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Title 40 —Protection of Environment
Chapter I —Environmental Protection Agency
Subchapter U —Air Pollution Controls

Part 1031 Control of Air Pollution from Aircraft Engines

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**PART 1031—CONTROL OF AIR POLLUTION FROM AIRCRAFT
ENGINES**

Authority: 42 U.S.C. 7401-7671q.

Source: 87 FR 72351, Nov. 23, 2022, unless otherwise noted.

Subpart A—Scope and Applicability

§ 1031.1 Applicability.

This part applies to aircraft gas turbine engines on and after January 1, 2023. Emission standards apply as described in subpart B of this part.

- (a) Except as provided in paragraph (b) of this section, the regulations of this part apply to aircraft engines subject to 14 CFR part 33.
- (b) The requirements of this part do not apply to the following aircraft engines:
 - (1) Reciprocating engines (including engines used in ultralight aircraft).
 - (2) Turboshift engines such as those used in helicopters.
 - (3) Engines used only in aircraft that are not airplanes.
 - (4) Engines not used for propulsion.

§ 1031.5 Engines installed on domestic and foreign aircraft.

The Secretary of Transportation shall apply these regulations to aircraft of foreign registry in a manner consistent with obligations assumed by the United States in any treaty, convention or agreement between the United States and any foreign country or foreign countries.

§ 1031.10 State standards and controls.

No State or political subdivision of a State may adopt or attempt to enforce any aircraft or aircraft engine standard with respect to emissions unless the standard is identical to a standard that applies to aircraft or aircraft engines under this part.

§ 1031.15 Exemptions.

Individual engines may be exempted from current standards as described in this section. Exempted engines must conform to regulatory conditions specified for an exemption in this part and other applicable regulations. Exempted engines are deemed to be "subject to" the standards of this part even though they are not required to comply with the otherwise applicable requirements. Engines exempted with respect to certain standards must comply with other standards as a condition of the exemption.

- (a) Engines installed in new aircraft. Each person seeking relief from compliance with this part at the time of certification must submit an application for exemption to the FAA in accordance with the regulations of 14 CFR parts 11 and 34. The FAA will consult with the EPA on each exemption application request before the FAA takes action. Exemption requests under this paragraph (a) are effective only with FAA approval and EPA's written concurrence.
- (b) Temporary exemptions based on flights for short durations at infrequent intervals. The emission standards of this part do not apply to engines that power aircraft operated in the United States for short durations at infrequent intervals. Exemption requests under this paragraph (b) are effective with FAA approval. Such operations are limited to:
 - (1) Flights of an aircraft for the purpose of export to a foreign country, including any flights essential to demonstrate the integrity of an aircraft prior to its flight to a point outside the United States.

- (2) Flights to a base where repairs, alterations or maintenance are to be performed, or to a point of storage, and flights for the purpose of returning an aircraft to service.
- (3) Official visits by representatives of foreign governments.
- (4) Other flights the Secretary of Transportation determines to be for short durations at infrequent intervals. A request for such a determination shall be made before the flight takes place.

§ 1031.20 Exceptions.

Individual engines may be excepted from current standards as described in this section. Excepted engines must conform to regulatory conditions specified for an exception in this part and other applicable regulations. Excepted engines are deemed to be “subject to” the standards of this part even though they are not required to comply with the otherwise applicable requirements. Engines excepted with respect to certain standards must comply with other standards from which they are not excepted.

- (a) **Spare engines.** Newly manufactured engines meeting the definition of “spare engine” are automatically excepted as follows:
 - (1) This exception allows production of a newly manufactured engine for installation on an in-use aircraft. It does not allow for installation of a spare engine on a new aircraft.
 - (2) Spare engines excepted under this paragraph (a) may be used only if they are certificated to emission standards equal to or lower than those of the engines they are replacing, for all regulated pollutants.
 - (3) Engine manufacturers do not need to request approval to produce spare engines, but must include information about spare engine production in the annual report specified in § 1031.150(d).
 - (4) The permanent record for each engine excepted under this paragraph (a) must indicate that the engine was manufactured as an excepted spare engine.
 - (5) Engines excepted under this paragraph (a) must be labeled with the following statement: “EXCEPTED SPARE”.
- (b) [Reserved]

Subpart B—Emission Standards and Measurement Procedures

§ 1031.30 Overview of emission standards and general requirements.

