



# ICAO ENGINE nvPM EMISSIONS DATA SHEET

## SUBSONIC ENGINES

ENGINE IDENTIFICATION: Trent 972-84  
UNIQUE ID NUMBER: 01P18RR104  
COMBUSTOR: Phase5 Tiled  
ENGINE TYPE: TF

BYPASS RATIO (-): 8.4  
PRESSURE RATIO  $\pi_{co}$  (-): 38.7  
RATED OUTPUT  $F_{oo}$  (kN): 346.0

### 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>	149.9	1.68E+15	2492
AS % OF CAEP/10 LIMIT	-	-	64.9
AS % OF CAEP/11 LIMIT (InP)	43.1	40.3	
AS % OF CAEP/11 LIMIT (NT)	70.0	60.5	

### 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	2.672	62.4	2.31E+14	
CLIMB OUT	85	2.2	2.210	73.5	3.41E+14	
APPROACH	30	4.0	0.735	63.5	1.03E+15	
IDLE	7	26.0	0.258	6.5	4.15E+14	
LTO TOTAL (kg, mg, number of particles)			983	42253	4.74E+17	-
NUMBER OF ENGINES				2	2	2
NUMBER OF TESTS				3	3	3
AVERAGE LTO/ $F_{oo}$ VALUES (mg/kN, particles/kN)				122.1	1.37E+15	-
MAX EI VALUES (mg/kg, particles/kg) AND MAX MASS CONC. ( $\mu\text{g}/\text{m}^3$ )				104.0	1.14E+15	2125

\* 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	67.4	3.05E+14
CLIMB OUT	85	80.1	5.20E+14
APPROACH	30	74.6	2.54E+15
IDLE	7	8.6	1.05E+15

### AMBIENT CONDITIONS

	From	To	FUEL	
BAROMETER (kPa)	99.7	100.5	HEAT OF COMBUSTION (MJ/kg)	43.12
TEMPERATURE (K)	276.6	286.7	HYDROGEN CONTENT (%mass)	13.75
HUMIDITY (kg water/kg dry air)	0.0024	0.0112	AROMATICS CONTENT (%vol)	17.8
			NAPHTHALENE CONTENT (%vol)	1.67
			SULPHUR CONTENT (ppm by mass)	365

MANUFACTURER: Rolls-Royce plc  
TEST ORGANIZATION: Rolls-Royce plc  
TEST LOCATION: Derby  
TEST DATES: 18/11/2015-25/04/2016

### REMARKS

1. Certification Report EDNS01000750023
2. The maximum EI<sub>mass</sub> occurs between 30% and 85%  $F_{oo}$
3. Corrected peak EI number value (fuel correction) since EEDB v30