



ICAO ENGINE nvPM EMISSIONS DATA SHEET

SUBSONIC ENGINES

ENGINE IDENTIFICATION: Trent XWB-97 BYPASS RATIO (-): 8.1
UNIQUE ID NUMBER: 01P21RR125 PRESSURE RATIO π_{c0} (-): 48.4
COMBUSTOR: Phase5 Tiled (Improved)
ENGINE TYPE: TF RATED OUTPUT F_{00} (kN): 436.7

REGULATORY DATA

CHARACTERISTIC VALUES:	LTO_{mass}/F_{00} (mg/kN)	LTO_{num}/F_{00} (particles/kN)	NVPM MASS CONCENTRATION ($\mu\text{g}/\text{m}^3$)
LTO/ F_{00} AND MAX nvPM _{mass}	93.7	1.39E+15	1339
AS % OF CAEP/10 LIMIT	-	-	37.9
AS % OF CAEP/11 LIMIT (InP)	27.0	33.3	
AS % OF CAEP/11 LIMIT (NT)	43.8	49.9	

MEASURED DATA

MODE	POWER SETTING (% F_{00})	TIME minutes	FUEL FLOW kg/s	EMISSIONS INDICES*		NVPM MASS CONCENTRATION PEAK nvPM _{mass} ($\mu\text{g}/\text{m}^3$)
				EI _{mass} (mg/kg)	EI _{num} (particles/kg)	
TAKE-OFF	100	0.7	3.498	43.5	1.95E+14	
CLIMB OUT	85	2.2	2.798	35.1	2.10E+14	
APPROACH	30	4.0	0.918	59.0	9.27E+14	
IDLE	7	26.0	0.301	8.3	4.83E+14	
LTO TOTAL (kg, mg, number of particles)			1206	36237	5.37E+17	-
NUMBER OF ENGINES				3	3	3
NUMBER OF TESTS				5	5	5
AVERAGE LTO/ F_{00} VALUES (mg/kN, particles/kN)				83.0	1.23E+15	-
MAX EI VALUES (mg/kg, particles/kg) AND MAX MASS CONC. ($\mu\text{g}/\text{m}^3$)				64.7	9.61E+14	1217

* 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_{00})	CORRECTED EMISSIONS INDICES	
		EI _{mass_SL} (mg/kg)	EI _{num_SL} (particles/kg)
TAKE-OFF	100	47.4	2.86E+14
CLIMB OUT	85	38.7	3.22E+14
APPROACH	30	68.4	1.75E+15
IDLE	7	11.0	1.20E+15

AMBIENT CONDITIONS

	From	To	FUEL	
BAROMETER (kPa)	98.5	102.0	HEAT OF COMBUSTION (MJ/kg)	43.37
TEMPERATURE (K)	282.3	294.1	HYDROGEN CONTENT (%mass)	14.03
HUMIDITY (kg water/kg dry air)	0.0031	0.0080	AROMATICS CONTENT (%vol)	15.4
			NAPHTHALENE CONTENT (%vol)	0.19
			SULPHUR CONTENT (ppm by mass)	300

MANUFACTURER: Rolls-Royce plc
TEST ORGANIZATION: Rolls-Royce plc
TEST LOCATION: Derby
TEST DATES: 15/04/2020-29/04/2020

REMARKS

- Smoke Improved Combustor
- Data from Certification Report EDNS01000886411
- The maximum EI_{mass} occurs between 30% and 85% F_{00}
- Corrected peak EI number value (fuel correction) since EEDB v30