- (a) **Overview of standards.** Standards apply to different types and sizes of aircraft engines as described in §§ 1031.40 through 1031.90. All new engines and some in-use engines are subject to smoke standards (either based on smoke number or nvPM mass concentration). Some new engines are also subject to standards for gaseous emissions (HC, CO, and NO_x) and nvPM (mass and number).
 - (1) Where there are multiple tiers of standards for a given pollutant, the named tier generally corresponds to the meeting of the International Civil Aviation Organization's (ICAO's) Committee on Aviation Environmental Protection (CAEP) at which the standards were agreed to internationally. Other standards are named Tier 0, Tier 1, or have names that describe the standards.
 - (2) Where a standard is specified by a formula, determine the level of the standard as follows:

- (i) For smoke number standards, calculate and round the standard to the nearest 0.1 smoke number.
 - (ii) For maximum nvPM mass concentration standards, calculate and round the standard to the nearest 1 $\mu\text{g}/\text{m}^3$.
 - (iii) For LTO nvPM mass standards, calculate and round the standard to three significant figures.
 - (iv) For LTO nvPM number standards calculate and round the standard to three significant figures.
 - (v) For gaseous emission standards, calculate and round the standard to three significant figures, or to the nearest 0.1 g/kN for turbojet and turbofan standards at or above 100 g/kN.
- (3) Perform tests using the procedures specified in § 1031.140 to measure emissions for comparing to the standard. Engines comply with an applicable standard if test results show that the engine type certificate family's characteristic level does not exceed the numerical level of that standard.
- (4) Engines that are covered by the same type certificate and are determined to be derivative engines for emissions certification purposes under the requirements of § 1031.130 are subject to the emission standards of the previously certified engine. Otherwise, the engine is subject to the emission standards that apply to a new engine type.

(b) **Fuel venting.**

- (1) The fuel venting standard in paragraph (b)(2) of this section applies to new subsonic and supersonic aircraft engines subject to this part. This fuel venting standard also applies to the following in-use engines:
- (i) Turbojet and turbofan engines with rated output at or above 36 kN thrust manufactured after February 1, 1974.
 - (ii) Turbojet and turbofan engines with rated output below 36 kN thrust manufactured after January 1, 1975.
 - (iii) Turboprop engines manufactured after January 1, 1975.
- (2) Engines may not discharge liquid fuel emissions into the atmosphere. This standard is directed at eliminating intentional discharge of liquid 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. Certification for the fuel venting standard will be based on an inspection of the method designed to eliminate these emissions.

§ 1031.40 Turboprop engines.

The following standards apply to turboprop engines with rated output at or above 1,000 kW:

- (a) **Smoke.** Engines of a type or model for which the date of manufacture of the individual engine is on or after January 1, 1984, may not have a characteristic level for smoke number exceeding the following value:

$$\text{SN} = 187 \cdot \text{rO}^{-0.168}$$

- (b) [Reserved]

§ 1031.50 Subsonic turbojet and turbofan engines at or below 26.7 kN thrust.

The following standards apply to new turbofan or turbojet aircraft engines with rated output at or below 26.7 kN thrust that are installed in subsonic aircraft:

- (a) **Smoke.** Engines of a type or model for which the date of manufacture of the individual engine is on or after August 9, 1985 may not have a characteristic level for smoke number exceeding the lesser of 50 or the following value:

$$SN = 83.6 \cdot rO^{-0.274}$$

- (b) [Reserved]

§ 1031.60 Subsonic turbojet and turbofan engines above 26.7 kN thrust.

The following standards apply to new turbofan or turbojet aircraft engines with rated output above 26.7 kN thrust that are installed in subsonic aircraft:

- (a) **Smoke.**

- (1) **Tier 0.** Except as specified in (a)(2) of this section, engines of a type or model with rated output at or above 129 kN, and for which the date of manufacture of the individual engine after January 1, 1976 and is before January 1, 1984 may not have a characteristic level for smoke number exceeding the following emission standard:

$$SN = 83.6 \cdot rO^{-0.274}$$

- (2) **JT8D and JT3D engines.**

- (i) Engines of the type JT8D for which the date of manufacture of the individual engine is on or after February 1, 1974, and before January 1, 1984 may not have a characteristic level for smoke number exceeding an emission standard of 30.
- (ii) Engines of the type JT3D for which the date of manufacture of the individual engine is on or after January 1, 1978 and before January 1, 1984 may not have a characteristic level for smoke number exceeding an emission standard of 25.

- (3) **Tier 0 in-use.** Except for engines of the type JT8D and JT3D, in-use engines with rated output at or above 129 kN thrust may not exceed the following smoke number standard:

$$SN = 83.6 \cdot rO^{-0.274}$$

- (4) **JT8D in-use.** In-use aircraft engines of the type JT8D may not exceed a smoke number standard of 30.

