



# TYPE-CERTIFICATE DATA SHEET

EASA.E.036

**for**

Trent 1000 series engines

## **Type Certificate Holder**

Rolls-Royce plc  
62 Buckingham Gate  
London  
SW1E 6AT  
United Kingdom

For Models:

Trent 1000-A	Trent 1000-A2	Trent 1000-AE3	Trent7000-72
Trent 1000-AE	Trent 1000-AE2	Trent 1000-CE3	Trent7000-72C
Trent 1000-C	Trent 1000-C2	Trent 1000-D3	
Trent 1000-CE	Trent 1000-CE2	Trent 1000-G3	
Trent 1000-D	Trent 1000-D2	Trent 1000-H3	
Trent 1000-E	Trent 1000-E2	Trent 1000-J3	
Trent 1000-G	Trent 1000-G2	Trent 1000-K3	
Trent 1000-H	Trent 1000-H2	Trent 1000-L3	
	Trent 1000-J2	Trent 1000-M3	
	Trent 1000-K2	Trent 1000-N3	
	Trent 1000-L2	Trent 1000-P3	
		Trent 1000-Q3	
		Trent 1000-R3	



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## I. General

### 1. Type/ Model

Trent 1000-A, Trent 1000-C, Trent 1000-D, Trent 1000-E, Trent 1000-G, Trent 1000-H

Engines incorporating SB 72-G319 are identified by Build Standard “/01”.  
Engines incorporating SB 72-G893 are identified by Build Standard “/01A”.

Trent 1000-AE, Trent 1000-CE

These engines incorporate SB 72-G319 within the DIS minimum Type Design Definition.  
Engines incorporating SB 72-G893 are identified by Build Standard “/01A”

Trent 1000-A2, Trent 1000-AE2, Trent 1000-C2, Trent 1000-CE2, Trent 1000-D2,  
Trent 1000-E2, Trent 1000-G2, Trent 1000-H2, Trent 1000-J2, Trent 1000-K2, Trent 1000-L2

Trent 1000-AE3, Trent 1000-CE3, Trent 1000-D3, Trent 1000-G3, Trent 1000-H3,  
Trent 1000-J3, Trent 1000-K3, Trent 1000-L3, Trent 1000-M3, Trent 1000-N3, Trent 1000-P3,  
Trent 1000-Q3, Trent 1000-R3

Trent7000-72, Trent7000-72C

These engine models are approved for use on Large Aeroplanes at the ratings and within the operating limitations specified below, subject to compliance with the powerplant installation requirements appropriate to approved installations.

### 2. Type Certificate Holder

Rolls-Royce plc  
62 Buckingham Gate  
London  
SW1E 6AT  
United Kingdom

DOA ref.: EASA.21J.035

### 3. Manufacturer

Rolls-Royce plc



#### **4. Date of Application**

##### Engine Models

Trent 1000-A, Trent 1000-C, Trent 1000-D, Trent 1000-E, Trent 1000-G, Trent 1000-H

Application Date: 30 April 2004

##### Engine Models

Trent 1000-A2, Trent 1000-C2, Trent 1000-D2, Trent 1000-E2, Trent 1000-G2, Trent 1000-H2,  
Trent 1000-J2, Trent 1000-K2, Trent 1000-L2

Application Date: 16 May 2012

##### Engine Models

Trent 1000-AE, Trent 1000-CE, Trent 1000-AE2, Trent 1000-CE2

Application Date: 28 March 2014

##### Engine Models

Trent 1000-AE3, Trent 1000-CE3, Trent 1000-D3, Trent 1000-G3, Trent 1000-H3, Trent 1000-J3,  
Trent 1000-K3, Trent 1000-L3, Trent 1000-M3, Trent 1000-N3, Trent 1000-P3, Trent 1000-Q3,  
Trent 1000-R3

Application Date: 22 November 2013

##### Engine Models

Trent7000-72, Trent7000-72C

Application Date: 7 October 2014

#### **5. Certification Reference Date**

30 September 2004

#### **6. EASA Type Certification Date**

##### Engine Models

Trent 1000-A, Trent 1000-C, Trent 1000-D, Trent 1000-E, Trent 1000-G, Trent 1000-H

07 August 2007



Engine Models

Trent 1000-A2, Trent 1000-C2, Trent 1000-D2, Trent 1000-E2, Trent 1000-G2, Trent 1000-H2,  
Trent 1000-J2, Trent 1000-K2, Trent 1000-L2

10 September 2013

Engine Models

Trent 1000-AE, Trent 1000-CE, Trent 1000-AE2, Trent 1000-CE2

06 May 2015

Engine Models

Trent 1000-AE3, Trent 1000-CE3, Trent 1000-D3, Trent 1000-G3, Trent 1000-H3, Trent 1000-J3,  
Trent 1000-K3, Trent 1000-L3, Trent 1000-M3, Trent 1000-N3, Trent 1000-P3, Trent 1000-Q3,  
Trent 1000-R3

11 July 2016

Engine Models

Trent7000-72, Trent7000-72C

20 July 2018



## II. Certification Basis

### 1. EASA Certification Basis

#### 1.1. Airworthiness Standards

##### For all Models

- CS-E: original issue, dated 24 October 2003
- Time Limited Dispatch: CS-E 1030 amendment 3
- ETOPS: CS-E 1040 amendment 3

#### 1.2. Special Conditions (SC)

none

#### 1.3. Equivalent Safety Findings

##### For all models

- CS-E 740 150 Hour Endurance Test
- CS-E 740(f) Non declaration or display of Maximum Continuous Speed Limitation
- CS-E 790 Ingestion of Rain and Hail

