European Aviation Safety Agency

EASA

TYPE CERTIFICATE DATA SHEET

Number: E.111
Issue: 02
Date: 29 September 2014
Type: Rolls-Royce plc
Trent XWB series engines

Models:

Trent XWB-75
Trent XWB-79
Trent XWB-79B
Trent XWB-84

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I. General

1. Type/Models:

Trent XWB / Trent XWB-75, Trent XWB-79, Trent XWB-79B, Trent XWB-84

2. Type Certificate Holder:

Rolls-Royce plc
PO Box 31
Derby DE24 8BJ
United Kingdom

Design Organisation Approval No.: EASA.21J.035

3. Manufacturer:

Rolls-Royce plc

4. EASA Certification Application Date: 16 June 2008

5. Certification Reference Date: 1 October 2010

6. EASA Certification Date: 07 February 2013

II. Certification Basis

1. EASA Certification Basis:

1.1 Airworthiness Standards:

- CS-E amendment 2, effective 18 December 2009 as issued by EASA Decision N°2009/18/R on 11 December 2009
- CS-E 1040 ETOPS amendment 3, effective 23 December 2010 as issued by EASA Decision N°2010/015/R on 16 December 2010

1.2 Special Conditions:

- None

1.3 Equivalent safety findings:

- CS-E 790(a)(1) "Ingestion of Large Hailstones"
- CS-E 740 "Endurance tests"
- CS-E 840 & 850 "HP Rotor "Rotor Integrity" compliance"

1.4 Deviations:

- None

1.5 Environmental protection requirements:

- ICAO Annex 16 Volume II, third edition, including Amendment 7, effective 17 November 2011, as applicable to turbofan engines. NOx Standard in accordance with Part III, Chapter 2, § 2.3.2, e) (CAEP/8)

III. Technical Characteristics

1. Type Design Definition:

The certified engine configurations are defined in the following Drawing Introduction Sheet (DIS) or later approved issues:

- Trent XWB-75 DIS 2304 Issue 3
- Trent XWB-79 DIS 2338 Issue 3
- Trent XWB-79B DIS 2339 Issue 3
- Trent XWB-84 DIS 2306 Issue 3

See note 06

2. Description:

Three-shaft, high bypass ratio, axial flow, turbofan with Low Pressure (LP), Intermediate Pressure (IP) and High Pressure (HP) compressors driven by separate turbines through coaxial shafts:

- single stage LP compressor (fan), 8-stage IP compressor (IPC), 6-stage HP compressor (HPC)
- annular combustor with 20-off fuel spray nozzles
- single stage HP turbine (HPT), 2-stage IP turbine (IPT), 6-stage LP turbine (LPT)
- dual channel full authority digital engine control (FADEC).

The LP compressor (Fan) diameter is 3.00m (118”). The LP and IP assemblies rotate in a counter clockwise direction; the HP assembly rotates clockwise, when viewed from the rear of the engine. The engine FADEC has an airframe interface for digital bus communications. An Engine Monitor Unit (EMU) provides vibration signals to the aircraft.

3. Equipment:

The engine starter is part of the engine type design. Refer to the engine Drawing Introduction Sheet for details. The Thrust Reverser Unit is not part of the engine type design.

See note 04

4. Dimensions:

- Overall Length: 5812 mm (228.8 inches)
  Length - tip of spinner minus rubber tip to rear of Cold Nozzle

- Maximum Radius: 2001 mm (78.8 inches)
  Radius - from centre line, not including drains mast

5. Weight:

- Maximum dry engine weight: 7277 kg (not including fluids, nacelle and aircraft interface parts)

6. Ratings:

	Thrust, kN (lbf)			
	Trent XWB 75	Trent XWB 79	Trent XWB 79B	Trent XWB 84
Net Take-off (5 minutes)	330.0 (74,200)	351.0 (78,900)	351.0 (78,900)	374.5 (84,200)
Equivalent Bare Engine Take-Off	334.0 (75,094)	355.2 (79,845)	355.2 (79,845)	379.0 (85,213)
Net Maximum Continuous	296.3 (66,600)	317.6 (71,400)	317.6 (71,400)	317.6 (71,400)
Equivalent Bare Engine Maximum Continuous	299.9 (67,414)	321.4 (72,264)	321.4 (72,264)	321.4 (72,264)