- (5) **Tier 1.** Engines of a type or model for which the date of manufacture of the individual engine is on or after January 1, 1984 and before January 1, 2023 may not have a characteristic level for smoke number exceeding an emission standard that is the lesser of 50 or the following:

$$SN = 83.6 \cdot rO^{-0.274}$$

- (6) **Tier 10.** Engines of a type or model for which the date of manufacture of the individual engine is on or after January 1, 2023 may not have a characteristic level for the maximum nvPM mass concentration in $\mu\text{g}/\text{m}^3$ exceeding the following emission standard:

$$nvPM_{MC} = 10^{(3 + 2.9 \cdot rO_{\lambda} - 0.274)}$$

(b) **LTO nvPM mass and number.** An engine's characteristic level for nvPM mass and nvPM number may not exceed emission standards as follows:

(1) **Tier 11 new type.** The following emission standards apply to engines of a type or model for which an application for original type certification is submitted on or after January 1, 2023 and for engines covered by an earlier type certificate if they do not qualify as derivative engines for emission purposes as described in § 1031.130:

TABLE 1 TO § 1031.60(b)(1)—TIER 11 NEW TYPE NVPM STANDARDS

Rated output (rO) in kN	nvPM _{mass} in milligrams/kN	nvPM _{num} in particles/kN
26.7 < rO ≤ 150	1251.1–6.914·rO	1.490·10 ¹⁶ –8.080·10 ¹³ ·rO
rO > 150	214.0	2.780·10 ¹⁵

(2) **Tier 11 in-production.** The following emission standards apply to engines of a type or model for which the date of manufacture of the individual engine is on or after January 1, 2023:

TABLE 2 TO § 1031.60(b)(2)—TIER 11 IN-PRODUCTION NVPM STANDARDS

Rated output (rO) in kN	nvPM _{mass} in milligrams/kN	nvPM _{num} in particles/kN
26.7 < rO ≤ 200	4646.9–21.497·rO	2.669·10 ¹⁶ –1.126·10 ¹⁴ ·rO
rO > 200	347.5	4.170·10 ¹⁵

(c) **HC.** Engines of a type or model for which the date of manufacture of the individual engine is on or after January 1, 1984, may not have a characteristic level for HC exceeding an emission standard of 19.6 g/kN.

(d) **CO.** Engines of a type or model for which the date of manufacture of the individual engine is on or after July 7, 1997, may not have a characteristic level for CO exceeding an emission standard of 118 g/kN.

(e) **NO_x.** An engine's characteristic level for NO_x may not exceed emission standards as follows:

(1) **Tier 0.** The following NO_x emission standards apply to engines of a type or model for which the date of manufacture of the first individual production model was on or before December 31, 1995, and for which the date of manufacture of the individual engine was on or after December 31, 1999, and before December 31, 2003:

$$\text{NO}_x = 40 + 2 \cdot \text{rPR} \text{ g/kN}$$

- (2) **Tier 2.** The following NO_x emission standards apply to engines of a type or model for which the date of manufacture of the first individual production model was after December 31, 1995, or for which the date of manufacture of the individual engine was on or after December 31, 1999, and before December 31, 2003:

$$\text{NO}_x = 32 + 1.6 \cdot \text{rPR} \text{ g/kN}$$

- (3) **Tier 4 new type.** The following NO_x emission standards apply to engines of a type or model for which the date of manufacture of the first individual production model was after December 31, 2003, and before July 18, 2012:

TABLE 3 TO § 1031.60(e)(3)—TIER 4 NEW TYPE NO_x STANDARDS

If the rated pressure ratio (rPR) is—	and the rated output (kN) is—	the NO _x emission standard (g/kN) is—
(i) rPR ≤ 30	(A) 26.7 < rO ≤ 89 (B) rO > 89	37.572 + 1.6·rPR–0.2087·rO 19 + 1.6·rPR
(ii) 30 < rPR < 62.5	(A) 26.7 < rO ≤ 89 (B) rO > 89	42.71 + 1.4286·rPR–0.4013·rO + 0.00642·rPR·rO 7 + 2·rPR
(iii) rPR ≥ 82.6	All	32 + 1.6·rPR

- (4) **Tier 6 in-production.** The following NO_x emission standards apply to engines of a type or model for which the date of manufacture of the individual engine is on or after July 18, 2012:

TABLE 4 TO § 1031.60(e)(4)—TIER 6 IN-PRODUCTION NO_x STANDARDS

If the rated pressure ratio (rPR) is—	and the rated output (kN) is—	the NO _x emission standard (g/kN) is—
(i) rPR ≤ 30	(A) 26.7 < rO ≤ 89 (B) rO > 89	38.5486 + 1.6823·rPR–0.2453·rO – 0.00308·rPR·rO 16.72 + 1.4080·rPR
(ii) 30 < rPR < 82.6	(A) 26.7 < rO ≤ 89 (B) rO > 89	46.1600 + 1.4286·rPR–0.5303·rO + 0.00642·rPR·rO –1.04 + 2.0·rPR

If the rated pressure ratio (rPR) is—	and the rated output (kN) is—	the NO _x emission standard (g/kN) is—
(iii) rPR ≥ 82.6	All	32 + 1.6·rPR

- (5) **Tier 8 new type.** The following NO_x standards apply to engines of a type or model for which the date of manufacture of the first individual production model was on or after January 1, 2014; or for which an application for original type certification is submitted on or after January 1, 2023; or for engines covered by an earlier type certificate if they do not qualify as derivative engines for emission purposes as described in § 1031.130:

TABLE 5 TO § 1031.60(e)(5)—TIER 8 NEW TYPE NO_x STANDARDS

If the rated pressure ratio (rPR) is—	and the rated output (kN) is—	the NO _x emission standard (g/kN) is—
(i) rPR ≤ 30	(A) 26.7 < rO ≤ 89 (B) rO > 89	40.052 + 1.5681·rPR - 0.3615·rO - 0.0018·rPR·rO 7.88 + 1.4080·rPR
(ii) 30 < rPR < 104.7	(A) 26.7 < rO ≤ 89 (B) rO > 89	41.9435 + 1.505·rPR - 0.5823·rO + 0.005562·rPR·rO -9.88 + 2.0·rPR
(iii) rPR ≥ 104.7	All	32 + 1.6·rPR

§ 1031.90 Supersonic engines.

The following standards apply to new engines installed in supersonic airplanes:

- (a) **Smoke.** Engines of a type or model for which the date of manufacture was on or after January 1, 1984, may not have a characteristic level for smoke number exceeding an emission standard that is the lesser of 50 or the following:
- $$SN = 83.6 \cdot rO^{-0.274}$$
- (b) [Reserved]
- (c) **HC.** Engines of a type or model for which the date of manufacture was on or after January 1, 1984, may not have a characteristic level for HC exceeding the following emission standard in g/kN rated output:
- $$HC = 140 \cdot 0.92^{rPR}$$
- (d) **CO.** Engines of a type or model for which the date of manufacture was on or after July 18, 2012, may not have a characteristic level for CO exceeding the following emission standard in g/kN rated output:
- $$CO = 4550 \cdot rPR^{-1.03}$$

- (e) **NO_x Engines** of a type or model for which the date of manufacture was on or after July 18, 2012, may not have a characteristic level for NO_x engines exceeding the following emission standard in g/kN rated output:

$$\text{NO}_x = 36 + 2.42 \cdot \text{rPR}$$

§ 1031.130 Derivative engines for emissions certification purposes.

- (a) **Overview.** For purposes of compliance with exhaust emission standards of this part, a type certificate applicant may request from the FAA a determination that an engine configuration be considered a derivative engine for emissions certification purposes. The applicant must demonstrate that the configuration is derived from and similar in type design to an engine that has a type certificate issued in accordance with 14 CFR part 33, and at least one of the following circumstances applies:
- (1) The FAA determines that a safety issue requires an engine modification.
 - (2) All regulated emissions from the proposed derivative engine are lower than the corresponding emissions from the previously certificated engine.
 - (3) The FAA determines that the proposed derivative engine's emissions are similar to the previously certificated engine's emissions as described in paragraph (c) of this section.
- (b) **Determining emission rates.** To determine new emission rates for a derivative engine for demonstrating compliance with emission standards under § 1031.30(a)(4) and for showing emissions similarity in paragraph (c) of this section, testing may not be required in all situations. If the previously certificated engine model or any associated sub-models have a characteristic level before modification that is at or above 95% of any applicable standard for smoke number, HC, CO, or NO_x or at or above 80% of any applicable nvPM standard, you must test the proposed derivative engine. Otherwise, you may use engineering analysis to determine the new emission rates, consistent with good engineering judgment. The engineering analysis must address all modifications from the previously certificated engine, including those approved for previous derivative engines.
- (c) **Emissions similarity.**
- (1) A proposed derivative engine's emissions are similar to the previously certificated engine's emissions if the type certificate applicant demonstrates that the engine meets the applicable emission standards and differ from the previously certificated engine's emissions only within the following ranges:
 - (i) ±3.0 g/kN for NO_x.
 - (ii) ±1.0 g/kN for HC.
 - (iii) ±5.0 g/kN for CO.
 - (iv) ±2.0 SN for smoke number.
 - (v) The following values apply for nvPM_{MC}:
 - (A) ±200 µg/m³ if the characteristic level of maximum nvPM_{MC} is below 1,000 µg/m³.
 - (B) ±20% of the characteristic level if the characteristic level for maximum nvPM_{MC} is at or above 1,000 µg/m³.
 - (vi) The following values apply for nvPM_{mass}:

- (A) 80 mg/kN if the characteristic level for $\text{nvPM}_{\text{mass}}$ emissions is below 400 mg/kN.
 - (B) $\pm 20\%$ of the characteristic level if the characteristic level for $\text{nvPM}_{\text{mass}}$ emissions is greater than or equal to 400 mg/kN.
- (vii) The following values apply for nvPM_{num} :
 - (A) 4×10^{14} particles/kN if the characteristic level for nvPM_{num} emissions is below 2×10^{15} particles/kN.
 - (B) $\pm 20\%$ of the characteristic level if the characteristic level for nvPM_{num} emissions is greater than or equal to 2×10^{15} particles/kN.
- (2) In unusual circumstances, the FAA may, for individual certification applications, adjust the ranges beyond those specified in paragraph (c)(1) of this section to evaluate a proposed derivative engine, consistent with good engineering judgment.

§ 1031.140 Test procedures.

- (a) **Overview.** Measure emissions using the equipment, procedures, and test fuel specified in Appendices 1 through 8 of ICAO Annex 16 (incorporated by reference, see § 1031.210) as described in this section (referenced in this section as “ICAO Appendix #”). For turboprop engines, use the procedures specified in ICAO Annex 16 for turbofan engines, consistent with good engineering judgment.
- (b) **Test fuel specifications.** Use a test fuel meeting the specifications described in ICAO Appendix 4. The test fuel must not have additives whose purpose is to suppress smoke, such as organometallic compounds.
- (c) **Test conditions.** Prepare test engines by including accessories that are available with production engines if they can reasonably be expected to influence emissions.
 - (1) The test engine may not extract shaft power or bleed service air to provide power to auxiliary gearbox-mounted components required to drive aircraft systems.
 - (2) Test engines must reach a steady operating temperature before the start of emission measurements.
- (d) **Alternate procedures.** In consultation with the EPA, the FAA may approve alternate procedures for measuring emissions. This might include testing and sampling methods, analytical techniques, and equipment specifications that differ from those specified in this part. An applicant for type certification may request this approval by sending a written request with supporting justification to the FAA and to the Designated EPA Program Officer. Such a request may be approved only in the following circumstances:
 - (1) The engine cannot be tested using the specified procedures.
 - (2) The alternate procedure is shown to be equivalent to or better (e.g., more accurate or precise) than the specified procedure.

- (e) **LTO cycles.** The following landing and take-off (LTO) cycles apply for emission testing and calculating weighted LTO values:

TABLE 1 TO § 1031.140(e)—LTO TEST CYCLES

Mode	Subsonic				Supersonic	
	Turboprop		Turbojet and turbofan		Percent of rO	Time in mode (minutes)
	Percent of rO	Time in mode (minutes)	Percent of rO	Time in mode (minutes)		
Take-off	100	0.5	100	0.7	100	1.2
Climb	90	2.5	85	2.2	65	2.0
Descent	NA	NA	NA	NA	15	1.2
Approach	30	4.5	30	4.0	34	2.3
Taxi/ground idle	7	26.0	7	26.0	5.8	26.0