##### Engine models

Trent 1000-AE, Trent 1000-CE, Trent 1000-A2, Trent 1000-AE2, Trent 1000-C2, Trent 1000-CE2, Trent 1000-D2, Trent 1000-E2, Trent 1000-G2, Trent 1000-H2, Trent 1000-J2, Trent 1000-K2, Trent 1000-L2, Trent 1000-AE3, Trent 1000-CE3, Trent 1000-D3, Trent 1000-G3, Trent 1000-H3, Trent 1000-J3, Trent 1000-K3, Trent 1000-L3, Trent 1000- M3, Trent 1000-N3, Trent 1000-P3, Trent 1000-Q3, Trent 1000-R3, Trent7000-72, Trent7000-72C

- CS-E 840 and CS-E 850 HP Shaft Prime Reliability

##### Engine models

Trent 1000-AE3, Trent 1000-CE3, Trent 1000- D3, Trent 1000-G3, Trent 1000-H3, Trent 1000-J3, Trent 1000-K3, Trent 1000-L3, Trent 1000- M3, Trent 1000-N3, Trent 1000-P3, Trent 1000-Q3, Trent 1000-R3

- CS-E 740 (e) and (f) (4) (v) Oil system limits
- CS-E 740 (f)(1) Supplementary test to CS-E 740 for higher rotational N3 limitation



### Engine Models

Trent7000-72, Trent7000-72C

CS-E 740 (h)(1)

150 Hour Endurance Test

#### 1.4. Deviations

Trent7000-72, Trent7000-72C

- Temporary Deviation – CS-E 1040 ETOPS – Compliance has been established on 09 November 2018, see Note 14.

#### 1.5. Environmental Protection

### Engine Models

Trent 1000-A, Trent 1000-C, Trent 1000-D, Trent 1000-E, Trent 1000-G, Trent 1000-H

- Emissions and Fuel venting: ICAO Annex 16, Volume II, Part III (3rd Edition, July 2008), Amendment 6

### Engine Models

Trent 1000-A2, Trent 1000-C2, Trent 1000-D2, Trent 1000-E2, Trent 1000-G2, Trent 1000-H2, Trent 1000-J2, Trent 1000-K2, Trent 1000-L2

- Emissions and Fuel Venting: ICAO Annex 16, Volume II, Part III (3rd Edition, July 2008), Amendment 7 dated 17 November 2011

### Engine Models

Trent 1000-AE, Trent 1000-CE, Trent 1000-AE2, Trent 1000-CE2

- Emissions and Fuel Venting: CS-34 Commission Regulation (EU) No 6/2013 Article 1 effective 29 January 2013 referencing Amendment 7 of Volume II of ICAO Annex 16, Volume II to the Chicago Convention.  
NOx levels in compliance with Part III, Chapter 2, paragraph 2.3.2 e) (CAEP/8) of the above mentioned Annex.





## Engine Models

Trent 1000-AE3, Trent 1000-CE3, Trent 1000-D3, Trent 1000-G3, Trent 1000-H3, Trent 1000-J3, Trent 1000-K3, Trent 1000-L3, Trent 1000-M3, Trent 1000-N3, Trent 1000-P3, Trent 1000-Q3, Trent 1000-R3, Trent7000-72, Trent7000-72C

- Emissions and Fuel Venting: CS-34 Amendment 2 as implemented by ED Decision 2016/001/R (12th January 2016); ICAO Annex 16 Volume II, Amendment 8 (1<sup>st</sup> January 2015); NOx levels in compliance with Part III, Chapter 2, paragraph 2.3.2e) (CAEP/8) of the above mentioned Annex.



### III. Technical Characteristics

#### 1. Type Design Definition

The minimum standard of Engine Type Design for operation in accordance with the Trent 1000 Type Certificate Data Sheet are defined in the following documents:

Model	Engine Type Definition
Trent 1000-A	DIS 2286 Issue 3
Trent 1000-AE	DIS 2374 Issue 2
Trent 1000-C	DIS 2287 Issue 3
Trent 1000-CE	DIS 2375 Issue 2
Trent 1000-D	DIS 2288 Issue 3
Trent 1000-E	DIS 2289 Issue 3
Trent 1000-G	DIS 2291 Issue 3
Trent 1000-H	DIS 2292 Issue 3
Trent 1000-A2	DIS 2327 issue 3
Trent 1000-AE2	DIS 2376 Issue 2
Trent 1000-C2	DIS 2328 issue 3
Trent 1000-CE2	DIS 2377 Issue 2
Trent 1000-D2	DIS 2329 issue 3
Trent 1000-E2	DIS 2330 issue 3
Trent 1000-G2	DIS 2331 issue 3
Trent 1000-H2	DIS 2332 issue 3
Trent 1000-J2	DIS 2333 issue 3
Trent 1000-K2	DIS 2334 issue 3
Trent 1000-L2	DIS 2335 issue 3
Trent 1000-AE3	DIS 2372 issue 3
Trent 1000-CE3	DIS 2373 issue 3
Trent 1000-D3	DIS 2357 issue 3
Trent 1000-G3	DIS 2360 issue 3
Trent 1000-H3	DIS 2361 issue 3
Trent 1000-J3	DIS 2362 issue 3
Trent 1000-K3	DIS 2363 issue 3
Trent 1000-L3	DIS 2364 issue 3
Trent 1000-M3	DIS 2365 issue 3
Trent 1000-N3	DIS 2367 issue 3
Trent 1000-P3	DIS 2368 issue 3
Trent 1000-Q3	DIS 2370 issue 3
Trent 1000-R3	DIS 2369 issue 3
Trent7000-72	DIS 2379 issue 2 plus MB73-K233, MB72-K150 and MB72-K200
Trent7000-72C	DIS 2378 issue 1 plus MB73-K233, MB72-K150 and MB72-K200

Changes to the Engine Type Design are introduced by approved Service Bulletins (SB). See note 12.