See notes 1 and 2

7. Control System:

The software is part of the engine Type Design – As defined in DIS issue 3:

- Engine Electronic Control: Version XWB3.5.3 P/N RRY2FXWB0030008
- Engine Monitoring Unit: Version EX5.0 P/N RRY57M3A0000023

The control and monitoring system software meets the following levels according to EUROCAE ED-12B / RTCA DO178B:

- Engine Electronic Control is designated Level “A”.
- Engine Monitoring Unit is designated Level “E”, except that the flight deck vibration display is level “C”.

8. Fluids

8.1 Fuel and Additives:
Refer to the applicable engine “Operating Instructions” document.

8.2 Oil:
Refer to the applicable engine “Operating Instructions” document.

9. Aircraft Accessory Drives:

Drive	Rotation	Gear ratio / HP rotor	Shear Torque (Nm)
Aircraft Hydraulic Generation (2 drives)	CCW	0.363	974
Aircraft Electrical Generation (front)	CCW	1.726	612.2 – 703.9
Aircraft Electrical Generation (rear)	CCW	1.762	612.2 – 703.9

CCW = Counter Clockwise when looking at the gearbox drive pad. Refer to the applicable engine “Engine Installation Manual” document for installation details and operational requirements.

10. Maximum Permissible Air Bleed Extraction:

%W26 and %W30 represent the percentage of air mass-flow through the core of the engine at the HPC entry (location 26) and at the HPC exit (location 30). Bleed flows vary linearly between the points listed.

10.1 Cabin Environmental Bleed Air System (EBAS):

Maximum Normal Cabin Air Bleed Schedule		
TET (k)	%W26	Source
1000	11.0	HPC 6
1415	11.0	HPC 6
1716	4.9	HPC 6 / IPC 8
>1786	2.1	IPC 8

Maximum Abnormal Cabin Air Bleed Schedule		
TET (k)	%W26	Source
1000	14.6	HPC 6
1485	14.6	HPC 6
1685	12.8	HPC 6
1720	10.4	HPC 6 / IPC 8
1750	6.5	IPC 8
>1815	3.7	IPC 8

10.2 Nacelle Anti-Icing (NAI) Bleed Air System :

Nacelle Anti-Icing Bleed Schedule		
TET (k)	%W30	Source
1000	1.00	HPC 3
1256	1.00	HPC 3
1685	0.97	HPC 3
>1815	0.45	HPC 3

IV. Operational Limits:

1. Temperature Limits:

1.1 Turbine Gas Temperature (°C):
Turbine Gas Temperature (TGT) is measured by thermocouples positioned at the stage 1 Nozzle Guide Vane of the LP Turbine.

	Maximum TGT Trimmed (Displayed) (°C)
Take-Off (5 minutes)	900
Maximum Continuous	850
Ground start and shutdown	700
In-flight relight	900
Maximum exhaust gas over temperature (*)	920

(*) The engine is approved for a maximum exhaust gas over temperature for inadvertent use for periods of up to 20 seconds without requiring maintenance action. The cause of the over temperature must be investigated and corrected.

1.2 Oil Temperature (°C):

At the oil tank outlet:

Minimum for starting	minus 40
Minimum for acceleration to power	+ 50
Maximum Continuous	+ 180

1.3 Fuel Inlet Temperature (°C):

At the pylon interface point:

Minimum in flight	minus 54 (or fuel freeze point, whichever is higher)
Minimum for ground starting	minus 54 (or fuel freeze point, whichever is higher)
Maximum	+ 55

Refer to the applicable engine “Installation Manual” document for additional information.

1.4 Engine Equipment Temperatures:
Refer to the applicable engine “Installation Manual” document.

2. Rotational Speed Limits (rpm):

	Maximum Rotational Speeds		
	LP Rotor (N1)	IP Rotor (N2)	HP Rotor (N3)
Take-Off (5 minutes)	2649 (98.1%)	8298 (101.2%)	12361 (98.1%)
Maximum Continuous	2614 (96.8%)	8143 (99.3%)	12159 (96.5%)
Reference speed (100%)	2700	8200	12600

Stabilised operation in the speed range 70.6% to 80.6% N1 (ISA day) is not permitted during all ground operations. The EEC software includes a logic which does not permit stabilised operation in this speed range as appropriate for the ambient conditions. However, passing through the above speed range, while increasing or decreasing thrust is permitted.

