



ICAO ENGINE nvPM EMISSIONS DATA SHEET

SUBSONIC ENGINES

ENGINE IDENTIFICATION: CFM56-5B1/3 BYPASS RATIO (-): 5.5
UNIQUE ID NUMBER: 01P08CM102 PRESSURE RATIO π_{co} (-): 30.2
COMBUSTOR: Tech Insertion
ENGINE TYPE: TF RATED OUTPUT F_{co} (kN): 133.4

REGULATORY DATA

CHARACTERISTIC VALUES:	LTO_{mass}/F_{co} (mg/kN)	LTO_{num}/F_{co} (particles/kN)	NVPM MASS CONCENTRATION ($\mu\text{g}/\text{m}^3$)
LTO/F_{co} AND MAX $nvPM_{mass}$	126.0	9.56E+14	2644
AS % OF CAEP/10 LIMIT	-	-	46.1
AS % OF CAEP/11 LIMIT (InP)	7.1	8.2	
AS % OF CAEP/11 LIMIT (NT)	38.3	23.3	

MEASURED DATA

MODE	POWER SETTING (% F_{co})	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	1.318	78.7	3.84E+14	
CLIMB OUT	85	2.2	1.063	53.4	4.27E+14	
APPROACH	30	4.0	0.347	1.9	7.87E+13	
IDLE	7	26.0	0.108	0.7	2.42E+13	
LTO TOTAL (kg, mg, number of particles)			448	12132	9.18E+16	-
NUMBER OF ENGINES				1	1	1
NUMBER OF TESTS				3	3	3
AVERAGE LTO/F_{co} VALUES (mg/kN, particles/kN)				90.9	6.88E+14	-
MAX EI VALUES (mg/kg, particles/kg) AND MAX MASS CONC. ($\mu\text{g}/\text{m}^3$)				78.7	4.34E+14	2054

* 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_{co})	CORRECTED EMISSIONS INDICES	
		$EI_{mass_{SL}}$ (mg/kg)	$EI_{num_{SL}}$ (particles/kg)
TAKE-OFF	100	90.5	9.10E+14
CLIMB OUT	85	63.5	1.18E+15
APPROACH	30	3.0	4.37E+14
IDLE	7	1.1	1.20E+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