**DEPARTMENT OF TRANSPORTATION**
FEDERAL AVIATION ADMINISTRATION

T00021SE
Revision 1
BOEING
787-8
September 22, 2011

## TYPE CERTIFICATE DATA SHEET T00021SE

This data sheet, which is part of Type Certificate No. T00021SE, prescribes conditions and limitations under which the product for which the type certificate was issued meets the airworthiness requirements of the Federal Aviation Regulations.

Type Certificate Holder: The Boeing Company
P.O. Box 3707
Seattle, WA 98124-2207

**I - 787-8, Transport Category, Approved August 26, 2011**

Engines: Rolls Royce PLC Turbofan Engine Models: Trent 1000-A (Engine Type Certificate No. E00076EN)

Fuel: Rolls Royce PLC Turbofan Engines:
Fuels conforming to:
ASTM D-1655 grades Jet-A and Jet A-1
MIL-T-5624 grade JP-5
MIL-T-83133 grade JP-8
GOST 10227-86 grade TS-1
are acceptable. Fuels produced to other specifications and having properties meeting the requirements of the above specifications are acceptable. The fuel and any fuel additives must conform to the relevant Engine Operating Instructions.

Engine Limits: Rolls-Royce PLC Turbofan Engines
See the FAA-approved Airplane Flight Manual for engine ratings.

Airspeed Limits: VMO/MMO = 350KEAS / 360KIAS / 0.90M.
For other airspeed limits, see the appropriate FAA-approved Airplane Flight Manual.

CG Range: See the appropriate FAA-approved Airplane Flight Manual.

Empty Weight C.G.: None

Maximum Weights: See the appropriate FAA-approved Airplane Flight Manual.

| Model | Eligible Serial Numbers |
|---|---|
| 787-8 | 34488 |

**PERTINENT DATA**

Minimum Crew: Two (2): pilot and copilot

**I. 787-8 (cont'd)**

Maximum Passengers: The maximum number of passengers approved for emergency evacuation is:
381with four pairs of exits in an (A, A, A, A) exit arrangement,
355 with four pairs of exits in a (C, A, A, A) exit arrangement,
330 with four pairs of exits in an (A, A, C, A) exit arrangement, and
300 with four pairs of exits in a (C, A, C, A) exit arrangement.
Maximum passenger capacity may be further limited by Environmental Control System ventilation per occupant requirement defined in 25.831(a).

Max. Baggage/Cargo: See appropriate FAA-approved Weight and Balance Manual.

Fuel and Oil Capacities: See appropriate FAA-approved Weight and Balance Manual.

Maximum Operating Altitude: 43,100 feet

Certification Basis: 14 CFR Part 25, Airworthiness Standards, through Amendment 25-119 and Amendments 25-120, 25-124, 25-125 and 25-128 with exceptions as noted below.

| Section No. | Title | At Amdt. 25- |
|---|---|---|
| 25.1309 | For Cargo Fire Protection Systems | 119 |

Amendment 25-118 was not published and therefore has no applicability.

14 CFR Part 26, Continued Airworthiness and Safety Improvements, through Amendment 26-5, for §§ 26.11, 26.21, 26.37, 26.43, and 26.45:

14 CFR Part 34, Fuel Venting and Exhaust Emission Requirements for Turbine Engine Powered, through Amendment 34-4. The certification basis for emissions also includes compliance to the International Civil Aviation Organization ( ICAO) Annex 16, Volume II, Amendment 6, dated July 2008.

14 CFR Part 36, Noise Standards: Aircraft Type Certification and Airworthiness Certification, through Amendment 36-28. The certification basis for noise also includes compliance to ICAO Annex 16, Volume I, Amendment 9, dated July 9, 2008.

The Following Optional Design Regulations have been complied with:

Ditching: 14 CFR §§ 25.801, 25.1411(d), (e), (f), (g) and 25.1415
Ice Protection: 14 CFR § 25.1419
ETOPS: The 787 has been evaluated in accordance with 14 CFR § 25.1535 and found suitable for 180-minute Extended Range Operations with Two-Engine Airplanes (ETOPS) when operated and maintained in accordance with Boeing Document No. D021Z002-01, "Model 787 ETOPS Configuration, Maintenance, and Procedures." This finding does not constitute approval to conduct ETOPS operations.

Exemptions from 14 CFR Part 25:

1. Grant of Exemption, § 25.562(b)(2), Relief from floor warpage testing requirements for flightdeck seats on the Boeing Model 787 series airplanes; **Exemption No. 9486**, September 11, 2007.