For Trent7000-72 and Trent7000-72C, see note 15.



## 2. Description

The Trent 1000 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 2.85m with a swept fan blade and OGV's. The combustion system consists of a single annular combustor with 18-off fuel spray nozzles. The LP and IP assemblies rotate independently in an anti-clockwise direction, the HP assembly rotates clockwise, when viewed from the rear of the engine. The Compressor and Turbine have the following features:

Compressor	Turbine
LP – Single stage	LP – 6 stage
IP – 8 stage	IP – single stage
HP – 6 stage	HP – single stage

The engine control system utilises an EEC (Electronic Engine Controller) which has an airframe interface for digital bus communications. An EMU (Engine Monitor Unit) is fitted (to provide vibration signals to the aircraft).

## 3. Equipment

For details of equipment included in the type design definition: refer to Installation Manual.

For details of equipment and nacelle hardware supplied by the Airframe TC holder that may be mounted on or driven by the engine: refer to Installation Manual.

Note: The engine is certified for use with an operable Thrust Reverser Unit. Note that the Thrust Reverser Unit does not form part of the engine type design and is certified as part of the aircraft type design.

## 4. Dimensions

### Engine Models

Trent 1000-A, Trent 1000-C, Trent 1000-D, Trent 1000-E, Trent 1000-G, Trent 1000-H  
Trent 1000-AE, Trent 1000-CE  
Trent 1000-A2, Trent 1000-AE2, Trent 1000-C2, Trent 1000-CE2, Trent 1000-D2,  
Trent 1000-E2, Trent 1000-G2, Trent 1000-H2, Trent 1000-J2, Trent 1000-K2, Trent 1000-L2  
Trent 1000-AE3, Trent 1000-CE3, Trent 1000-D3, Trent 1000-G3, Trent 1000-H3,  
Trent 1000-J3, Trent 1000-K3, Trent 1000-L3, Trent 1000-M3, Trent 1000-N3, Trent 1000-P3,  
Trent 1000-Q3, Trent 1000-R3

Overall Length mm (ins)	4771 (187.8)
Maximum Radius mm (ins)	1899 (74.8)



### Engine Models

Trent7000-72, Trent7000-72C

Overall Length mm (ins)	4775 (188.0)
Maximum Radius mm (ins)	1837 ( 72.3)

Length - tip of spinner to rear of the tail bearing housing inner plug flange

Radius - from centre line, not including drains mast

## 5. Dry Weight

### Engine Models

Trent 1000-A, Trent 1000-C, Trent 1000-D, Trent 1000-E, Trent 1000-G, Trent 1000-H

Maximum dry engine weight (kg)	Without SB 72-G319	5936
	With SB 72-G319	6033

Including nacelle EBU items certified as part of the engine but not including fluids.

### Engine Models

Trent 1000-AE, Trent 1000-CE

Maximum dry engine weight (kg)	6033
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Including nacelle EBU items certified as part of the engine but not including fluids

### Engine Models

Trent 1000-A2, Trent 1000-AE2, Trent 1000-C2, Trent 1000-CE2, Trent 1000-D2, Trent 1000-E2,  
Trent 1000-G2, Trent 1000-H2, Trent 1000-J2, Trent 1000-K2, Trent 1000-L2

Maximum dry engine weight (kg)	5947
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Including nacelle EBU items certified as part of the engine but not including fluids

### Engine Models

Trent 1000-AE3, Trent 1000-CE3, Trent 1000-D3, Trent 1000-G3, Trent 1000-H3, Trent 1000- J3,  
Trent 1000-K3, Trent 1000-L3, Trent 1000-M3, Trent 1000-N3, Trent 1000-P3, Trent 1000- Q3,  
Trent 1000-R3

Maximum dry engine weight (kg)	6114
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Including nacelle EBU items certified as part of the engine but not including fluids.



Engine Models

Trent7000-72, Trent7000-72C

Maximum dry engine weight (kg)	6445
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Including nacelle EBU items certified as part of the engine but not including fluids.

**6. Ratings**

The ISA sea-level static thrust ratings are:

Rating		Trent 1000-A	Trent 1000-AE	Trent 1000-C	Trent 1000-CE
Thrust, kN (lbf)	Take-Off (net) (5 minutes)	307.8 (69,194)	307.8 (69,194)	331.4 (74,511)	331.4 (74,511)
	Equivalent Bare Engine Take-Off	310.9 (69,885)	310.9 (69,885)	334.7 (75,239)	334.7 (75,239)
	Maximum Continuous (net)	287.9 (64,722)	287.9 (64,722)	309.3 (69,523)	309.3 (69,523)
	Equivalent Bare Engine Maximum Continuous	290.8 (65,382)	290.8 (65,382)	312.3 (70,217)	312.3 (70,217)
Applicable Engine Models		Trent 1000-A	Trent 1000-AE Trent 1000-AE2 Trent 1000-A2 Trent 1000-AE3	Trent 1000-C	Trent 1000-CE Trent 1000-CE2 Trent 1000-C2 Trent 1000-CE3

Rating		Trent 1000-D	Trent 1000-E	Trent 1000-G	Trent 1000-H
Thrust, kN (lbf)	Take-Off (net) (5 minutes)	331.4 (74,511)	265.3 (59,631)	320.6 (72,066)	284.2 (63,897)
	Equivalent Bare Engine Take-Off	334.7 (75,239)	268.0 (60,253)	323.7 (72,777)	287.1 (64,551)
	Maximum Continuous (net)	309.3 (69,523)	261.8 (58,866)	287.9 (64,722)	261.8 (58,866)
	Equivalent Bare Engine Maximum Continuous	312.3 (70,217)	264.6 (59,481)	290.8 (65,382)	264.6 (59,481)
Applicable Engine Models		Trent 1000-D Trent 1000-D2 Trent 1000-D3	Trent 1000-E Trent 1000-E2	Trent 1000-G Trent 1000-G2 Trent 1000-G3	Trent 1000-H Trent 1000-H2 Trent 1000-H3



