



Part 34

Aircraft Emissions

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Aircraft Emissions

34.1 Applicability

This Part shall apply to all turbine engines and their derivative versions included in the classifications defined for emission certification purposes where such engines are fitted to aircraft registered in Arab Republic of Egypt where engaged in international air navigation.

34.3 Definitions

Afterburning. A mode of engine operation wherein a combustion system fed (in whole or part) by vitiated air is used.

Approach phase. The operating phase defined by the time during which the engine is operated in the approach operating mode.

Climb phase. The operating phase defined by the time during which the engine is operated in the climb operating mode.

Date of manufacture. The date of issue of the document attesting that the individual aircraft or engine as appropriate conforms to the requirements of the type or the date of an analogous document.

Derivative version. An aircraft gas turbine engine of the same generic family as an originally type-certificated engine and having features which retain the basic core engine and combustor design of the original model and for which other factors, as judged by the certificating authority, have not changed.

Note.— Attention is drawn to the difference between the definition of “derived version of an aeroplane” in Volume I of Annex 16 and the definition of “derivative version” in this Volume.

Exhaust nozzle. In the exhaust emissions sampling of gas turbine engines where the jet effluxes are not mixed (as in some turbofan engines for example) the nozzle considered is that for the gas generator (core) flow only. Where, however, the jet efflux is mixed the nozzle considered is the total exit nozzle.

Non-Volatile Particulate Matter (nvPM). Emitted particles that exist at gas turbine engine exhaust nozzle exit plane that do not volatilise when heated to a temperature of 350°C.

Oxides of nitrogen. The sum of the amounts of the nitric oxide and nitrogen dioxide contained in a gas sample calculated as if the nitric oxide were in the form of nitrogen dioxide.

Rated thrust. For engine emissions purposes, the maximum take-off thrust approved by the certificating authority for use under normal operating conditions at ISA sea level static conditions without the use of water injection as approved by the certificating authority. Thrust is expressed in kilonewtons.

Reference pressure ratio. The ratio of the mean total pressure at the last compressor discharge plane of the compressor to the mean total pressure at the compressor entry plane when the engine is developing take-off thrust rating in ISA sea level static conditions.

Smoke. The carbonaceous materials in exhaust emissions which obscure the transmission of light.

Smoke Number. The dimensionless term quantifying smoke emissions.

Take-off phase. The operating phase defined by the time during which the engine is operated at the rated thrust.

Taxi/ground idle. The operating phases involving taxi and idle between the initial starting of the propulsion engine(s) and the initiation of the take-off roll and between the time of runway turn-off and final shutdown of all propulsion engine(s).

Type Certificate. A document issued by a Contracting State to define the design of an aircraft, engine or propeller type and to certify that this design meets the appropriate airworthiness requirements of that State.(see ECAR Part 1).

Unburned hydrocarbons. The total of hydrocarbon compounds of all classes and molecular weights contained in a gas sample, calculated as if they were in the form of methane.

34.5 Abbreviations

Where the following symbols are used in Volume II of this Annex, they have the meanings ascribed to them below:

CO Carbon monoxide

DP The mass of any gaseous pollutant emitted during the reference emissions landing and take-off cycle

F_n Thrust in International Standard Atmosphere (ISA), sea level conditions, for the given operating mode

F_{oo} Rated thrust (see definition)

F^*_{oo} Rated thrust with afterburning applied

HC Unburned hydrocarbons (*see* definition)

NO Nitric oxide

NO₂ Nitrogen dioxide

NO_x Oxides of nitrogen (see definition)

nvPM Non-Volatile Particulate Matter(see definition & note)

SN Smoke Number (see definition)

Π_{oo} Reference pressure ratio (see definition)

Note: The concentration of nvPM mass (nvPM_{mass}) shall be reported in µg/m³

34.7 Provisions

The provisions of this chapter shall apply to all aircraft engines and their derivative versions, intended for propulsion only at subsonic speeds, as stated in Annex 16 volume II to the Convention of International Civil Aviation as amended ,for which an application for type certification is submitted to the ECAA.

The provision further specified shall apply to all turbofan and turbojet engines of a type or model, and their derivative versions, with a rated thrust greater than 26.7 kN and whose date of manufacture of the individual engine is on or after 1 January 2020.