**I. 787-8 (cont'd)**

Exemptions (cont'd)

2. Grant of Exemption, § 25.809(a), Relief from the requirement that flightcrew emergency exits have a means to view outside conditions under all lighting situations for the Boeing Model 787 series airplanes; **Exemption No. 10114**, August 11, 2010.
3. Time Limited Grant of Exemption, § 25.809(a), Relief for a limited number of the Boeing Model 787 series airplanes from the requirement that passenger emergency exits have a means to view outside conditions under all lighting situations; **Exemption No. 10235**, April 8, 2011.
4. Partial Grant of Exemption, § 25.841(a)(2)(i)(ii), Relief for the Boeing Model 787 series airplanes from the requirement that, during a decompression caused by failures of the engines, airplane cabin pressure altitude not exceed 25,000 feet for more than 2 minutes or exceed 40,000 feet for any duration; **Exemption No. 8857**, March 30, 2007.
5. Time Limited Grant of Exemption, § 25.1309(c), Temporary relief from the requirement to provide indication of anticipated fuel system contamination to the flightcrew of Boeing Model 787-8 airplanes powered by Rolls-Royce Trent 1000 engines; **Exemption No. 10199**, January 28, 2011, and **Exemption No. 10199A**, August 18, 2011.
6. Grant of Exemption, § 25.1447(c)(1), Relief from the requirement for passenger oxygen masks to be automatically presented before the cabin pressure altitude exceeds 15,000 feet for the Boeing Model 787 series airplanes; **Exemption No. 9801**, December 12, 2008.

Equivalent Levels of Safety (ELOS) are indentified as:

| | | |
|---|---|---|
| TC6918SE-T-A-9 | §§ 25.341, 25.343, 25.345, 25.371, 25.373, 25.391 | ELOS for Gust and Continuous Turbulence Design Loads |
| TC6918SE-T-A-10 | § 25.335(b) | ELOS for Design Airspeeds |
| TC6918SE-T-A-11 | §§ 25.391, 25.393, 25.415 | ELOS Finding for the Ground Gust Requirements |
| TC6918SE-T-A-12 | § 25.331(c) | ELOS for Symmetric Maneuvering Conditions |
| TC6918SE-T-A-13 | § 25.629 | ELOS for Aeroelastic Stability |
| TC6918SE-T-CS-1 | § 25.810(a)(1)(ii) | ELOS Finding for Escape Slide Inflation Times |
| TC6918SE-T-CS-2 | § 25.811(f) | ELOS Finding for Emergency Exit Markings and Door Sill Reflectance |
| PS07-0585-CS-10 | §§ 25.811(d), 25.811(g), 25.812(b)(1)(i), and 25.812(b)(1)(ii) | ELOS Finding for Graphical Exit Signs |
| TC6918SE-T-CS-12 | § 25.791(a) | Lighted "No Smoking" Signs in Lieu of Placards |
| TC6918SE-T-CS-14 | § 25.856(b), | ELOS Finding Associated to Post-Crash Fire Survivability |
| PS07-0585-CS-18 | § 25.811(e)(4)(i), (ii), and (iii) | ELOS Finding for the Passenger Door Operational Arrow Location and Color |
| PS06-0413-CS-25 | § 25.783(e)(2) | ELOS Finding for Passenger and Large Cargo Door Indication |
| TC6918SE-T-ES-5 | § 25.831(g) | ELOS for Acceptable High Temperature Physiological Environment During Failure Conditions |
| TC6918SE-T-ES-16 | § 25.1443(c) | ELOS Finding for the Passenger Oxygen System |

**I. 787-8 (cont'd)**

ELOS (cont'd)