Rating		Trent 1000-J	Trent 1000-K	Trent 1000-L	Trent 1000-M
Thrust, kN (lbf)	Take-Off (net) (5 minutes)	347.5 (78,129)	347.5 (78,129)	331.4 (74,511)	354.6 (79,728)
	Equivalent Bare Engine Take-Off	350.9 (78,886)	350.9 (78,886)	334.7 (75,239)	358.1 (80,494)
	Maximum Continuous (net)	319.5 (71,818)	319.5 (71,818)	309.3 (69,523)	323.3 (72,691)
	Equivalent Bare Engine Maximum Continuous	322.6 (72,519)	322.6 (72,519)	312.3 (70,217)	326.5 (73,409)
Applicable Engine Models		Trent 1000-J2 Trent 1000-J3	Trent 1000-K2 Trent 1000-K3	Trent 1000-L2 Trent 1000-L3	Trent 1000-M3

Rating		Trent 1000-N	Trent 1000-P	Trent 1000-Q	Trent 1000-R
Thrust, kN (lbf)	Take-Off (net) (5 minutes)	354.6 (79,728)	331.4 (74,511)	347.5 (78,129)	360.4 (81,028)
	Equivalent Bare Engine Take-Off	358.1 (80,494)	334.7 (75,239)	350.9 (78,886)	363.9 (81,802)
	Maximum Continuous (net)	323.3 (72,691)	309.3 (69,523)	319.5 (71,818)	323.3 (72,691)
	Equivalent Bare Engine Maximum Continuous	326.5 (73,409)	312.3 (70,217)	322.6 (72,519)	326.5 (73,409)
Applicable Engine Models		Trent 1000-N3	Trent 1000-P3	Trent 1000-Q3	Trent 1000-R3

Rating		Trent7000-72	Trent7000-72C
Thrust, kN (lbf)	Take-Off (net) (5 minutes)	324.0 (72,834)	324.0 (72,834)
	Equivalent Bare Engine Take-Off	327.9 (73,718)	327.9 (73,718)
	Maximum Continuous (net)	289.2 (65,005)	289.2 (65,005)
	Equivalent Bare Engine Maximum Continuous	292.8 (65,830)	292.8 (65,830)
Applicable Engine Models		Trent7000-72	Trent7000-72C

Refer to Section VI Notes 1, 2 and 3.



The Trent 1000-A and Trent 1000-C engine models have the option to include enhanced ratings that are incorporated by Service Bulletins 73-H046 and 73-H093 respectively. These two ratings become Trent 1000-AE (SB 73-H046) and Trent 1000-CE (SB 73-H093).

## 7. Control System

The engine is equipped with a Full Authority Digital Engine Control (FADEC) system and an Engine Monitoring Unit (EMU).

Refer to the Installation Manual and Operating Instructions for further information.  
Refer to Section VI Notes 4 and 5.

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

### 8.1. Fuel and Additives

Refer to the Operating Instructions for information on approved fuel and additive specifications.

### 8.2. Oil

Refer to the Operating Instructions for information on approved oil specifications.

## 9. Aircraft Accessory Drives

### Engine Models

Trent 1000-A, Trent 1000-C, Trent 1000-D, Trent 1000-E, Trent 1000-G, Trent 1000-H  
Trent 1000-AE, Trent 1000-CE  
Trent 1000-A2, Trent 1000-AE2, Trent 1000-C2, Trent 1000-CE2, Trent 1000-D2,  
Trent 1000-E2, Trent 1000-G2, Trent 1000-H2, Trent 1000-J2, Trent 1000-K2, Trent 1000-L2  
Trent 1000-AE3, Trent 1000-CE3, Trent 1000-D3, Trent 1000-G3, Trent 1000-H3,  
Trent 1000-J3, Trent 1000-K3, Trent 1000-L3, Trent 1000-M3, Trent 1000-N3, Trent 1000-P3,  
Trent 1000-Q3, Trent 1000-R3

The engine's accessory gearbox may be fitted with two Variable Frequency Starter Generators (VFSG) and one Hydraulic Pump to provide electrical and hydraulic power to the aircraft. These units are part of the airframe, and certified under Aircraft Airworthiness Standards. The Engine Installation Manual details installation and operational requirements, including torque and power limitations.

### Engine Models

Trent7000-72, Trent7000-72C

The engine's accessory gearbox may be fitted with an Integrated Drive Generator (IDG) and two Hydraulic Pumps to provide electrical and hydraulic power to the aircraft. These units are part of the



airframe, and certified under Aircraft Airworthiness Standards. The Engine Installation Manual details installation and operational requirements, including torque and power limitations.

## 10. Maximum Permissible Air Bleed Extraction

Only the Trent7000-72 and Trent7000-72C engine models supply compressor air to the airframe for the purpose of cabin ventilation (“Cabin Bleed”). All of the Trent 1000 engine models (including the Trent7000-72 and Trent7000-72C) supply compressor air for the purpose of anti-icing of airframe components (“Nacelle Anti-Ice Bleed”). The anti-icing bleed flow demand is modulated via a regulating valve.