34.9 Compliance

- (a) Each aircraft operator shall submit to the ECAA the documents defining methods of compliance with Annex 16 Volume II as amended.
- (b) The maximum nvPM mass concentration [µg/m³] obtained from measurement at sufficient thrust settings, in such away that the emission maximum can be determined, and computed in accordance with the procedures of Appendix 7 and converted to characteristic levels by the procedures of Appendix 6, or equivalent procedures as agreed by the certificating authority shall not exceed the level determined from the following formula:

$$\text{Regulatory limit concentration of } nvPM_{mass} = 10^{(3 + 2.9 F_{oo}^{-0.274})}$$

- (c) ECAA shall recognize as valid engine exemptions for an engine production cut-off requirement granted by a competent certificating authority of another Contracting State provided that the exemptions are granted in accordance with the process and criteria defined in the Environmental Technical Manual (Doc 9501), Volume II — Procedures for the Emissions Certification of Aircraft Engines.
- (d) In considering exemptions, certificating authorities should take into account the probable numbers of such engines that will be produced and their impact on the environment. When such an exemption is granted, the certificating authority should

consider imposing a time limit on the production of such engines for installation on new aircraft. In such cases, an exemption document shall be issued by the certificating authority, the identification plates on the engines shall be marked “EXEMPT NEW,” or “EXEMPT SPARE” and the grant of exemption shall be noted in the permanent engine record. Exemptions shall be reported by engine serial number and made available via an official public register.

- (e) If an engine type fails a certification test, the certificating authority shall permit the manufacturer, if he/she so wishes, to conduct additional tests on the certification engines. If the total results available still show that the engine type fails the certification requirements, the manufacturer shall be allowed to test as many additional engines as desired. The resulting test results shall then be considered with all previous data.
- (f) If the result is still failure, the manufacturer shall be allowed to select one or more engines for modification. The results of the tests already made on the selected engine(s) while unmodified shall be inspected, and further testing shall be done so that at least three tests are available. The mean of these tests shall be determined for each engine and described as the “unmodified mean”.
- (g) The engine(s) may then be modified, and at least three tests shall be conducted on the modified engine(s), the mean of which shall be described as the “modified mean” in each case. This “modified mean” shall be compared to the “unmodified mean” to give a proportional improvement which shall then be applied to the previous certification test result to determine if compliance has been achieved. It shall be determined before testing of any modified engine is begun that the modification(s) comply with the appropriate airworthiness requirements.
- (h) This procedure shall be repeated until compliance has been demonstrated or the engine type application is withdrawn

34.11 The documents attesting the aircraft engine emission certification

The document attesting the aircraft engine emissions certification shall provide for each individual engine at least the following information applicable to the engine type:

- (a) Name of certificating authority;
- (b) Manufacturer’s type and model designation;
- (c) Statement of any additional modifications incorporated for the purpose of compliance with the applicable emissions certification requirements;
- (d) Rated thrust;
- (e) Reference pressure ratio;
- (f) The coefficients needed to determine the characteristic levels of engine emissions as given in Table A6-1 Annex 16 Volume II as amended.

34.13 Fuel venting emissions Assessment.

- (a) No fuel venting emissions shall be discharged into the atmosphere from any new or in-use aircraft gas turbine engine subject to this part. This paragraph is directed at the elimination of intentional discharge to the atmosphere of fuel drained from fuel nozzle manifolds after engines are shut down and does not apply to normal fuel seepage from shaft seals, joints, and fittings.
- (b) Conformity with the standard set forth in paragraph (a) of this section shall be determined by inspection of the method designed to eliminate these emissions.
- (c) Any manufacturer or operator may show compliance with the fuel venting and emissions requirements of this section by any means that prevents the intentional discharge of fuel from fuel nozzle manifolds after the engines are shut down. Acceptable means of compliance include one of the following:
 - (1) Incorporation of an approved system that reticulates the fuel back into the fuel system.
 - (2) Capping or securing the pressurization and drain valve.
 - (3) Manually draining the fuel from a holding tank into a container.
- (d) Prevention of intentional fuel venting Aircraft shall be so designed and constructed as to prevent the intentional discharge into the atmosphere of liquid fuel from the fuel nozzle manifolds resulting from the process of engine shutdown following normal flight or ground operations.

34.15 Aircraft Engine Emissions Assessment

- (a) Each aircraft registered in Egypt will be assessed by the ECAA to prove that the aircraft complies with Annex 16 Volume II requirements.
- (b) The ECAA will validate the documents submitted by the applicant to attest the aircraft engine emissions certification granted by the certificating authority, provided that the requirements under which such certification was granted are not less stringent than the provisions of Annex 16 volume II to the engine type.
- (c) Any aircraft Engine Emissions found during services, not conforming with the provisions of Annex 16 volume II will be considered un-airworthy until the proper corrective action is undertaken.

Note.— The document attesting certification relating to fuel venting may take the form of a separate fuel venting certificate or a suitable statement contained in another document approved by the certificating authority