TYPE CERTIFICATE DATA SHEET Nº EM-2015T06

Type Certificate Holder:

GENERAL ELECTRIC COMPANY
GE AVIATION
1 Neumann Way
Cincinnati, OH 45215-6310
USA

EM-2015T06-00

Sheet 01

GENERAL ELECTRIC

GEnx-1B54/P1, GEnx-1B58/P1, GEnx-1B64/P1, GEnx-1B67/P1, GEnx-1B70/P1, GEnx-1B70/72/P1, GEnx-1B70/75/P1, GEnx-1B74/75/P1, GEnx-1B75/P1, GEnx-1B54/P2, GEnx-1B58/P2, GEnx-1B64/P2, GEnx-1B67/P2, GEnx-1B70/P2, GEnx-1B70/72/P2, GEnx-1B70/75/P2, GEnx-1B74/75/P2, GEnx-1B75/P2, GEnx-1B78/P2.

20 May 2015

Engines of models described herein conforming with this data sheet, which is part of Type Certificate No. 2015T06, 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

GEnx-1B engine is a dual rotor, axial flow, high bypass ratio turbofan. The 10-stage high pressure compressor is driven by a 2-stage high pressure turbine; a single-stage fan and 4-stage low pressure compressor is driven by a 7-stage low pressure turbine. The engine is controlled by a Full Authority Digital Engine Control (FADEC), which has an airframe connection for digital communication. An Engine Monitoring Unit (EMU) provides vibration level signals to the aircraft.

RATINGS
(See Note 1)

MODELS GEnx-1B54/P1, GEnx-1B58/P1, GEnx-1B64/P1, GEnx-1B67/P1.

Engine Thrust, at sea level, kN, (lbf.)	GEnx-1B54/P1	GEnx-1B58/P1	GEnx-1B64/P1	GEnx-1B67/P1
- Maximum Continuous - static	250.44 (56 300)	--	273.57 (61 500)	--
Fan speed, rpm	2 166	--	2 247	--
- Takeoff - 5 min	255.33 (57 400)	271.34 (61 000)	298.03 (67 000)	308.71 (69 400)
Fan speed, rpm	2 184	2 239	2 326	2360

MODELS GEnx-1B70/P1, GEnx-1B70/72/P1, GEnx-1B70/75/P1, GEnx-1B74/75/P1.

Engine Thrust, at sea level, kN, (lbf.)	GEnx-1B70/P1	GEnx-1B70/72/P1	GEnx-1B70/75/P1	GEnx-1B74/75/P1
- Maximum Continuous - static	295.80 (66 500)	--	--	305.15 (68 600)
Fan speed, rpm	2 319	--	--	2 375
- Takeoff - 5 min	321.60 (72 300)	--	--	341.18 (76 700)
Fan speed, rpm	2 401	--	--	2 496

MODELS GEnx-1B75/P1, GEnx-1B54/P2, GEnx-1B58/P2, GEnx-1B64/P2.

Engine Thrust, at sea level, kN, (lbf.)	GEnx-1B75/P1	GEnx-1B54/P2	GEnx-1B58/P2	GEnx-1B64/P2
- Maximum Continuous - static	306.04 (68 800)	250.44 (56 300)	--	273.57 (61 500)
Fan speed, rpm	2 378	2 166	--	2 247
- Takeoff - 5 min	345.18 (77 600)	255.33 (57 400)	271.34 (61 000)	298.03 (67 000)
Fan speed, rpm	2 510	2 184	2 239	2 326

MODELS GEnx-1B67/P2, GEnx-1B70/P2, GEnx-1B70/72/P2, GEnx-1B70/75/P2.

Engine Thrust, at sea level, kN, (lbf.)	GEnx-1B67/P2	GEnx-1B70/P2	GEnx-1B70/72/P2	GEnx-1B70/75/P2
- Maximum Continuous - static	273.57 (61 500)	295.80 (66 500)	--	--
Fan speed, rpm	2 247	2 319	--	--
- Takeoff - 5 min	308.71 (69 400)	321.60 (72 300)	--	--
Fan speed, rpm	2 360	2 401	--	--

"--" Same as previous model; "#" Not applicable

RATINGS (Cont.)
(See Note 1)

MODELS GEnx-1B74/75/P2, GEnx-1B75/P2, GEnx-1B78/P2.