### 10.1 Thermal Anti-Icing Bleed Off takes for Normal and Abnormal operation

#### Engine Models:

Trent 1000-A, Trent 1000-AE, Trent 1000-C, Trent 1000-CE, Trent 1000-D, Trent 1000-E, Trent 1000-G, Trent 1000-H, Trent 1000-A2, Trent 1000-AE2, Trent 1000-C2, Trent 1000-CE2, Trent 1000-D2, Trent 1000-E2, Trent 1000-G2, Trent 1000-H2, Trent 1000-J2, Trent 1000-K2, Trent 1000-L2

Engine Power Setting TET (K)	Maximum Cowl Thermal Anti Ice Flow % Core Mass Flow (W26)
Idle to 1430	2.67
1430 to 1785	2.67 to 1.25 varying linearly
1785 to 1820	1.25 to 0.54 varying linearly
1820 and above	0.54

“W26” represents the air mass flow through the core of the engine.

#### Engine Models

Trent 1000-AE3, Trent 1000-CE3, Trent 1000-D3, Trent 1000-G3, Trent 1000-H3, Trent 1000- J3, Trent 1000-K3, Trent 1000-L3, Trent 1000-M3, Trent 1000-N3, Trent 1000-P3, Trent 1000-Q3, Trent 1000-R3

Engine Power Setting TET (K)	Maximum Cowl Thermal Anti Ice Flow % Core Mass Flow (W26)
Idle to 1015	2.9
1015 to 1765	2.9 to 2.1 varying linearly
1765 to 1810	2.1 to 0.5 varying linearly
Above 1810	0.5





Engine Models

Trent7000-72, Trent7000-72C

Engine Power Setting TET (K)	Maximum Nacelle Anti Ice Flow % Core Mass Flow (%W26)
Idle to 1175	0.86
1175 to 1725	0.86 to 0.82 varying linearly
1725 to 1750	0.82 to 0.54 varying linearly
1750 to 1830	0.54 to 0.39 varying linearly
Above 1830	0.39

10.2 Engine Bleed Air System (EBAS) offtakes for Normal and Abnormal operation

Engine Models

Trent7000-72, Trent7000-72C

EBAS comprises both the Environmental Control System (ECS) for cabin ventilation and bleed air for aircraft anti-ice purposes. It is fed either from IP compressor stage 8 (IP8) or from HP compressor stage 6 (HP6).

%W26 represents the percentage of air mass-flow through the core of the engine at the HPC entry. Bleed flows vary linearly between the points listed.

Engine Power Setting TET (K)	Maximum Normal ECS Bleed Schedule %W26	Bleed Source
Idle to 1260	15.8	HP6
1260 to 1600	15.8 to 5.6 (linear)	HP6
1600 to 1708	5.6 to 4.3 (linear)	IP8
1708 to 1740	4.3 to 3.2 (linear)	IP8
1740 to 1835	3.2 to 2.35 (linear)	IP8
Above 1835	2.35	IP8

Engine Power Setting TET (K)	Maximum Abnormal ECS Bleed Schedule %W26	Bleed Source
Idle to 1500	16.9	HP6
1500 to 1655	16.9 to 11.3 (linear)	HP6
1655 to 1708	11.3 to 9.5 (linear)	IP8
1708 to 1725	9.5 to 7.2 (linear)	IP8
1725 to 1835	7.2 to 4.95 (linear)	IP8
Above 1835 to redline	4.95	IP8





Engine Models

Trent7000-72, Trent7000-72C

Minimum fuel temperature: (at, or below 14,600ft)	minus 44
Minimum fuel temperature: (above 14,600 ft)	minus 54
Maximum fuel temperature:	55

Refer to the Installation Manual for additional information.

1.4 Oil temperature (°C)

Combined oil scavenge temperature:

Engine Models

Trent 1000-A, Trent 1000-C, Trent 1000-D, Trent 1000-E, Trent 1000-G, Trent 1000-H

Limit	Without SB 72-G319	With SB 72-G319	Fuel Inlet Temperature
Minimum for engine starting	Minus 40		-
Minimum for acceleration to power	40		For fuel inlet temperature minus 23°C and higher
	Varies linearly from 40 to 77		For fuel inlet temperature between minus 23°C and minus 45°C
Maximum for unrestricted use	196	193	-
Maximum transient (15 minutes)	205	201	-



Engine Models

Trent 1000-AE, Trent 1000-CE, Trent 1000-A2, Trent 1000-AE2, Trent 1000-C2, Trent 1000-CE2, Trent 1000-D2, Trent 1000-E2, Trent 1000-G2, Trent 1000-H2, Trent 1000-J2, Trent 1000-K2, Trent 1000-L2

Limit		Fuel Inlet Temperature
Minimum for engine starting	Minus 40	
Minimum for acceleration to power	40	For fuel inlet temperature minus 23°C and higher
	Varies linearly from 40 to 77	For fuel inlet temperature between minus 23°C and minus 45°C
Maximum for unrestricted use	193	
Maximum transient (15 minutes)	201	

Engine Models

Trent 1000-AE3, Trent 1000-CE3, Trent 1000-D3, Trent 1000-G3, Trent 1000-H3, Trent 1000-J3, Trent 1000-K3, Trent 1000-L3, Trent 1000-M3, Trent 1000-N3, Trent 1000-P3, Trent 1000-Q3, Trent 1000-R3

Limit		Fuel Inlet Temperature
Minimum for engine starting	Minus 40	
Minimum for acceleration to power	40	For fuel inlet temperature minus 23°C and higher.
	Varies linearly from 40 to 90	For fuel inlet temperature between minus 23°C and minus 45°C.
Maximum for unrestricted use	196	
Maximum transient (15 minutes)	201	



## Engine Models

Trent7000-72, Trent7000-72C

Limit		Fuel Inlet Temperature
Minimum for engine starting	Minus 20	
Minimum for acceleration to power	40	For fuel inlet temperature minus 11°C and higher.
	Varies linearly from 40 to 106	For fuel inlet temperature between minus 11°C and minus 54°C.
Maximum for unrestricted use	191	
Maximum transient (15 minutes)	196	

