



# ICAO ENGINE nvPM EMISSIONS DATA SHEET

## SUBSONIC ENGINES

ENGINE IDENTIFICATION: Trent 1000-CE3  
UNIQUE ID NUMBER: 02P23RR127  
COMBUSTOR: Phase5 Tiled  
ENGINE TYPE: TF

BYPASS RATIO (-): 9.0  
PRESSURE RATIO  $\pi_{c0}$  (-): 46.0  
RATED OUTPUT  $F_{00}$  (kN): 334.7

### REGULATORY DATA

| CHARACTERISTIC VALUES:                     | $LTO_{mass}/F_{00}$<br>(mg/kN) | $LTO_{num}/F_{00}$<br>(particles/kN) | NVPM MASS CONCENTRATION<br>( $\mu\text{g}/\text{m}^3$ ) |
|--|--------------------------------|--------------------------------------|---|
| LTO/ $F_{00}$ 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<br>SETTING<br>(% $F_{00}$ ) | TIME<br>minutes | FUEL FLOW<br>kg/s | EMISSIONS INDICES*            |                                     | NVPM MASS CONCENTRATION<br>PEAK nvPM <sub>mass</sub><br>( $\mu\text{g}/\text{m}^3$ ) |
|---|-----------------------------------|-----------------|-------------------|-------------------------------|-------------------------------------|--|
|   |                                   |                 |                   | EI <sub>mass</sub><br>(mg/kg) | EI <sub>num</sub><br>(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/ $F_{00}$ 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<br>SETTING<br>(% $F_{00}$ ) | CORRECTED EMISSIONS INDICES      |  |
|-----------|-----------------------------------|----------------------------------|--|
|           |                                   | EI <sub>mass_SL</sub><br>(mg/kg) | EI <sub>num_SL</sub><br>(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%  $F_{00}$
4. The maximum EI<sub>num</sub> occurs between 30% and 85%  $F_{00}$
5. Corrected peak EI number value (fuel correction) since EEDB v30