Engine Thrust, at sea level, kN, (lbf.)	GEnx-1B74/75/P2	GEnx-1B75/P2	GEnx-1B78/P2
- Maximum Continuous - static	305.15 (68 600)	306.04 (68 800)	305.15 (68 600)
Fan speed, rpm	2 375	2 378	2 375
- Takeoff - 5 min	341.18 (76 700)	345.18 (77 600)	357.64 (80 400)
Fan speed, rpm	2 496	2 510	2 586

ENGINE CONFIGURATION
(See Note 13)

GE Part Numbers Components:

	GEnx-1B54/P1	GEnx-1B58/P1	GEnx-1B64/P1	GEnx-1B67/P1
- Fuel Metering Unit (FMU)	2122M20	--	--	--
- FADEC Hardware	2121M82	--	--	--
	2447M85	--	--	--
- FADEC Software (earliest P/N)	2124M23P13	--	--	--
- FADEC Rating Plug	2125M31P62	2125M31P08	2125M31P68	2125M31P20
- Configuration Box Engine Configuration	2400M60P10	--	--	--
- Fuel Pump	2122M22	--	--	--

	GEnx-1B70/P1	GEnx-1B70/72/P1	GEnx-1B70/75/P1	GEnx-1B74/75/P1
- Fuel Metering Unit (FMU)	2122M20	--	--	--
- FADEC Hardware	2121M82	--	--	--
	2447M85	--	--	--
- FADEC Software (earliest P/N)	2124M23P13	--	--	--
- FADEC Rating Plug	2125M31P74	2125M31P32	2125M31P80	2125M31P44
- Configuration Box Engine Configuration	2400M60P10	--	--	--
- Fuel Pump	2122M22	--	--	--

"--" Same as previous model; "#" Not applicable

ENGINE CONFIGURATION (Cont.)

(See Note 13)

GE Part Numbers Components:

	GEnx-1B75/P1	GEnx-1B54/P2	GEnx-1B58/P2	GEnx-1B64/P2
- Fuel Metering Unit (FMU)	2122M20	2459M17	--	--
- FADEC Hardware	2121M82 2447M85	2447M85	--	--
- FADEC Software (earliest P/N)	2124M23P13	2124M23P15	--	--
- FADEC Rating Plug	2125M31P50	2125M31P62	2125M31P08	2125M31P68
- Configuration Box Engine Configuration	2400M60P10	2400M60P07	--	--
- Fuel Pump	2122M22	--	--	--

	GEnx-1B67/P2	GEnx-1B70/P2	GEnx-1B70/72/P2	GEnx-1B70/75/P2
- Fuel Metering Unit (FMU)	2459M17	--	--	--
- FADEC Hardware	2447M85	--	--	--
- FADEC Software (earliest P/N)	2124M23P15	--	--	--
- FADEC Rating Plug	2125M31P20	2125M31P74	2125M31P32	2125M31P80
- Configuration Box Engine Configuration	2400M60P07	--	--	--
- Fuel Pump	2122M22	--	--	--

	GEnx-1B74/75/P2	GEnx-1B75/P2	GEnx-1B78/P2
- Fuel Metering Unit (FMU)	2459M17	--	--
- FADEC Hardware	2447M85	--	--
- FADEC Software (earliest P/N)	2124M23P15	--	--
- FADEC Rating Plug	2125M31P44	2125M31P50	2125M31P86
- Configuration Box Engine Configuration	2400M60P07	--	--
- Fuel Pump	2122M22	--	--

"--" Same as previous model; "#" Not applicable

IGNITION SYSTEM

The GEnx-1B Series engines ignition system is composed of the following:
- Two Ignition Exciters GE P/N 2121M94;
- Two Igniter Plugs GE P/N 1754M84.

EQUIPMENTS AND COMPONENTS

For details of equipment included in the Type Design Definition, refer to the applicable Installation Manual. A thrust reverser unit is not part of the engine type design. The engines are approved for operation with a thrust reverser unit.

FUEL TYPE

Fuel types and additives conforming to the GE Aviation Specification D50TF2, and GEnx-1B Service Bulletin 73-0001.

OIL TYPE

Oils Type 2 conforming to the GE Aviation Specification D50TF1 and GEnx-1B Service Bulletin 79-0001.

TEMPERATURE LIMITS

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

PRESSURE LIMITS

For fuel and oil pressure limits, see Note 3.

ROTOR SPEED LIMITS

For engine rotational speed limits, see Note 4.