## 2. Pressure Limits

### 2.1 Fuel pressure (kPa)

#### Engine Models

Trent 1000-A, Trent 1000-C, Trent 1000-D, Trent 1000-E, Trent 1000-G, Trent 1000-H  
Trent 1000-AE, Trent 1000-CE, Trent 1000-A2, Trent 1000-AE2, Trent 1000-C2, Trent 1000-CE2,  
Trent 1000-D2, Trent 1000-E2, Trent 1000-G2, Trent 1000-H2, Trent 1000-J2, Trent 1000-K2,  
Trent 1000-L2  
Trent 1000-AE3, Trent 1000-CE3, Trent 1000-D3, Trent 1000-G3, Trent 1000-H3,  
Trent 1000-J3, Trent 1000-K3, Trent 1000-L3, Trent 1000-M3, Trent 1000-N3, Trent 1000-P3,  
Trent 1000-Q3, Trent 1000-R3

Minimum absolute inlet pressure (measured at engine inlet):

	kPa	psi
Steady state conditions with engine running:	34.5 + Vapour Pressure	5 + Vapour Pressure
Transient conditions with engine running (2 seconds):	13.8 + Vapour Pressure	2 + Vapour Pressure

For engine operation with the aircraft boost pumps inoperative the engine minimum fuel pressure limit is reduced down to 3.4 psi at altitudes of up to 35000 feet for up to 600 minutes.

Refer to the Installation Manual for additional information.



Maximum pressure at inlet (measured at the pylon interface):

	kPa	psi
Steady state conditions with engine running:	483	70
Transient conditions with engine running (2 seconds):	966	140
Static after engine shut down:	1172	170

### Engine Models

Trent7000-72, Trent7000-72C

Minimum absolute inlet pressure (measured at engine inlet):

	kPa	psi
Steady state conditions with engine running:	34.5 + Vapour Pressure	5 + Vapour Pressure

Refer to the Installation Manual for additional information.

Maximum pressure at inlet (measured at the pylon interface):

	kPa	psi
Steady state conditions with engine running:	276	40
Transient conditions with engine running (2 seconds):	689	100
Static after engine shut down:	689	100



## 2.2 Oil pressure (kPa)

Minimum oil pressure:

### Engine Models

Trent 1000-A, Trent 1000-C, Trent 1000-D, Trent 1000-E, Trent 1000-G, Trent 1000-H

	Without SB 72-G319		With SB 72-G319	
	kPa	psi	kPa	psi
Ground idle to 74% IP rpm	207	30	207	30
Between 74% and 100% IP rpm	Varies linearly from 207 to 517	Varies linearly from 30 to 75	Varies linearly from 207 to 621	Varies linearly from 30 to 90
Above 100% IP rpm	517	75	621	90

### Engine Models

Trent 1000-AE, Trent 1000-CE, Trent 1000-A2, Trent 1000-AE2, Trent 1000-C2, Trent 1000-CE2, Trent 1000-D2, Trent 1000-E2, Trent 1000-G2, Trent 1000-H2, Trent 1000-J2, Trent 1000-K2, Trent 1000-L2, Trent7000-72, Trent7000-72C

	kPa	psi
Ground idle to 74% IP rpm	207	30
Between 74% and 100% IP rpm	Varies linearly from 207 to 621	Varies linearly from 30 to 90
Above 100% IP rpm	621	90



### Engine Models

Trent 1000-AE3, Trent 1000-CE3, Trent 1000-D3, Trent 1000-G3, Trent 1000-H3, Trent 1000- J3, Trent 1000-K3, Trent 1000-L3, Trent 1000-M3, Trent 1000-N3, Trent 1000-P3, Trent 1000-Q3, Trent 1000-R3

	kPa	Psi
Ground idle to 74% IP rpm	207	30
Between 74% and 100% IP rpm	Varies linearly from 207 to 621	Varies linearly from 30 to 90
Above 100% IP rpm	621	90

See note 13.

### **3. Maximum Permissible Rotor Speeds:**

When maintenance running is performed above idle thrust with the aircraft static, the control system automatically applies a temperature dependent LP speed Keep Out Zone. Refer to the Maintenance Manual for details.

### Engine Models

Trent 1000-A, Trent 1000-C, Trent 1000-D, Trent 1000-E, Trent 1000-G, Trent 1000-H

<b>Rotor</b>		<b>HP</b>	<b>IP</b>	<b>LP</b>
Reference speeds, 100% rpm		13391	8937	2683
Without SB 72-G319	Maximum for Take-off (5 minute limit, refer to Section VI Note 3)	98.6%	100.8%	101.4%
	Maximum Continuous (refer to Section VI Note 8)	97.8%	99.5%	101.4%
With SB 72-G319	Maximum for Take-off (5 minute limit, refer to Section VI Note 3 and 11)	100.2%	103.5%	101.5%
	Maximum Continuous (refer to Section VI Note 8 and 11)	99.2%	100.8%	101.5%

(Data makes allowance for instrumentation accuracies)

For engines without SB 72-G319, LP speed must not exceed 96.5% during any aircraft operation with an apparent tailwind, ie tailwind greater than aircraft forward speed. This limitation does not apply to an engine with SB 72-G319.





