

U.S. DEPARTMENT OF TRANSPORTATION  FEDERAL AVIATION ADMINISTRATION  TYPE CERTIFICATE DATA SHEET  E00076EN	TCDS NUMBER E00076EN  DATE: August 7, 2007  ROLLS-ROYCE plc  MODELS: Trent 1000-A      Trent 1000-G Trent 1000-C      Trent 1000-H Trent 1000-D Trent 1000-E
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Engines of models described herein conforming with this data sheet (which is part of Type Certificate Number E00076EN) and other approved data on file with the Federal Aviation Administration, meet the minimum standards for use in certificated aircraft in accordance with pertinent aircraft data sheets and applicable portions of the Federal Aviation Regulations, provided they are installed, operated, and maintained as prescribed by the approved manufacturer's manuals and other approved instructions.

TYPE CERTIFICATE (TC) HOLDER: Rolls-Royce plc  
 PO Box 31  
 Derby, DE24 8BJ  
 United Kingdom

I. MODELS	Trent 1000-A	Trent 1000-C	Trent 1000-D	Trent 1000-E	Trent 1000-G	Trent 1000-H									
TYPE	<p>The engine is a three shaft high bypass ratio, axial flow, turbofan with low pressure, intermediate pressure and high pressure compressors driven by separate turbines through coaxial shafts. The LP compressor fan diameter is 112 inches with a swept fan blade and outlet guide vanes. The combustion system consists of a single annular combustor with 18 fuel spray nozzles. The LP and IP assemblies rotate independently in a counter clockwise direction, the HP assembly rotates clockwise, when viewed from back of the engine looking forward. The compressor and turbine have the following features:</p> <table style="width: 100%; border: none;"> <tr> <td style="text-align: center;"><u>Compressor</u></td> <td style="text-align: center;"><u>Turbine</u></td> </tr> <tr> <td style="text-align: center;">LP - single stage</td> <td style="text-align: center;">LP - 6 stage</td> </tr> <tr> <td style="text-align: center;">IP - 8 stage</td> <td style="text-align: center;">IP - single stage</td> </tr> <tr> <td style="text-align: center;">HP - 6 stage</td> <td style="text-align: center;">HP - single stage</td> </tr> </table> <p>The engine control system utilizes an electronic engine controller (EEC) which has an airframe interface for digital bus communications. An engine monitoring unit (EMU) is fitted to provide vibration signals to the aircraft.</p>							<u>Compressor</u>	<u>Turbine</u>	LP - single stage	LP - 6 stage	IP - 8 stage	IP - single stage	HP - 6 stage	HP - single stage
<u>Compressor</u>	<u>Turbine</u>														
LP - single stage	LP - 6 stage														
IP - 8 stage	IP - single stage														
HP - 6 stage	HP - single stage														
RATINGS (See NOTE 1)															
Takeoff (5 min) Thrust, (net) - lbf (See NOTE 5)	69,194	74,511	74,511	62,264	72,066	63,897									
Maximum continuous Thrust, (net) - lbf	64,722	69,523	69,523	61,758	64,722	61,758									
Equivalent bare engine Takeoff thrust – lbf	69,885	75,239	75,239	62,906	72,777	64,551									
Equivalent bare engine Maximum continuous- lbf	65,382	70,217	70,217	62,397	65,382	62,397									

I. MODELS	Trent 1000-A	Trent 1000-C	Trent 1000-D	Trent 1000-E	Trent 1000-G	Trent 1000-H	

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REV.	-	-	-	-	-	-	-

LEGEND: "-" INDICATES "SAME AS PRECEDING MODEL"  
 "---" INDICATES "NOT APPLICABLE"

<p><b>PRINCIPAL DIMENSIONS, inches</b></p> <p>Length – tip of spinner minus rubber tip to rear of cold nozzle.</p> <p>Radius – from centerline not including drain mast</p>	<p>186.4</p> <p>74.8</p>	<p>--</p> <p>--</p>					
<p><b>CENTER OF GRAVITY, inches</b></p> <p>From center of front engine mount. (power plant station 3000mm)</p> <p>From Horizontal Centerline</p> <p>From Vertical Centerline</p>	<p>30.2</p> <p>0.8</p> <p>-3.5</p>	<p>--</p> <p>--</p> <p>--</p>					
<p><b>WEIGHT Dry Basic Engine (lbs)</b></p>	<p>12,710</p>	<p>--</p>	<p>--</p>	<p>--</p>	<p>--</p>	<p>--</p>	<p>--</p>
<p><b>ENGINE PARTICULARS BUILD STANDARD RR Drawing Introduction Sheet (DIS)</b></p>	<p>2286 Issue 2</p>	<p>2287 Issue 2</p>	<p>2288 Issue 2</p>	<p>2289 Issue 2</p>	<p>2291 Issue 2</p>	<p>2292 Issue 2</p>	