AIR BLEED

For maximum permissible air bleed extraction, see Note 5.

DIMENSIONS AND WEIGHT

- Length: 4 950 mm (194.9 inches) (from fan spinner to aft centerbody flange).
- Wight: 3 533 mm (139.1 inches) (maximum envelope).
- Height: 3 485 mm (137.2 inches) (maximum envelope).
- Weight: 7 277 kg (13 552 lbs) (dry, including basic engine accessories as listed in the OEM´s engine specifications).

CENTER OF GRAVITY

GEnx-1B/P1 and GEnx-1B/P2 Series (engine only):
- Station (axial): 5 501.6 mm (216.6 inches)
- Waterline: 2 537.5 mm (99.9 inches)
- Buttline: 2 557.8 mm (100.7 inches)

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 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-approved type design, as stated in ANAC report number V.33-1070-**00** dated 20 May 2015 or further revisions.

CERTIFICATION BASIS

- GEnx-1B:

- RBAC 33, corresponding to 14 CFR Part 33, including amendments 33-1 through 33-21, inclusive, and amendment 33-23 section 33.76;
- RBAC 34, corresponding to 14 CFR Part 34, amendment 34-5, inclusive;
- GEnx-1B Fan Blade Special Condition No. 33-006-SC, raised by FAA;
- Equivalent Level of Safety (ELOS) findings, raised by FAA:
  - GEnx-1B/P1:
  - No. 8040-ELOS-12-NE01 to 14 CFR 33.27(c),
  - No. 8040-ELOS-12-NE02 to 14 CFR 33.68(a),
  - No. 8040-ELOS-12-NE05 to 14 CFR 33.77,
  - No. 8040-ELOS-12-NE03 to 14 CFR 33.87(a) and (b), and 33.93(a).
  - GEnx-1B/P2:
  - No. AT3129EN-E-P-1 to 14 CFR 33.27(c),
  - No. 8040-ELOS-08-NE05 to 14 CFR 33.77.

Model	Application	Issued TC
GEnx-1B54/P1	30 January 2015	20 May 2015
GEnx-1B58/P1	30 January 2015	20 May 2015
GEnx-1B64/P1	30 January 2015	20 May 2015
GEnx-1B67/P1	30 January 2015	20 May 2015
GEnx-1B70/P1	30 January 2015	20 May 2015
GEnx-1B70/72/P1	30 January 2015	20 May 2015
GEnx-1B70/75/P1	30 January 2015	20 May 2015

CERTIFICATION BASIS (Cont.)

Model	Application	Issued TC
GEnx-1B74/75/P1	30 January 2015	20 May 2015
GEnx-1B75/P1	30 January 2015	20 May 2015
GEnx-1B54/P2	30 January 2015	20 May 2015
GEnx-1B58/P2	30 January 2015	20 May 2015
GEnx-1B64/P2	30 January 2015	20 May 2015
GEnx-1B67/P2	30 January 2015	20 May 2015
GEnx-1B70/P2	30 January 2015	20 May 2015
GEnx-1B70/72/P2	30 January 2015	20 May 2015
GEnx-1B70/75/P2	30 January 2015	20 May 2015
GEnx-1B74/75/P2	30 January 2015	20 May 2015
GEnx-1B75/P2	30 January 2015	20 May 2015
GEnx-1B78/P2	30 January 2015	20 May 2015

NOTES

NOTE 1 The engine ratings are based on calibrated test stand performance under the following conditions;

- Sea level static, standard pressure (14,696 psia), 59°F;
- No 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

NOTE 2 Maximum Permissible Temperatures:

- GEnx-1B54, -1B58, -1B64, -1B67, -1B70:

  Indicated Turbine Exhaust Gas Temperature (T49), °C (°F):

Takeoff - 5 minutes (See Note 12)	1 035 (1 895)
30 seconds Maximum Transient	1 040 (1 904)
Maximum continuous	1 005 (1 841)
Ground starts (manual or auto)	750 (1 382)

NOTE 2 (Cont.)