### Engine Models

Trent 1000-AE, Trent 1000-CE

<b>Rotor</b>	<b>HP</b>	<b>IP</b>	<b>LP</b>
Reference speeds, 100% rpm	13391	8937	2683
Maximum for Take-off (5 minute limit, refer to Section VI, note 3 and 11)	100.2 %	103.5%	101.5%
Maximum Continuous (Refer to Section VI, note 8 and 11)	99.2%	100.8%	101.5%

(Data makes allowance for instrumentation accuracies)

### Engine Models

Trent 1000-A2, Trent 1000-AE2, Trent 1000-C2, Trent 1000-CE2, Trent 1000-D2, Trent 1000-E2,  
Trent 1000-G2, Trent 1000-H2, Trent 1000-J2, Trent 1000-K2, Trent 1000-L2

<b>Rotor</b>	<b>HP</b>	<b>IP</b>	<b>LP</b>
Reference speeds, 100% rpm	13391	8937	2683
Maximum for Take-off (5 minute limit, refer to Section VI, note 3)	101.0%	103.5%	101.5%
Maximum Continuous (Refer to Section VI, note 8)	99.5%	100.8%	101.5%

(Data makes allowance for instrumentation accuracies)

### Engine Models

Trent 1000-AE3, Trent 1000-CE3, Trent 1000-D3, Trent 1000-G3, Trent 1000-H3, Trent 1000-J3,  
Trent 1000-K3, Trent 1000-L3, Trent 1000-M3, Trent 1000-N3, Trent 1000-P3, Trent 1000-Q3,  
Trent 1000-R3, Trent7000-72, Trent7000-72C

<b>Rotor</b>	<b>HP</b>	<b>IP</b>	<b>LP</b>
Reference speeds, 100% rpm	13391	8937	2683
Maximum for Take-off (5 minute limit, refer to Section VI, note 3)	101.5%	103.5%	101.5%
Maximum Continuous (Refer to Section VI, note 8)	99.5%	100.8%	101.5%

(Data makes allowance for instrumentation accuracies)

## **4. Installation Assumptions:**

Refer to Installation Manual for details.



## 5. Time Limited Dispatch:

### All Engine Models

These engine models have been approved for Time Limited Dispatch in accordance with CS-E 1030. The maximum rectification period for each dispatchable state is specified in the Installation Manual.

## 6. ETOPS Capability:

### Engine Models

Trent 1000-A, Trent 1000-C, Trent 1000-D, Trent 1000-E, Trent 1000-G, Trent 1000-H  
Trent 1000-AE, Trent 1000-CE, Trent 1000-A2, Trent 1000-AE2, Trent 1000-C2, Trent 1000-CE2,  
Trent 1000-D2, Trent 1000-E2, Trent 1000-G2, Trent 1000-H2, Trent 1000-J2, Trent 1000-K2,  
Trent 1000-L2  
Trent 1000-AE3, Trent 1000-CE3, Trent 1000-D3, Trent 1000-G3, Trent 1000-H3,  
Trent 1000-J3, Trent 1000-K3, Trent 1000-L3, Trent 1000-M3, Trent 1000-N3, Trent 1000-P3,  
Trent 1000-Q3, Trent 1000-R3

These engine models are approved for ETOPS capability in accordance with CS-E 1040 for a Maximum Approved Diversion Time of 330 minutes at MCT thrust plus 15 minutes at hold power. ETOPS does not require any special engine limitation, marking, placard, or configuration. This approval does not constitute an approval to conduct ETOPS operations

### Engine Models

Trent7000-72, Trent7000-72C

The engine is approved for ETOPS capability in accordance with CS-E1040 amendment 3 by EASA Certificate 10067382 dated 09 November 2018 for a Maximum Approved Diversion Time of 180 minutes at Maximum Continuous thrust plus 15 minutes at hold thrust. ETOPS is restricted to engines of a life of less than 500 EFC, and incorporating MB72-K203. ETOPS does not require any other special engine limitation, marking, placard, or configuration. Engine Condition Monitoring is required.



## V. Operating and Service Instructions

### Engine Models

Trent 1000-A, Trent 1000-AE, Trent 1000-C, Trent 1000-CE, Trent 1000-D, Trent 1000-E,  
Trent 1000-G, Trent 1000-H

Document	Document Reference
Installation Manual including Engine Control System Dispatch Statement	DNS 130613
Operating Instructions	OI-Trent 1000-B787
Engine Manual	E-Trent-10RR
Maintenance Manual	B787-81205-Axxxx
Time Limits Manual (for engines without SB 72-G319 fitted)	T-Trent-10RR
Time Limits Manual (for engines with SB 72-G319 fitted)	T-Trent-10RRB
Service Bulletins	Trent 1000 — as required

Note: The Maintenance Manual is compiled by the Airframer and is specific to Aircraft Operators, "xxxx" denotes the Airlines customer code.

### Engine Models

Trent 1000-A2, Trent 1000-AE2, Trent 1000-C2, Trent 1000-CE2, Trent 1000-D2, Trent 1000-E2,  
Trent 1000-G2, Trent 1000-H2, Trent 1000-J2, Trent 1000-K2, Trent 1000-L2

Document	Document Reference
Installation Manual including Engine Control System Dispatch Statement	DNS193530
Operating Instructions	OI-Trent 1000-B787C1
Engine Manual	E-Trent-10RRC
Maintenance Manual	B787-81205-Axxxx
Time Limits Manual	T-Trent-10RRC
Service Bulletins	Trent 1000 — as required

Note: The Maintenance Manual is compiled by the Airframer and is specific to Aircraft Operators, "xxxx" denotes the Airlines customer code.



### Engine Models

Trent 1000-AE3, Trent 1000-CE3, Trent 1000-D3, Trent 1000-G3, Trent 1000-H3, Trent 1000-J3, Trent 1000-K3, Trent 1000-L3, Trent 1000-M3, Trent 1000-N3, Trent 1000-P3, Trent 1000-Q3, Trent 1000-R3

Document	Document Reference
Installation Manual	EDNS01000566257
Operating Instructions	OI-Trent 1000-TEN-B787
Engine Manual	E-Trent-10RRT
Maintenance Manual	B787-81205-Axxxx
Time Limits Manual	T-Trent-10RRT
Service Bulletins	Trent 1000 - as required

Note: The Maintenance Manual is compiled by the Airframer and is specific to Aircraft Operators, "xxxx" denotes the Airlines customer code.