3. Pressure Limits:

3.1 Fuel Pressure Limits (measured at pylon interface):

Minimum absolute	34.5 kPa (5 psi) + Fuel True Vapour Pressure
Maximum gauge pressure - Transient conditions due to high power shut down	2517 kPa (365 psi)
Maximum gauge pressure - Transient conditions when the engine is running	1276 kPa (185 psi)
Maximum gauge pressure - Thermal relief after Engine shut down	689 kPa (100 psi)
Maximum gauge pressure - Steady state conditions	483 kPa (70 psi)

3.2 Oil Pressure Limits:

	Minimum oil pressure kPa (psid)
From Ground Idle to 70% N3	172.4 (25)
From 70% to 92.5% N3	Increasing Linearly to 330.9 (48)
From 92.5% to 96% N3	Increasing Linearly to 517.1 (75)
From 96% to 97% N3	517.1 (75)
From 97% to 97.5% N3	Increasing Linearly to 655.0 (95)
From 97.5% and above	655.0 (95)

4. Installation Assumptions:

Refer to the applicable engine "Installation Manual" document.

5. Time Limited Dispatch:

The engine is approved for Time Limited Dispatch in accordance with CS-E 1030 by EASA Certificate 10050644 dated 26 September 2014 (EEC software version XWB3.5.3 and later approved revisions). The maximum rectification period for each dispatchable state is specified in the Airworthiness Limitations Section of the applicable "Time Limits Manual".

6. ETOPS Capability:

The engine (DIS issue 3 and later approved revisions) is approved for ETOPS capability in accordance with CS-E1040 amendment 3 by EASA Certificate 10050670 dated 29 September 2014 for a Maximum Approved Diversion Time of 405 minutes at Maximum Continuous thrust plus 15 minutes at hold thrust. ETOPS does not require any special engine limitation, marking, placard, or configuration. Engine Condition Monitoring according to task TRENTXWB-A-77-34-00-00A01-370A-A is required. This approval does not constitute an approval to conduct ETOPS operations.

V. Operating and Service Instructions

Installation Manual	DNS184155
Operating Instructions	OI-TRENT-XWB – A350
Engine Manual	TRENTXWB-K0680-EMAN0-01
Time Limits Manual	TRENTXWB-K0680-TIME0-01
Cleaning, Inspection and Repair Manual	TRENTXWB-K0680-CIRM0-01
Check and Rectify Manual	TRENTXWB-K0680-CARM0-01
Illustrated Parts Catalogue	TRENTXWB-K0680-EIPCB-01
Maintenance Manual	Airbus A350 Customer Aircraft Maintenance Manual
Service Bulletins	Trent XWB — as required

VI. Notes

1. 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.

2. The Equivalent Bare Engine Take-off and Maximum Continuous thrusts are derived from the approved Net Take-off and Net Maximum Continuous thrust by excluding the losses attributable to the inlet, cold nozzle, hot nozzle, by-pass duct flow leakage and the after body. No power off-takes are assumed.

3. The EASA approved Airworthiness Limitations Section of the Instructions for Continued Airworthiness is published in the applicable “Time Limits Manual”.

4. This engine is approved for use with Goodrich thrust reverser system P/N 351T3000-503. Maximum reverse thrust should not be used below 60 KCAS when idle reverse thrust should be promptly selected. Reverse thrust should be fully deselected below 40 KCAS.

5. The engine may be used in ambient temperatures up to ISA +40°C. Refer to the applicable “Installation Manual” for details of the Operating Envelope, including the air inlet distortion at the engine inlet.

6. In issue 02 of this TCDS, the DIS issue 3 engine configuration approved by EASA Certificate 10050669 dated 29 September 2014 is replacing the originally certified DIS issue 2 configuration. No engines were produced to DIS 2.