| | | |
|---|---|---|
| TC6918SE-T-ES-18 | § 25.1441(c) | Crew Determination of Quantity of Oxygen in Passenger Oxygen System Distribution Bottles |
| TC6918SE-T-ES-19 | § 25.841(b)(6) | ELOS Finding on Cabin Altitude Warning System for Operations into High Altitude Airports |
| TC6918SE-T-ES-20 | § 25.1443(d) | ELOS Finding for Portable Pulse Oxygen System |
| TC6918SE-T-F-4 | § 25.1517 | ELOS Finding for Rough Air Speed ($V_{RA}$) |
| TC6918SE-T-F-6 | § 25.107(e)(1)(iv) | ELOS Finding for Minimum Unstick ($V_{MU}$) Speed Margin |
| TC6918SE-T-F-14 | § 25.677(b) | ELOS Finding for Trim Displays |
| TC6918SE-T-F-17 | § 25.255 | ELOS Finding for Out-of-Trim Characteristics |
| PS06-0413-F-20 | § 25.1325(e) | ELOS Finding for the Standby Air Data System |
| PS05-0177-P-2 | § 25.981(b)(2) | ELOS Finding for the Fuel Tank Flammability Rule (FTFR). |
| TC6918SE-T-P-2 | §§ 25.933(a)(1)(i) & 25.933(a)(1)(ii) | ELOS Finding for Flight Critical Thrust Reverser |
| TC6918SE-T-P-3 | § 25.1182(a) | ELOS Finding for Fire Safety Requirements for the Aft Strut Fairing Compartment |
| TC6918SE-T-P-13R1 | Part 25 subpart E, F, and G | ELOS Finding for the Auxiliary Power Unit (APU) Installation |
| TC6918SE-T-P-17 | § 25.934 | ELOS Finding for the Engine and Thrust Reverser System Testing |
| TC6918SE-T-P-19 | §§ 25.1023(b) and 25.1121(c) | ELOS Finding for Auxiliary Power System |
| TC6918SE-T-P-20 | §§ 25.997 and 25.1305(c)(6) | ELOS Finding for Warning Means for Engine Fuel Filter Contamination |
| TC6918SE-T-P-27 | § 25.1145(a) | Engine Igniter Flight-deck Switch Configuration |
| TC6918SE-T-SA-7 | §§ 25.1301 and 25.1309 | ELOS Finding for use of ARAC Recommended Revision To §§ 25.1301, 25.1309, and 25.1310 |
| TC6918SE-T-SA-10 | § 25.1459(a)(2) | ELOS Finding for Flight Recorders |
| TC6918SE-T-SA-11 | § 25.1303(c)(1) | ELOS Finding for Overspeed Aural Warning |
| TC6918SE-T-SA-29 | § 25.1333(a) | ELOS Finding for Instrument Systems |
| TC6918SE-T-SE-14 | § 25.1351(b)(5) | ELOS Finding for the Flight Control Electronics DC Power System |
| TC6918SE-T-SF-1 | § 25.671(c)(2) | ELOS Finding for Flight Control System Failure Criteria |
| TC6918SE-T-SF-5 | § 25.777(e) | ELOS Finding on the Wing Flap Control Lever |

Special Conditions with respect to the following subjects apply to the Model 787-8:

| SC No., | Subject |
|---|---|
| 25-348-SC | Composite Wing and Fuel Tank Structure—Fire Protection Requirements |
| 25-354A-SC | Interaction of Systems and Structures, Electronic Flight Control System-Control Surface Awareness, High Intensity Radiated Fields (HIRF) Protection, Limit Engine Torque Loads for Sudden Engine Stoppage, and Design Roll Maneuver Requirement |

**I. 787-8 (cont'd)**

Special Conditions (cont'd)

| | |
|---|---|
| 25-355-SC | Reinforced Flightdeck Bulkhead |
| 25-356-SC | Systems and Data Networks Security-Isolation or Protection From Unauthorized Passenger Domain Systems Access |
| 25-357-SC | Systems and Data Networks Security-Protection of Airplane Systems and Data Networks from Unauthorized External Access |
| 25-359-SC | Lithium Ion Battery Installation |
| 25-360-SC | Composite Fuselage In-Flight Fire/Flammability Resistance |
| 25-362-SC | Crashworthiness Emergency Landing Conditions |
| 25-363-SC | Tire Debris Penetration of Fuel Tank Structure |
| 25-365-SC | Operation Without Normal Electrical Power |
| 25-370-SC | Seats With Non-Traditional, Large, Non-Metallic Panels |
| 25-414-SC | Lightning Protection of Fuel Tank Structure to Prevent Fuel Tank Vapor Ignition |

**ADDITIONAL DESIGN REQUIREMENTS AND CONDITIONS:**

The following design details or information must be maintained to ensure that an unsafe design condition is not present:

In-flight Engine Restart

The Boeing Model 787 engines incorporate numerous technological advances intended to increase efficiency and reliability. However, some of these features have the potential to decrease engine in-flight starting performance relative to the engines envisioned when the applicable sections of 14 CFR Part 25 were promulgated. The following criteria for engine in-flight starting performance must be met to ensure that the level of safety intended by §§ 25.903(e) and 25.1351(d) is maintained on airplanes powered by current technology engines.