### Engine Models

Trent7000-72, Trent7000-72C

Document	Document Reference
Installation Manual	EDNS01000696188
Operating Instructions	EDNS01000696186
Engine Manual	E-T7000-1RR
Maintenance Manual	Airbus A330 Customer Aircraft Maintenance Manual
Time Limits Manual	T-T7000-1RR
Service Bulletins	Trent 1000 - as required

Note: The Maintenance Manual is compiled by the Airframer.

## **VI. Notes**

1. The Equivalent Bare Engine Take-off and Maximum Continuous thrusts quoted in Section III sub level 6 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.
2. The Ratings are based on having no power offtakes to aircraft accessories nor air bleeds.
3. The take-off rating and the associated operating limitations may be used for up to 10 minutes in the event of an engine failure.
4. All Models except Trent7000-72 and Trent7000-72C. The control and monitoring system software meets the following levels according to EUROCAE ED-12B/RTCA DO178B:
  - EEC is designated Level "A".
  - EMU is designated Level "E", except that the flight deck vibration display is Level "C".



Trent7000-72 and Trent7000-72C. The control and monitoring system software meets the following levels:

- EEC is designated EUROCAE ED-12B/RTCA DO178B Level "A".
- EMU is designated EUROCAE ED-12C/RTCA DO178C Level "C".

5. Refer to Installation Manual for details of Electro-Magnetic Interference (EMI), High Intensity Radiated Fields (HIRF) and Lightning capability.
6. The maximum exhaust gas over temperature limit is approved for inadvertent use for the periods specified without requiring maintenance action. The cause of the over temperature must be investigated and corrected.
7. Turbine Gas Temperature is measured by thermocouples positioned at the 1st stage Nozzle Guide Vane of the LP Turbine.
8. The Maximum Continuous Speed limitations defined in this Data Sheet are not displayed as limitations on the Aircraft flight deck. Non-display of these limitations was agreed during the certification programme.
9. The Trent 1000-Z Model approved at original certification was deleted at Issue 2 of TCDS E.036. No examples of this Model have been produced and this model is no longer required.
10. Issue 2 of TCDS E.036 also updated the minimum build standard approved under the Type Certificate as defined in Section III paragraph 1. Only engines complying with the new minimum build standard can be operated. Examples of the earlier build standard are no longer approved and must be reworked to comply with the new minimum build standard prior to service operation.
11. Trent 1000-E model Engine type definition always embodies SB 72-G319.
12. The EASA approved Airworthiness Limitations Section of the Instructions for Continued Airworthiness is published in the applicable "Time Limits Manual".
13. The minimum oil pressure limits defined for Trent 1000-AE3, Trent 1000-CE3, Trent 1000-D3, Trent 1000-G3, Trent 1000-H3, Trent 1000-J3, Trent 1000-K3, Trent 1000-L3, Trent 1000-M3, Trent 1000-N3, Trent 1000-P3, Trent 1000-Q3, Trent 1000-R3 shows trimmed/indicated kPa (psi) to ensure cockpit display is consistent with the other engine models.
14. A Temporary Deviation has been agreed which permits a restricted ETOPS approval – see Certificate 10067382. It is expected that these restrictions will be removed at a later issue of this TCDS.
15. The Engine Type Definition listed in Section III. Technical Characteristics for the Trent7000-72 and Trent7000-72C lists the minimum engine type definition for service. This includes the CS-E certification standard (DIS), modifications required for Airframe CS-25 certification and modification required for engine foreign authority validation.



**SECTION: ADMINISTRATIVE**

**I. Acronyms and Abbreviations**

n/a

**II. Type Certificate Holder Record**

Rolls-Royce plc

**III. Change Record**

Issue	Date	Changes	TC issue
Issue 01	07.08.2007	Initial Issue	Initial Issue, 07.08.2007
Issue 02	14 March 2011	Miscellaneous modifications	
Issue 03	11 November 2011	Introduction of Pack B models and miscellaneous modifications	
Issue 04	10 September 2013	Introduction of Pack C models and miscellaneous modifications	
Issue 05	27 March 2014	Introduction of Pack C ETOPS	
Issue 06	06 May 2015	Introduction of Trent 1000-AE, Trent 1000-CE, Trent 1000-AE2, Trent 1000-CE2 models	
Issue 07	11 July 2016	Introduction of models : Trent 1000-AE3, Trent 1000-CE3, Trent 1000-D3, Trent 1000-G3, Trent 1000-H3, Trent 1000- J3, Trent 1000-K3, Trent 1000-L3, Trent 1000-M3, Trent 1000-N3, Trent 1000-P3, Trent 1000- Q3, Trent 1000-R3	11 July 2016
Issue 08	17 August 2017	Change of DIS Issue 2 to Issue 3 for models: Trent 1000-AE3, Trent 1000-CE3, Trent 1000-D3, Trent 1000-G3, Trent 1000-H3, Trent 1000- J3, Trent 1000-K3, Trent 1000-L3, Trent 1000-M3, Trent 1000-N3, Trent 1000-P3, Trent 1000- Q3, Trent 1000-R3, ETOPS capacity, TLD, change of Minimum Fuel Temperature and change of Maximum Permissible Rotor Speeds for these models	
Issue 09	23 March 2018	Change of TC Holder's address	23 March 2018
Issue 10	20 July 2018	Introduction of models : Trent7000-72 and Trent7000-72C	20 July 2018
Issue 11	13 November 2018	Trent7000: Restricted approval of ETOPS (EASA Certificate 10067382), change of Type Definition, change of Technical manuals (EASA certificate 10067469); change of Trent Pack B and C1 DIS for Enhance Rating models (EASA certificate 10067387). Corrections of errors.	13 November 2018

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