- (f) **Pollutant-specific test provisions.** Use the following provisions to demonstrate whether engines meet the applicable standards:
- (1) **Smoke number.** Use the equipment and procedures specified in ICAO Appendix 2 and ICAO Appendix 6. Test the engine at sufficient thrust settings to determine and compute the maximum smoke number across the engine operating thrust range.
 - (2) **nvPM.** Use the equipment and procedures specified in ICAO Appendix 7 and ICAO Appendix 6, as applicable:
 - (i) **Maximum nvPM mass concentration.** Test the engine at sufficient thrust settings to determine and compute the maximum nvPM mass concentration produced by the engine across the engine operating thrust range, according to the procedures of ICAO Appendix 7.
 - (ii) **LTO nvPM mass and number.** Test the engine at sufficient thrust settings to determine the engine's nvPM mass and nvPM number at the percent of rated output identified in table 1 to paragraph (e) of this section.
 - (3) **HC, CO, and NO_x.** Use the equipment and procedures specified in ICAO Appendix 3, ICAO Appendix 5, and ICAO Appendix 6, as applicable. Test the engine at sufficient thrust settings to determine the engine's HC, CO, and NO_x emissions at the percent of rated output identified in table 1 to paragraph (e) of this section.
 - (4) **CO₂.** Calculate CO₂ emission values from fuel mass flow rate measurements in ICAO Appendix 3 and ICAO Appendix 5 or, alternatively, according to the CO₂ measurement criteria in ICAO Appendix 3 and ICAO Appendix 5.

- (g) **Characteristic level.** The compliance demonstration consists of establishing a mean value from testing some number of engines, then calculating a “characteristic level” by applying a set of statistical factors in ICAO Appendix 6 that take into account the number of engines tested. Round each characteristic level to the same number of decimal places as the corresponding standard. Engines comply with an applicable standard if the testing results show that the engine type certificate family's characteristic level does not exceed the numerical level of that standard.
- (h) **System loss corrected nvPM emission indices.** Use the equipment and procedures specified in ICAO Appendix 8, as applicable, to determine system loss corrected nvPM emission indices.

Subpart C—Reporting and Recordkeeping

§ 1031.150 Production reports.

Engine manufacturers must submit an annual production report for each calendar year in which they produce any engines subject to emission standards under this part.

- (a) The report is due by February 28 of the following calendar year. Include emission data in the report as described in paragraph (c) of this section. If you produce exempted or excepted engines, submit a single report with information on exempted/excepted and normally certificated engines.
- (b) Send the report to the Designated EPA Program Officer.
- (c) In the report, specify your corporate name and the year for which you are reporting. Include information as described in this section for each engine sub-model subject to emission standards under this part. List each engine sub-model manufactured or certificated during the calendar year, including the following information for each sub-model:
 - (1) The type of engine (turboprop, turbopump, etc.) and complete sub-model name, including any applicable model name, sub-model identifier, and engine type certificate family identifier.
 - (2) The certificate under which it was manufactured. Identify all the following:
 - (i) The type certificate number. Specify if the sub-model also has a type certificate issued by a certifying authority other than FAA.
 - (ii) Your corporate name as listed in the certificate.
 - (iii) Emission standards to which the engine is certificated.
 - (iv) Date of issue of type certificate (month and year).
 - (v) Whether or not this is a derivative engine for emissions certification purposes. If so, identify the previously certificated engine model.
 - (vi) The engine sub-model that received the original type certificate for an engine type certificate family.
 - (3) Identify the combustor of the sub-model, where more than one type of combustor is available.
 - (4) The calendar-year production volume of engines from the sub-model that are covered by an FAA type certificate. Record zero for sub-models with no engines manufactured during the calendar year, or state that the engine model is no longer in production and list the date of manufacture (month and year) of the last engine manufactured. Specify the number of these engines that are intended for use

on new aircraft and the number that are intended for use as non-exempt engines on in-use aircraft. For engines delivered without a final sub-model status and for which the manufacturer has not ascertained the engine's sub-model when installed before submitting its production report, the manufacturer may do any of the following in its initial report, and amend it later:

- (i) List the sub-model that was shipped or the most probable sub-model.
 - (ii) List all potential sub-models.
 - (iii) State "Unknown Sub-Model."
- (5) The number of engines tested and the number of test runs for the applicable type certificate.
- (6) Test data and related information required to certify the engine sub-model for all the standards that apply. Round reported values to the same number of decimal places as the standard. Include the following information, as applicable:
- (i) The engine's rated pressure ratio and rated output.
 - (ii) The following values for each mode of the LTO test cycle:
 - (A) Fuel mass flow rate.
 - (B) Smoke number.
 - (C) nvPM mass concentration.
 - (D) mass of CO₂
 - (E) Emission Indices for HC, CO, NO_x, and CO₂.
 - (F) The following values related to nvPM mass and nvPM number:
 - (1) Emission Indices as measured.
 - (2) System loss correction factor.
 - (3) Emissions Indices after correcting for system losses.
 - (iii) Weighted total values calculated from the tested LTO cycle modes for HC, CO, NO_x, CO₂, and nvPM mass and nvPM number. Include nvPM mass and nvPM number values with and without system loss correction.
 - (iv) The characteristic level for HC, CO, NO_x, smoke number, nvPM mass concentration, nvPM mass, and nvPM number.
 - (v) The following maximum values:
 - (A) Smoke number.
 - (B) nvPM mass concentration.
 - (C) nvPM mass Emission Index with and without system loss correction.
 - (D) nvPM number Emission Index with and without system loss correction.

