



ICAO ENGINE nvPM EMISSIONS DATA SHEET

SUBSONIC ENGINES

ENGINE IDENTIFICATION: CFM56-7B26/3 (Research Measurement) BYPASS RATIO (-): 5.1
UNIQUE ID NUMBER: 01P22FC001 PRESSURE RATIO π_{co} (-): 27.7
COMBUSTOR: Tech Insertion
ENGINE TYPE: TF RATED OUTPUT F_{oo} (kN): 117.0

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 $nvPM_{mass}$	118.7	1.06E+15	2253
AS % OF CAEP/10 LIMIT	-	-	36.8
AS % OF CAEP/11 LIMIT (InP)	5.6	7.8	
AS % OF CAEP/11 LIMIT (NT)	26.8	19.5	

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	1.213	69.1	4.52E+14	
CLIMB OUT	85	2.2	0.986	46.7	4.29E+14	
APPROACH	30	4.0	0.331	1.1	7.14E+13	
IDLE	7	26.0	0.108	1.8	2.67E+13	
LTO TOTAL (kg, mg, number of particles)			429	9989	8.90E+16	-
NUMBER OF ENGINES				1	1	1
NUMBER OF TESTS				3	3	3
AVERAGE LTO/F_{oo} VALUES (mg/kN, particles/kN)				85.4	7.61E+14	-
MAX EI VALUES (mg/kg, particles/kg) AND MAX MASS CONC. ($\mu\text{g}/\text{m}^3$)				69.1	4.52E+14	1750

* 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	78.8	1.12E+15
CLIMB OUT	85	55.1	1.28E+15
APPROACH	30	1.6	4.51E+14
IDLE	7	2.8	1.79E+14

AMBIENT CONDITIONS

	From	To	FUEL	
BAROMETER (kPa)	96.6	96.9	HEAT OF COMBUSTION (MJ/kg)	43.30
TEMPERATURE (K)	294.7	302.9	HYDROGEN CONTENT (%mass)	13.98
HUMIDITY (kg water/kg dry air)	0.0073	0.0101	AROMATICS CONTENT (%vol)	17.7
			NAPHTHALENE CONTENT (%vol)	0.75
			SULPHUR CONTENT (ppm by mass)	420

MANUFACTURER: CFM International
TEST ORGANIZATION: Empa
TEST LOCATION: SR Technics, Zurich, Switzerland
TEST DATES: 17/08/2013-18/08/2013

REMARKS

1. First in the world nvPM certification-like test (Year 2013)
2. Engine S/N 897-397
3. Report "Non-volatile Particulate Matter Emissions Certification of a CFM56-7B26/3" May 2020
4. nvPM mass measurement at limit of detection for approach and idle mode
5. Provided by Swiss Federal Office of Civil Aviation, Switzerland