02	2697M83P02
Health Monitoring (OMAP) Software P/N	2628M88P01	2628M88P02	2628M88P02

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

Fuel and fuel additives: Refer to the latest revision of CFM Service Bulletin LEAP-1B 73-0001 Oil: Refer to the latest revision of CFM Service Bulletin LEAP-1B 79-0001

9. Aircraft Accessory Drives

LEAP-1B						
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	CW	0.418	125 kW	106.3	60.7	10.8
Hydraulic pump	CW	0.191	15.9 m.daN	40.7	15	1.9

CW = clockwise when facing the gearbox drive pad

10. Maximum Permissible Air Bleed Extraction

LEAP-1B		
Bleed location	LP rotor speed	Airflow limit
Bypass duct	Above minimum idle	1 % of secondary airflow
HPC 4th stage	Above minimum idle	10% of primary airflow*
HPC 10th stage	Above minimum idle	15% of primary airflow*

*Absolute maximum. Refer to the LEAP-1B Installation Manual for detailed bleed schedule. 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	Maximum Continuous
LEAP-1B28, LEAP-1B28B2, LEAP-1B25, LEAP-1B27, LEAP-1B28B1, LEAP-1B28B3 (Pre-Service Bulletin LEAP-1B 72-0169)	1038 (indicated 1038)	1013 (indicated 1013)
LEAP-1B28, LEAP-1B28B2, LEAP-1B25, LEAP-1B27, LEAP-1B28B1, LEAP-1B28B3 (Post-Service Bulletin LEAP-1B 72-0169)	1060 (indicated 1038)	1040 (indicated 1013)
LEAP-1B21, LEAP-1B23, LEAP-1B28B2C LEAP-1B28BBJ1, LEAP-1B28BBJ2	1060 (indicated 1038)	1040 (indicated 1013)

Ground Start: 753 (indicated 753, Pre-Service Bulletin LEAP-1B 73-0025)
800 (indicated 753, Post-Service Bulletin LEAP-1B 73-0025)

Inflight Start: 883 (Starter Assist or Steady State Windmill)
920 (Quick Windmill Relight)
981 (High Power Fuel Cut)

All models are certified for a transitory exhaust gas temperature (EGT) exceedance at take-off of 10°C, during 30 seconds maximum. Refer to the applicable "Specific Operating Instructions" document.

1.2 Oil Temperature (°C)

Minimum for starting:	minus19 (LEAP-1B engines not compliant with CFM Service Bulletin LEAP-1B 72-0011) minus40 (LEAP-1B engines compliant with CFM Service Bulletin LEAP-1B 72-0011)
Minimum for acceleration to take-off power:	31
Maximum steady state:	140
Maximum transient (15 minutes):	155

1.3 Fuel Inlet Temperature (°C)

Minimum:	minus43
Maximum steady state:	54.5

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): 4586 (104.3 % - 100 % N1 is defined as 4397 rpm)
High pressure rotor (N2):

	Take-Off and Maximum Continuous
LEAP-1B28, LEAP-1B28B2, LEAP-1B25, LEAP-1B27, LEAP-1B28B1, LEAP-1B28B3 Pre-Service Bulletin LEAP-1B 72-0169	20171 (indicated 117.5 % - 100 % N2 is defined as 17167 rpm)
LEAP-1B28, LEAP-1B28B2, LEAP-1B25, LEAP-1B27, LEAP-1B28B1, LEAP-1B28B3 Post-Service Bulletin LEAP-1B 72-0169	19828 (indicated 117.5%)
LEAP-1B21, LEAP-1B23, LEAP-1B28B2C LEAP-1B28BBJ1, LEAP-1B28BBJ2	19828 (indicated 117.5%)

3. Pressure Limits

3.1 Fuel Pressure:

Minimum: 345 hPa (differential pressure)
Maximum: 3790 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 117.5% N2 (redline): 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 10 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

When compliant with CFM Service Bulletin LEAP-1B 71-0002, the engine is approved for ETOPS capability in accordance with CS-E 1040 amendment 3 by EASA Certificate 10062213 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.

V. Operating and Service Instructions

Manuals	LEAP-1B
Turbofan Engine Installation Manual (EIM)	CRL-2106b_1 Issue 09 Revision 0
Installation Drawing	CRL-2107b_1 Issue 00 Revision 0 CRL-2107b_2 Issue 01 Revision 0
Specific Operating Instructions (SOI)	CRL-2105b Revision 7

Instructions for Continued Airworthiness (ICA)	**LEAP-1B**
Maintenance Manual	See Aircraft Maintenance Manual (AMM)
Fault Isolation Manual	See Aircraft Fault Isolation Manual (FIM)
Engine Shop Manual (ESM)	SM.21
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 (S/B)	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-1B engine is approved for use with Boeing thrust reverser system P/N 315A6295.

Section 3 Administration

I. Acronyms and Abbreviations

Acronym / Abbreviation	Definition
EASA	European Union Aviation Safety Agency
CS-E	Certification Specification- Engines
ORS	Official Record Series
ICAO	International Civil Aviation Organisation
CAEP	Committee on Aviation Environmental Protection
nvPM	non-volatile Particulate Matter
daN	deca Newtons
HPC	High Pressure Compressor
hPa	hector Pascals
P/N	Part Number
S/B	Service Bulletin
SIN	Significant Item Number
ETOPS	Extended Twin Engine Operations

II. Type Certificate Holder Record

TCH Record	Period
CFM International SA 2, boulevard du Général Martial Valin 75015 Paris France. Design Organisation Approval No.: EASA.21J.086	Since initial issue

III. Amendment Record

TCDS Issue No.	TCDS Issue Date	Changes	TC Issue and Date
1	28 June 2024	Initial Issue	Issue 01, 28 June 2024