- (d) Identify the number of exempted or excepted engines with a date of manufacture during the calendar year, along with the engine model and sub-model names of each engine, the type of exemption or exception, and the use of each engine (for example, spare or new installation). For purposes of this paragraph (d), treat spare engine exceptions separate from other new engine exemptions.
- (e) Include the following signed statement and endorsement by an authorized representative of your company: "We submit this report under 40 CFR 1031.150. All the information in this report is true and accurate to the best of my knowledge."
- (f) Where information provided for the previous annual report remains valid and complete, you may report your production volumes and state that there are no changes, without resubmitting the other information specified in this section.

§ 1031.160 Recordkeeping.

- (a) You must keep a copy of any reports or other information you submit to us for at least three years.
- (b) Store these records in any format and on any media, as long as you can promptly send us organized, written records in English if we ask for them. You must keep these records readily available. We may review them at any time.

§ 1031.170 Confidential information.

The provisions of 40 CFR 1068.10 and 1068.11 apply for information you submit under this part.

[88 FR 4484, Jan. 24, 2023]

Subpart D—Reference Information

§ 1031.200 Abbreviations.

This part uses the following abbreviations:

TABLE 1 TO § 1031.200—ABBREVIATIONS

°	degree
%	percent
CO	carbon monoxide
CO ₂	carbon dioxide
EI	emission index
g	gram
HC	hydrocarbon(s)
kg	kilogram
kN	kilonewton
kW	kilowatt
LTO	landing and takeoff

m	meter
mg	milligram
µg	Microgram
NO _x	oxides of nitrogen
Num	number
nvPM	non-volatile particulate matter
nvPM _{mass}	non-volatile particulate matter mass
nvPM _{num}	non-volatile particulate matter number
nvPM _{MC}	non-volatile particulate matter mass concentration
rO	rated output
rPR	rated pressure ratio
SN	smoke number

§ 1031.205 Definitions.

The following definitions apply to this part. Any terms not defined in this section have the meaning given in the Clean Air Act (42 U.S.C. 7401-7671q). The definitions follow:

Aircraft has the meaning given in 14 CFR 1.1, a device that is used or intended to be used for flight in the air.

Aircraft engine means a propulsion engine that is installed on or that is manufactured for installation on an airplane for which certification under 14 CFR chapter I is sought.

Aircraft gas turbine engine means a turboprop, turbojet, or turbofan aircraft engine.

Airplane has the meaning given in 14 CFR 1.1, an engine-driven fixed-wing aircraft heavier than air, that is supported in flight by the dynamic reaction of the air against its wings.

Characteristic level has the meaning given in Appendix 6 of ICAO Annex 16 (incorporated by reference, see § 1031.210). The characteristic level is a calculated emission level for each pollutant based on a statistical assessment of measured emissions from multiple tests.

Date of manufacture means the date on which a manufacturer is issued documentation by FAA (or other recognized airworthiness authority for engines certificated outside the United States) attesting that the given engine conforms to all applicable requirements. This date may not be earlier than the date on which engine assembly is complete. Where the manufacturer does not obtain such documentation from FAA (or other recognized airworthiness authority for engines certificated outside the United States), date of manufacture means the date of final engine assembly.

Derivative engine for emissions certification purposes means an engine that is derived from and similar in type design to an engine that has a type certificate issued in accordance with 14 CFR part 33, and complies with the requirements of § 1031.130.

Designated EPA Program Officer means the Director of the Assessment and Standards Division, 2000 Traverwood Drive, Ann Arbor, Michigan 48105.

Emission index means the quantity of pollutant emitted per unit of fuel mass used.

Engine model means an engine manufacturer's designation for an engine grouping of engines and/or engine sub-models within a single engine type certificate family, where such engines have similar design, including being similar with respect to the core engine and combustor designs.

Engine sub-model means a designation for a grouping of engines with essentially identical design, especially with respect to the core engine and combustor designs and other emission-related features. Engines from an engine sub-model must be contained within a single engine model. For purposes of this part, an original engine model configuration is considered a sub-model. For example, if a manufacturer initially produces an engine model designated ABC and later introduces a new sub-model ABC-1, the engine model consists of two sub-models: ABC and ABC-1.