<b>APPROVED FUELS</b>	See Engine Operating Instructions for approved fuels and additives.
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<b>APPROVED OILS</b>	See Engine Operating Instructions for approved oils.
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<b>OIL CONSUMPTION</b>	Maximum 0.6 U.S. Quarts per hour.
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<b>EQUIPMENT</b>	<p>For details of equipment included in the type design definition refer to the Installation manual. For details of equipment supplied by the Airframe TC holder, refer to the installation manual. A thrust reverser unit is not part of the engine type design and is certified as part of the aircraft type design.</p> <p>The engine is not approved for operation with at thrust reverser unit.</p>
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CERTIFICATION BASIS	<p><u>Airworthiness Standards:</u> FAR 33 effective February 1, 1965, as amended by FAR 33-1 through 33-21.</p> <p><u>Emissions Standards:</u> 14 CFR part 34, effective September 10, 1990, as amended by 34-1 through 34-3 and 40 CFR part 87, effective December 19, 2005. In addition the engine meets ICAO environmental standards defined in Annex 16, amendment 5, dated November 24, 2005.</p> <p>Pursuant to FAR 21.29(a)(1)(ii), the Type Certificate was issued in validation of the European Aviation Safety Agency (EASA) Certification Standards CS-E, issue 24 October 2003 which were found to provide a level of safety equivalent to that provided by FAR 33, Amendment 33-21.</p> <table border="1"> <thead> <tr> <th><u>MODEL</u></th> <th><u>APPLICATION DATE</u></th> <th><u>ISSUED/REVISED</u></th> <th><u>DELETED</u></th> </tr> </thead> <tbody> <tr> <td>Trent 1000-A</td> <td>December 10, 2004</td> <td>August 7, 2007</td> <td></td> </tr> <tr> <td>Trent 1000-C</td> <td>December 10, 2004</td> <td>August 7, 2007</td> <td></td> </tr> <tr> <td>Trent 1000-D</td> <td>December 10, 2004</td> <td>August 7, 2007</td> <td></td> </tr> <tr> <td>Trent 1000-E</td> <td>December 10, 2004</td> <td>August 7, 2007</td> <td></td> </tr> <tr> <td>Trent 1000-G</td> <td>December 10, 2004</td> <td>August 7, 2007</td> <td></td> </tr> <tr> <td>Trent 1000-H</td> <td>December 10, 2004</td> <td>August 7, 2007</td> <td></td> </tr> </tbody> </table>	<u>MODEL</u>	<u>APPLICATION DATE</u>	<u>ISSUED/REVISED</u>	<u>DELETED</u>	Trent 1000-A	December 10, 2004	August 7, 2007		Trent 1000-C	December 10, 2004	August 7, 2007		Trent 1000-D	December 10, 2004	August 7, 2007		Trent 1000-E	December 10, 2004	August 7, 2007		Trent 1000-G	December 10, 2004	August 7, 2007		Trent 1000-H	December 10, 2004	August 7, 2007	
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IMPORT REQUIREMENTS	<p>To be considered eligible for installation on U.S. registered aircraft, each new engine to be exported to the United States with UK CAA or EASA airworthiness approval shall have a Joint Aviation Authorities (JAA) or EASA Form 1, Authorized Release Certificate. The JAA or EASA Form 1 should state that the engine conforms to the type design approved under the U.S. Type Certificate E00076EN, is in a condition for safe operation and has undergone a final operational check.</p> <p>Additional guidance is contained in FAA Advisory Circular 21-23, "Airworthiness Certification of Civil Aircraft, Engines, Propellers, and Related Products Imported into the United States."</p>
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#### NOTES

**NOTE 1.** The engine ratings are based on sea-level static, International Standard Atmosphere (ISA) conditions. The Equivalent Bare Engine Take-off Thrust quoted is derived from the approved Net Take-off Thrust by excluding the losses attributable to the inlet, cold nozzle, hot nozzle, by-pass duct flow leakage and the afterbody. No power take-offs are assumed. All models are flat rated to ISA + 15 degs C except the Trent 1000D which is flat rated to ISA +20 degs C.

**NOTE 2.** MAXIMUM PERMISSIBLE ENGINE ROTOR SPEEDS (%)

100% HP = 13,391 rpm; 100% IP = 8937 rpm; 100% LP = 2683 rpm

Takeoff (5 minutes, see NOTE 5)

HP	95.0%
IP	99.0%
LP	98.0%

Maximum Continuous

HP	95.0%
IP	98.5%
LP	98.0%

For static (below 20kts) ground operation, temperature dependent LP rotor speed keep out zones apply. The engine should be accelerated through this restriction in 5 seconds or less. Refer to the Engine Operation Instructions for details of the procedure.