In-flight starts (manual or auto)	875 (1 607)
In-flight starts (higt power fuel cut)	975 (1 787)

Oil Temperature Limits, °C (°F):

Continuous	160 (320)
Transient (15 minutes)	350 (177)

- GEnx-1B54/P1, -1B58/P1, -1B64/P1, -1B67/P1, -1B70/P1, -1B70/72/P1, -1B70/75/P1, -1B74/75/P1, -1B75P1:

Indicated Turbine Exhaust Gas Temperature (T49), °C (°F):

Takeoff - 5 minutes (See Note 12)	1 060 (1 940)
30 seconds Maximum Transient	1 065 (1 949)
Maximum continuous	1 030 (1 886)
Ground starts (manual or auto)	750 (1 382)
In-flight starts (manual or auto)	875 (1 607)
In-flight starts (higt power fuel cut)	975 (1 787)

Oil Temperature Limits, °C (°F):

Continuous	160 (320)
Transient (15 minutes)	350 (177)

- GEnx-1B54/P2, -1B58/P2, -1B64/P2, -1B67/P2, -1B70/P2, -1B70/72/P2, -1B70/75/P2, -1B74/75/P2, -1B75P2, 1B78/P2:

Indicated Turbine Exhaust Gas Temperature (T49), °C (°F):

Takeoff - 5 minutes (See Note 12)	1 065 (1 949)
30 seconds Maximum Transient	1 070 (1 958)
Maximum continuous	1 030 (1 886)
Ground starts (manual or auto)	750 (1 382)
In-flight starts (manual or auto)	875 (1 607)
In-flight starts (higt power fuel cut)	975 (1 787)

Oil Temperature Limits, °C (°F):

Continuous	160 (320)
Transient (15 minutes)	350 (177)

NOTE 3 Fuel and Oil Pressure Limits:

- Fuel Pressure Limits (measured at engine pump inlet):

The limit is from minimum fuel pressure of not less than greater of the vapor pressure plus 5.0 psi or ambient plus 5.0 psi to a maximum of 70.0 psig. For the GEnx-1B installed on the B-787, the minimum fuel pressure limit is extended down to minimum fuel pressure of 3.5 psia and maximum vapor-to-liquid ratio (v/l) of 0.45 fou up to 60 minutes followed by up to 600 minutes with minimum fuel pressure of 3.5 psia and a maximum vapor-to-liquid ratio (v/l) of 0.28.

- Oil Pressure Limits:

See Figure 8-1 of GEnx-1B Operating Instructions GEK-112857 for definition of minimum and maximum oil pressures.

NOTE 4 Maximum Permissible Rotor Speeds (rpm):

	N1 (Fan Rotor)		N2 (Core Rotor)	
	rpm	%	rpm	%
GEnx-1B54/P1, -58/P1, -64/P1, -67/P1, -70/P1, -70/72/P1, -70/75/P1, -74/75/P1, -75/P1	2 778	108.5	13 539	119.0
GEnx-1B54/P2, -58/P2, -64/P2, -67/P2, -70/P2, -70/72/P2, -70/75/P2, -74/75/P2, -75/P2, -78/P2	2 778	108.5	13 368	117.5

NOTE 5 Maximum Permissible Air Bleed Extraction:

- Applicable to engines equipped with a booster anti-ice system.

Percent Corrected Fan Speed (%N1K)	Stage 7 – Percent W25
0 to 31.3	5.0 %
31.3 to 66.4	4.7 %
> 66.4	3.3 %

Remarks: 1) 100% engine fan speed is 2 560 rpm;
2) 3.3% W25 is the maximum flow delivered to the engine inlet anti-ice system at any power setting.

NOTE 6 Aircraft Accessory Drives:

GEnx-1B54/P1, -58/P1, -64/P1, -67/P1, -70/P1, -70/72/P1, -70/75/P1, -74/75/P1, -75/P1
GEnx-1B54/P2, -58/P2, -64/P2, -67/P2, -70/P2, -70/72/P2, -70/75/P2, -74/75/P2, -75/P2, -78/P2

Accessory	Defined by	Rotation [See (a)]	Gear Ratio to Core Rotor	Drive Shaft (rpm)	Maximum Weight (Kg)	Maximum Overhung Moment (N.m)	Shear Torque (N.m)	Continuous Pad Rating (hp) [See (b)]	Overload (hp)
VFSG 1	ICNR-GE-BE059	CCW	1.1331	12 891.30	106.3 wet	194.4	2 214 ~ 2 285	676 (dual engine) 720 (single engine)	[See (c)]
VFSG 2	ICNR-GE-BE060	CCW	1.1331	12 891.30	106.3 wet	194.4	2 214 ~ 2 285	676 (dual engine) 720 (single engine)	[See (c)]
Hydraulic Pump	ICNR-GE-BE057	CCW	0.4438	5 049.10	13.74 wet	15.81 wet	297~420	62 (for /P1) 59 (for /P2)	85 (5 sec.)
Core Turn	0.5 Square Drive / Dwg-2305M71	CCW	0.6773	7 705.60	N/A	N/A	N/A	N/A	N/A