Engine type certificate family means a group of engines (comprising one or more engine models, including sub-models and derivative engines for emissions certification purposes of those engine models) determined by FAA to have a sufficiently common design to be grouped together under a type certificate.

EPA means the U.S. Environmental Protection Agency.

Except means to routinely allow engines to be manufactured and sold that do not meet (or do not fully meet) otherwise applicable standards. Note that this definition applies only with respect to § 1031.20 and that the term “except” has its plain meaning in other contexts.

Exempt means to allow, through a formal case-by-case process, an engine to be certificated and sold that does not meet the applicable standards of this part.

Exhaust emissions means substances emitted to the atmosphere from exhaust discharge nozzles, as measured by the test procedures specified in § 1031.140.

FAA means the U.S. Department of Transportation, Federal Aviation Administration.

Good engineering judgment involves making decisions consistent with generally accepted scientific and engineering principles and all relevant information, subject to the provisions of 40 CFR 1068.5.

ICAO Annex 16 means Volume II of Annex 16 to the Convention on International Civil Aviation (see § 1031.210 for availability).

New means relating to an aircraft or aircraft engine that has never been placed into service.

Non-volatile particulate matter (nvPM) means emitted particles that exist at a gas turbine engine exhaust nozzle exit plane that do not volatilize when heated to a temperature of 350 °C.

Rated output (rO) means the maximum power or thrust available for takeoff at standard day conditions as approved for the engine by FAA, including reheat contribution where applicable, but excluding any contribution due to water injection. Rated output is expressed in kilowatts for turboprop engines and in kilonewtons for turbojet and turbofan engines to at least three significant figures.

Rated pressure ratio (rPR) means the ratio between the combustor inlet pressure and the engine inlet pressure achieved by an engine operating at rated output, expressed to at least three significant figures.

Round has the meaning given in 40 CFR 1065.1001.

Smoke means the matter in exhaust emissions that obscures the transmission of light, as measured by the test procedures specified in § 1031.140.

Smoke number means a dimensionless value quantifying smoke emissions as calculated according to ICAO Annex 16.

Spare engine means an engine installed (or intended to be installed) on an in-use aircraft to replace an existing engine. See § 1031.20.

Standard day conditions means the following ambient conditions: temperature = 15 °C, specific humidity = 0.00634 kg H₂O/kg dry air, and pressure = 101.325 kPa.

Subsonic means relating to an aircraft that has not been certificated under 14 CFR chapter I to exceed Mach 1 in normal operation.

Supersonic airplane means an airplane for which the maximum operating limit speed exceeds a Mach number of 1.

System losses means the loss of particles during transport through a sampling or measurement system component or due to instrument performance. Sampling and measurement system loss is due to various deposition mechanisms, some of which are particle-size dependent. Determining an engine's actual emission rate depends on correcting for system losses in the nvPM measurement.

Turbofan engine means a gas turbine engine designed to create its propulsion from exhaust gases and from air that bypasses the combustion process and is accelerated in a ducted space between the inner (core) engine case and the outer engine fan casing.

Turbojet engine means a gas turbine engine that is designed to create its propulsion entirely from exhaust gases.

Turboprop engine means a gas turbine engine that is designed to create most of its propulsion from a propeller driven by a turbine, usually through a gearbox.

Turboshaft engine means a gas turbine engine that is designed to drive a rotor transmission system or a gas turbine engine not used for propulsion.

We (us, our) means the EPA Administrator and any authorized representatives.

§ 1031.210 Incorporation by reference.

Certain material is incorporated by reference into this part with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51. To enforce any edition other than that specified in this section, the EPA must publish a document in the FEDERAL REGISTER and the material must be available to the public. All approved material is available for inspection at EPA and at the National Archives and Records Administration (NARA). Contact EPA at: U.S. EPA, Air and Radiation Docket Center, WJC West Building, Room 3334, 1301 Constitution Ave. NW, Washington, DC 20004; www.epa.gov/dockets; (202) 202-1744. For information on the availability of this material at NARA, visit www.archives.gov/federal-register/cfr/ibr-locations.html or email fr.inspection@nara.gov. The material may be obtained from International Civil Aviation Organization, Document Sales Unit, 999 University Street, Montreal, Quebec, Canada H3C 5H7; (514) 954-8022; sales@icao.int; www.icao.int.

(a) Annex 16 to the Convention on International Civil Aviation, Environmental Protection, Volume II—Aircraft Engine Emissions, Fourth Edition, July 2017 (including Amendment No. 10, applicable January 1, 2021); IBR approved for §§ 1031.140; 1031.205.

(b) [Reserved]