



# ICAO ENGINE nvPM EMISSIONS DATA SHEET

## SUBSONIC ENGINES

ENGINE IDENTIFICATION: Trent 1000-N3  
UNIQUE ID NUMBER: 02P23RR135  
COMBUSTOR: Phase5 Tiled  
ENGINE TYPE: TF

BYPASS RATIO (-): 8.9  
PRESSURE RATIO  $\pi_{co}$  (-): 48.8  
RATED OUTPUT  $F_{oo}$  (kN): 358.1

### 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>	178.0	1.65E+15	3410
AS % OF CAEP/10 LIMIT	-	-	89.9
AS % OF CAEP/11 LIMIT (InP)	51.2	39.5	
AS % OF CAEP/11 LIMIT (NT)	83.2	59.2	

### 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	2.802	41.0	1.04E+14	
CLIMB OUT	85	2.2	2.274	61.2	1.95E+14	
APPROACH	30	4.0	0.732	82.9	8.91E+14	
IDLE	7	26.0	0.267	19.4	4.72E+14	
LTO TOTAL (kg, mg, number of particles)			1010	45841	4.24E+17	-
NUMBER OF ENGINES				1	1	1
NUMBER OF TESTS				3	3	3
AVERAGE LTO/ $F_{oo}$ VALUES (mg/kN, particles/kN)				128.0	1.18E+15	-
MAX EI VALUES (mg/kg, particles/kg) AND MAX MASS CONC. ( $\mu\text{g}/\text{m}^3$ )				153.9	9.32E+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	43.8	1.41E+14
CLIMB OUT	85	65.9	2.70E+14
APPROACH	30	95.2	1.97E+15
IDLE	7	23.3	9.28E+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