The maximum LP speed during all aircraft operations with forward airspeed less than 60 kts must not exceed 96.5%.

The Maximum Continuous speeds noted above are not displayed as limitations on the Aircraft flight deck.

**NOTE 3. TEMPERATURE LIMITS****TURBINE GAS TEMPERATURE - trimmed (TGT) °C**

Measured by thermocouples positioned at the 1<sup>st</sup> stage Nozzle Guide Vane of the LP Turbine.

Maximum Ground Starting and Shutdown	700
Maximum Inflight Relights	900
Maximum Takeoff (5 min., see NOTE 5.)	900
Maximum Continuous (unrestricted)	850
Maximum Over-temperature (see NOTE 11 )	920

**FUEL °C**

Measured at the inlet to the engine.

Minimum Fuel Temperature	-25
Maximum Fuel Temperature	45

**OIL °C**

Combined scavenge temperature.

Minimum for starting:	-10
Minimum for acceleration to power:	80
Maximum for unrestricted use:	185

**NOTE 4. PRESSURE LIMITS****FUEL**

Minimum absolute pressure at engine inlet: 5 psi + Vapor Pressure

Maximum absolute pressure at the pylon interface:

Continuous Idle and below	70 psi
Continuous above Idle	45 psi
Transient	140 psi
Static	170 psi

**OIL**

Minimum Ground idle to 74% IP rpm	30 psi
Minimum Above 100% IP rpm	75 psi

**NOTE 5.** The take-off rating and its associated operating limitations may be used for up to 10 minutes in the event of engine out contingency, but their use is otherwise limited to not more than 5 minutes.

**NOTE 6. MAXIMUM PERMISSIBLE COMPRESSOR AIR BLEEDS**

The Trent 1000 engines do not supply compressor air for airframe ventilation (Cabin Bleed), but does supply compressor air for the purpose of preventing ice build-up on the engine nacelle (Cowl Thermal Anti-Ice, (CTAI)).

Nacelle thermal anti-icing flow demand (HP3) is modulated via a regulating valve.

Cowl Thermal Anti-Icing Bleed for Normal and Abnormal Operation:

<u>Condition</u>	<u>Flow (% of W26)</u>
Up to 1380 K TET	1.0 %
1905 K TET and above	0.5 %

W26 represents the air mass-flow through the core of the engine. Bleed flows vary linearly between the points listed.

**NOTE 7.** Life-limited parts are identified in Time Limits Manual (See NOTE 8).

**NOTE 8.** Trent 1000 manuals submitted under EASA requirements and accepted as equivalent to FAR 33.4 and FAR 33.5 requirements are:

OPERATING INSTRUCTIONS	MAINTENANCE MANUAL	INSTALLATION MANUAL	ENGINE MANUAL	TIME LIMITS MANUAL
OI-Trent 1000-B787	TBD	DNS 130613	TBD	T-Trent-10RR

**NOTE 9.** Each of the documents listed below must state that it is approved by the European Aviation Safety Agency (EASA). Any such documents including those approved under a delegated authority, are accepted by the FAA and are considered FAA approved.

- Service bulletins,
- Structural repair manuals,
- Vendor manuals,
- Aircraft flight manuals, and
- Overhaul and maintenance manuals.
- Technical Variances

These approvals pertain to the type design only.

**NOTE 10.** These engines are fitted with a Digital Electronic Engine Fuel Control system in which the software is designated Level A according to EUROCAE ED-12B/RTCA DO178B

**NOTE 11.** The engine is approved of a maximum exhaust gas over-temperature of 920 °C for inadvertent use for periods up to 20 seconds without requiring maintenance action. The cause of the over-temperature must be investigated and corrected.

**NOTE 12.** VARIANTS

- Trent 1000-A Basic model.
- Trent 1000-C Same as basic model except for increased thrust ratings.
- Trent 1000-D Same as Trent 1000-C except except flat rated to ISA +20 °C.
- Trent 1000-E Same as basic model except for decreased thrust ratings.
- Trent 1000-G Same as basic model except for increased Take-off thrust ratings.
- Trent 1000-H Same as Trent 1000-E except for increased Take-off thrust ratings.

**NOTE 13.** These engines are not ETOPS eligible according to provisions in FAR 33.201

**NOTE 14.** These engines have not been approved to operate with faults present in the control system.

**NOTE 15.** These engines are not approved for use in thrust reverse operation.

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