



# ICAO ENGINE nvPM EMISSIONS DATA SHEET

## SUBSONIC ENGINES

ENGINE IDENTIFICATION: Trent 1000-D3  
UNIQUE ID NUMBER: 02P23RR128  
COMBUSTOR: Phase5 Tiled  
ENGINE TYPE: TF

BYPASS RATIO (-): 9.0  
PRESSURE RATIO  $\pi_{co}$  (-): 46.0  
RATED OUTPUT  $F_{oo}$  (kN): 334.7

### REGULATORY DATA

CHARACTERISTIC VALUES:	$LTO_{mass}/F_{oo}$ (mg/kN)	$LTO_{num}/F_{oo}$ (particles/kN)	NVPM MASS CONCENTRATION ( $\mu\text{g}/\text{m}^3$ )
LTO/ $F_{oo}$ AND MAX nvPM <sub>mass</sub>	191.5	1.70E+15	3410
AS % OF CAEP/10 LIMIT	-	-	87.7
AS % OF CAEP/11 LIMIT (InP)	55.1	40.8	
AS % OF CAEP/11 LIMIT (NT)	89.5	61.2	

### MEASURED DATA

MODE	POWER SETTING (% $F_{oo}$ )	TIME minutes	FUEL FLOW kg/s	EMISSIONS INDICES*		NVPM MASS CONCENTRATION PEAK nvPM <sub>mass</sub> ( $\mu\text{g}/\text{m}^3$ )
				EI <sub>mass</sub> (mg/kg)	EI <sub>num</sub> (particles/kg)	
TAKE-OFF	100	0.7	2.556	44.8	1.30E+14	
CLIMB OUT	85	2.2	2.090	76.3	2.53E+14	
APPROACH	30	4.0	0.687	76.5	8.68E+14	
IDLE	7	26.0	0.256	19.1	4.59E+14	
LTO TOTAL (kg, mg, number of particles)			947	46114	4.10E+17	-
NUMBER OF ENGINES				1	1	1
NUMBER OF TESTS				3	3	3
AVERAGE LTO/ $F_{oo}$ VALUES (mg/kN, particles/kN)				137.8	1.22E+15	-
MAX EI VALUES (mg/kg, particles/kg) AND MAX MASS CONC. ( $\mu\text{g}/\text{m}^3$ )				153.0	9.28E+14	2649

\* Emissions Indices are corrected for thermophoretic loss and fuel hydrogen content

### DATA FOR EMISSIONS INVENTORIES (ESTIMATIONS FOR ENGINE EXIT PLANE VALUES)

MODE	POWER SETTING (% $F_{oo}$ )	CORRECTED EMISSIONS INDICES	
		EI <sub>mass_SL</sub> (mg/kg)	EI <sub>num_SL</sub> (particles/kg)
TAKE-OFF	100	48.0	1.76E+14
CLIMB OUT	85	82.4	3.61E+14
APPROACH	30	88.2	1.94E+15
IDLE	7	23.1	9.08E+14

### AMBIENT CONDITIONS

	From	To	FUEL	
BAROMETER (kPa)	100.8	101.6	HEAT OF COMBUSTION (MJ/kg)	43.34
TEMPERATURE (K)	287.0	292.6	HYDROGEN CONTENT (%mass)	13.97
HUMIDITY (kg water/kg dry air)	0.0080	0.0090	AROMATICS CONTENT (%vol)	15.9
			NAPHTHALENE CONTENT (%vol)	0.11
			SULPHUR CONTENT (ppm by mass)	300

MANUFACTURER: Rolls-Royce plc  
TEST ORGANIZATION: Rolls-Royce plc  
TEST LOCATION: Derby  
TEST DATES: 04/10/2018

### REMARKS

1. Certification Report EDNS01000740804
2. Correction of minor error in reported nvPM data
3. The maximum EI<sub>mass</sub> occurs between 30% and 85%  $F_{oo}$
4. The maximum EI<sub>num</sub> occurs between 30% and 85%  $F_{oo}$
5. Corrected peak EI number value (fuel correction) since EEDB v30