



# ICAO ENGINE nvPM EMISSIONS DATA SHEET

## SUBSONIC ENGINES

ENGINE IDENTIFICATION: Trent7000-70 BYPASS RATIO (-): 9.1  
UNIQUE ID NUMBER: 04P24RR145 PRESSURE RATIO  $\pi_{co}$  (-): 43.4  
COMBUSTOR: Phase5 Tiled (Improved nvPM combustor)  
ENGINE TYPE: TF RATED OUTPUT  $F_{oo}$  (kN): 317.8

### 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>	93.2	1.16E+15	1690
AS % OF CAEP/10 LIMIT	-	-	42.6
AS % OF CAEP/11 LIMIT (InP)	26.8	27.8	
AS % OF CAEP/11 LIMIT (NT)	43.6	41.7	

### 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	2.380	35.2	1.46E+14	
CLIMB OUT	85	2.2	1.949	54.7	2.94E+14	
APPROACH	30	4.0	0.648	29.1	6.83E+14	
IDLE	7	26.0	0.251	10.5	3.31E+14	
LTO TOTAL (kg, mg, number of particles)			904	26241	3.26E+17	-
NUMBER OF ENGINES				3	3	3
NUMBER OF TESTS				5	5	5
AVERAGE LTO/ $F_{oo}$ VALUES (mg/kN, particles/kN)				82.6	1.03E+15	-
MAX EI VALUES (mg/kg, particles/kg) AND MAX MASS CONC. ( $\mu\text{g}/\text{m}^3$ )				86.8	9.52E+14	1537

\* 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	41.1	2.17E+14
CLIMB OUT	85	63.8	4.53E+14
APPROACH	30	35.8	1.38E+15
IDLE	7	13.3	7.20E+14

### AMBIENT CONDITIONS

	From	To	FUEL	
BAROMETER (kPa)	100.2	101.6	HEAT OF COMBUSTION (MJ/kg)	43.37
TEMPERATURE (K)	291.4	299.6	HYDROGEN CONTENT (%mass)	14.01
HUMIDITY (kg water/kg dry air)	0.0047	0.0099	AROMATICS CONTENT (%vol)	16.1
			NAPHTHALENE CONTENT (%vol)	0.18
			SULPHUR CONTENT (ppm by mass)	300

MANUFACTURER: Rolls-Royce plc  
TEST ORGANIZATION: Rolls-Royce plc  
TEST LOCATION: Derby  
TEST DATES: 05/05/2020-11/09/2020

### REMARKS

1. Certification Report EDNS01000945310
2. Improved nvPM combustor
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