1. Appropriate procedures for restarting the engines in the following cases must be provided in the airplane flight manual (AFM):
   a. a fuel cut during climb after the takeoff phase (defined as the flight phase from start of the takeoff roll to 1500 feet above the runway altitude),
   b. loss of all alternating current (AC) power in combination with an all engine flameout, and
   c. all engine flame-out at or below 20,000 feet.

Uncontrollable High Engine Thrust or Power

Numerous single and anticipated combinations of failures within traditional engine control systems result in losing the normal means to control the magnitude and/or direction of engine thrust (power). For some of these anticipated failure conditions, the flight crew cannot be relied upon to recognize and mitigate the failures before they become hazardous or catastrophic. The following design features are required to ensure an unsafe condition does not exist with regards to the loss of the normal means to control engine thrust (power).

1. Dual channel full authority digital electronic (engine) control (FADEC) which monitors engine conditions to trim fuel flow,
2. Thrust control malfunction accommodation to address conditions where fuel metering is not responding to pilot input on the ground, and
3. Redundant mechanical control interface between the flight crew and the FADEC.

Engine Rotor-Lock Evaluation

Service experience has shown that some engines are susceptible to a condition known as rotor-lock following an in-flight shut-down from power settings ranging from high power to idle. The engine design must be free from engine rotor lock.

**I. 787-8 (cont'd)**

Fuel Feed System Icing Threats

Under certain conditions, over a period of low fuel temperatures, ice may accumulate in the airplane fuel feed system and then be fed or released downstream to the engine, and result in failure to achieve a commanded thrust level, and this is considered an unsafe condition. As such, each aircraft/engine and aircraft/auxiliary power system (APS) fuel feed system must either be designed to prevent an accumulation of ice anywhere within the fuel tank and feed system from being
released into the engine and APS fuel system, or be designed so no loss of engine thrust occurs due to release of any ice accumulation anywhere within the airplane/engine operating envelope.

Return Landing Capability

Examination of takeoff performance capabilities of current and proposed large transport aircraft indicates that requirements other than climb performance should be addressed when considering safe return operations and the need for a fuel jettison system. The 787 fuel jettison system must be installed, and the jettison rate should be such that there is adequate return to landing capability, when considering the following items, in a 30-minute flight with 15 minutes of active fuel jettisoning in conjunction with operational procedures:

1. Exceedence of certificated maximum brake energies;
2. Exceedence of tire speed limits;
3. Controllability (e.g., hydraulic or flight control system failures);
4. Margins to flap placard, or load relief operation speeds in turbulent air;
5. Climb capability, engine inoperative procedure;
6. Landing distances (actual distances, including contaminated runway).

**THE FOLLOWING INFORMATION AND NOTES APPLY TO ALL MODELS UNLESS OTHERWISE NOTED**:

Certification Maintenance Requirements (CMRs): See FAA-approved Certification Maintenance Requirements, document number D001Z009-03-03.

Production Basis: Production Certificate No. 700. See Note 4 and Note 8.

Leveling Means: A plumb bob attachment and leveling provision scale are provided in the left main gear wheel well.

Datum: Sta 0.0, located 55.8 in forward of airplane nose (B.S. 55.8).

Mean Aerodynamic Chord (MAC): 246.9 inches

Control Surface Movements: To insure proper operation of the airplane, the movement of the various control surfaces must be carefully controlled by proper rigging of the flight control systems. The airplane must, therefore, be rigged according to the following FAA-approved data in the following Boeing documents:

B787-A-27-11-00-18A-270B-A - Aileron – Rigging
B787-A-27-11-00-19A-270B-A - Flaperon – Rigging
B787-A-27-31-00-27A-270B-A - Elevator – Rigging
B787-A-27-21-00-31A-270B-A - Rudder – Rigging
B787-A-27-51-00-28A-270B-A - Trailing Edge Flap System – Rigging
B787-A-27-61-00-17A-270B-A - Spoiler – Rigging
B787-A-27-81-00-24A-270B-A - Leading Edge Slat System – Rigging