Remarks:

(a) Rotation is difined facing the pad. CCW = Counter Clockwise;
(b) Inflight, total for both VFSG´s;
(c) 1 021 hp total both drive-pads at flight idle, with no more than 528 hp on any one drive-pad for up to 1 second (single engine). 866 hp total both drive-pads at flight idle, with no more than 471 hp on any one drive-pad for up to 5 minutes (dual engine).
(d) 100 percent engine core speed is 11 377 rpm.

NOTE 7 Life limits for critical components for GEnx-1B/P1 and GEnx-1B/P2 are published in Chapter 5 of the GEnx Engine Manual GEK-112851.

The GEnx-1B cyclic life limits are based on a commercial mission cycle, which consists of a start, takeoff, climb, cruise descent, and landing. Use (or non-use) of a fan reverser for braking during landing does not affect cycle counts. Each of the following constitutes one cycle:

- a flight consisting of a takeoff and landing,
- a touch-and-go landing or simulated touch-and-go landing (no weight on wheels) for pilot training.

NOTE 8 The GEnx-1B/P1 and -1B/P2 series engines comply with RBAC 33 (corresponding to 14 CFR Part 33) Sections 33.4, Appendix A, A33.3(c), 33.71(c)(4) and 33.201, and are therefore eligible for installation on Extended Operations (ETOPS) and Early ETOPS approved airplanes. The demonstrated diversion time is 330 minutes at maximum continuous thrust plus 15 minutes at hold power and go-around power. Note that ETOPS eligibility does not constitute airplane or operational level approvals necessary to conduct ETOPS flights.

For the GEnx-1B/P1 and GEnx-1B/P2 series engines installed on B787 aircraft, the engine fuel pump must be replaced prior to the next ETOPS flight after any single suction feed operation even of duration greater than 30 minutes. Suction feed operation is defined by engine pump fuel pressure less than the greater of true vapor pressure plus 5.0 psi or ambient plus 5.0 psi.

NOTE 9 TLD - Criteria pertaining to the engine control systems' dispatch and maintenance requirements are specified in:
For the GEnx-1B/P1 and GEnx-1B/P2 series engines:

- General Electric FADEC Control System Time Limited Dispatch Summary Document GEK-114112, and
- Airworthiness Limitations Section of the GEnx Engine Manual GEK-114119.

NOTE 10 Fan Blades Repair – Approval of repairs of the fan blade composite material in the root section of the fan blade up to the inner annulus flow path line must be coordinated with the FAA Engine Certification Office. Substantiation of the repair must show that compliance to GEnx-1B Special Condition No. 33-066-SC is maintained.

NOTE 11 Icing Conditions – For the GEnx-1B/P1 and GEnx-1B/P2 series engines, the requirements and limitations for ground operation in icing conditions are specified in the Operating Instructions GEK-112857.

NOTE 12 Takeoff Time Limits – The normal 5-minute takeoff time limits may be extended to 10 minutes for engine out contingency.

NOTE 13 The following emissions standards promulgated in RBAC 34 which endorses 14 CFR Part 34, Amendment 5, effective 31 December 2012, have been complied with for the GEnx-1B/P1 and GEnx-1B/P2 series engines:

- Fuel Venting Emission Standards: § 34.10(a) and § 34.11;
- Smoke Number (SN) Emission Standards: § 34.21(e)(2);
- Carbon Monoxide (CO) Emission Standards: § 34.21(d)(1)(ii);
- Hydrocarbons(HC) Emission Standards: § 34.21(d)(1)(i);
- Oxides of Nitrogen (NOx) Emission Standards: § 34.23(b)(1).

In addition, the engine manufacturer has declared that the ICAO emissions standards identified in Annex 16, Volume II, 3rd Edition, Part III, Chapter 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 been demonstrated.

NOTE 14 The GEnx-1B/P1 and GEnx-1B/P2 series engine models are limited to installation on the Boeing B787-8 model aircraft only with respect to the installed power response characteristics.

NOTE 15 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)