



ICAO ENGINE nvPM EMISSIONS DATA SHEET

SUBSONIC ENGINES

ENGINE IDENTIFICATION: CFM56-7B20E BYPASS RATIO (-): 5.5
UNIQUE ID NUMBER: 01P11CM111 PRESSURE RATIO π_{co} (-): 22.4
COMBUSTOR: Tech Insertion
ENGINE TYPE: TF RATED OUTPUT F_{oo} (kN): 91.6

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 $nvPM_{mass}$	56.0	9.42E+14	910
AS % OF CAEP/10 LIMIT	-	-	13.1
AS % OF CAEP/11 LIMIT (InP)	2.1	5.7	
AS % OF CAEP/11 LIMIT (NT)	9.1	12.6	

MEASURED DATA

MODE	POWER SETTING (% F_{oo})	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	0.896	33.5	4.22E+14	
CLIMB OUT	85	2.2	0.746	22.7	3.60E+14	
APPROACH	30	4.0	0.268	1.0	3.93E+13	
IDLE	7	26.0	0.094	0.9	5.63E+13	
LTO TOTAL (kg, mg, number of particles)			348	3691	6.21E+16	-
NUMBER OF ENGINES				1	1	1
NUMBER OF TESTS				3	3	3
AVERAGE LTO/ F_{oo} VALUES (mg/kN, particles/kN)				40.3	6.78E+14	-
MAX EI VALUES (mg/kg, particles/kg) AND MAX MASS CONC. ($\mu\text{g}/\text{m}^3$)				33.5	4.20E+14	707

* 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	
		$EI_{mass_{SL}}$ (mg/kg)	$EI_{num_{SL}}$ (particles/kg)
TAKE-OFF	100	41.5	1.38E+15
CLIMB OUT	85	29.1	1.29E+15
APPROACH	30	1.5	2.22E+14
IDLE	7	1.6	3.81E+14

AMBIENT CONDITIONS

	From	To	FUEL	
BAROMETER (kPa)	99.5	100.2	HEAT OF COMBUSTION (MJ/kg)	43.27
TEMPERATURE (K)	295.5	311.8	HYDROGEN CONTENT (%mass)	13.83
HUMIDITY (kg water/kg dry air)	0.0066	0.0122	AROMATICS CONTENT (%vol)	18.7
			NAPHTHALENE CONTENT (%vol)	0.67
			SULPHUR CONTENT (ppm by mass)	519

MANUFACTURER: CFM International
TEST ORGANIZATION: Safran Aircraft Engines
TEST LOCATION: Villaroche, France
TEST DATES: 25/07/2019-30/07/2019

REMARKS

- Engine 849-166/1
- Certification Report CR-2097/3 SUPPLEMENT 2-5B, CR-2097/3 SUPPLEMENT 2-7B