**THE FOLLOWING INFORMATION AND NOTES APPLY TO ALL MODELS UNLESS OTHERWISE NOTED (cont'd)**:

Maximum control surface travel:

| Control Surface | Maximum TED/TEL (Deg.) | Maximum TEU/TER (Deg.) |
|---|---|---|
| Ailerons | 16.94° | -32.20° |
| Elevators | 26.93° | -32.54° |
| Flaperon | 39.26° | -31.61° |
| Spoilers 6, 7, 8, 9 | -13.21° | 60.95° |
| Spoilers 1, 2, 3, 12, 13, 14 | -13.24° | 60.77° |
| Spoilers 4, 5, 10, 11 | -13.16° | 63.00° |
| Rudder | 32.10° | -30.12° |
| Horizontal Stabilizer | 4.25° | -12.75° |
| Inboard Flaps | -2.80° | 41.20° |
| Outboard Flaps | -2.00° | 41.20° |
| Inboard Slats | -0.34° | 23.47° |
| Outboard Slats | -0.40° | 30.16° |

Trailing Edge Down = TED
Trailing Edge Up = TEU
Trailing Edge Left = TEL
Trailing Edge Right = TER
Degrees = Deg.

Required Equipment — The basic required equipment as prescribed in the applicable airworthiness regulations (see Certification Basis) must be installed in the aircraft for certification.

Service Information: — Boeing Document B787-81205-Z0210-00, "787-8 Structural Repair Manual" is FAA-approved; Service Bulletins and other service information, when FAA-approved, will contain a statement declaring FAA approval.

Note 1 — A current Weight and Balance Report, Boeing Document D043Z580-aaaa-xxxxx (where aaaa is the owner identifier and xxxxx is the aircraft serial number) must be provided for each aircraft at the time of original airworthiness certification and at all times thereafter, except in the case of the operator having an FAA-approved loading system for weight and balance control.

Note 2 — Airplane operation must be in accordance with the FAA-approved Airplane Flight Manual, Boeing Document D631Z003. All placards required by either the FAA-approved Flight Manual, the applicable operating rules, or the Certification Basis must be installed in the airplane.

Note 3 — To maintain compliance with Type Certification requirements of the 787 airplane, each operator must incorporate into their airline's FAA-approved maintenance program the applicable items from the following FAA-approved documents (as cited in Section 9 of the 787 Maintenance Planning Data, Boeing Document D011Z009-03):

**THE FOLLOWING INFORMATION AND NOTES APPLY TO ALL MODELS UNLESS OTHERWISE NOTED (cont'd)**:

| | |
|---|---|
| D011Z009-03-01, | 787 Airworthiness Limitations (AWLs). Contains required structural inspections and the retirement times for structural safe-life and life-limited parts. Also contains required retirement times for systems life-limited parts and other systems limitations. |
| D011Z009-03-02, | 787 Airworthiness Limitations (AWLs) – Line Number Specific. Existing structures AWLs that were impacted by airplane production non-conformances may result in airplane specific revised inspection requirements and/or inspection intervals. |
| D011Z009-03-03, | 787 Certification Maintenance Requirements (CMRs). Required periodic tasks to specific Systems installations. |
| D011Z009-03-04, | 787 Special Compliance Items (SCIs) /Airworthiness Limitations. This document lists and provides instructions for Airworthiness Limitation Instructions (ALIs) and Critical Design Configuration Control Limitations (CDCCLs) required to comply with 14 CFR Part 25.981. |

Note 4 The following Aircraft Serial Numbers were produced under the Type Certification only:
787-8:
40693, 40694, 40695, 34486, 34832, & 36278.

Note 5 Installations using quick release hardware to install commodities such as galleys, closets, lavatories and stowage bins in adaptable zones in the passenger cabin shall be shown compliant to 25.561(c)(2).

Note 6 The Model 787 has been approved to operate in "Reduced Vertical Separation Minimum" (RVSM) airspace. Continued airworthiness and operational approval aspects of RVSM must be constructed according to Advisory Circular (AC) 91-RVSM, titled "Approval of Aircraft and Operators for Flight in Airspace Above Flight Level (FL) 290 Where a 1,000 Foot Vertical Separation Minimum is Applied."

Note 7 EASA has found the model 787-8 to be compliant with the International Civil Aviation Organization ( ICAO) emissions requirements, Annex 16, Volume II, Amendment 6, dated July 2008, and with the ICAO noise requirements, Annex 16, Volume I, Amendment 9, dated July 9, 2008.

Note 8 Production Certificate No. 700 was amended to include the 787-8 and issued. Boeing is authorized to issue airworthiness certificates under the Organization Delegation Authorization (ODA) Procedures of 14 CFR part 183, subpart D, and FAA Order 8100.15A.

….END….