prior to the issuance of the type certificate, and to the owner at the time of delivery of the engine, approved instructions for installing and operating the engine. The instructions must include at least the following:

(a) *Installation instructions.* (1) The location of engine mounting attachments, the method of attaching the engine to the aircraft, and the maximum allowable load for the mounting attachments and related structure.

(2) The location and description of engine connections to be attached to accessories, pipes, wires, cables, ducts, and cowling.

(3) An outline drawing of the engine including overall dimensions.

(4) A definition of the physical and functional interfaces with the aircraft and aircraft equipment, including the propeller when applicable.

(5) Where an engine system relies on components that are not part of the engine type design, the interface conditions and reliability requirements for those components upon which engine type certification is based must be specified in the engine installation instructions directly or by reference to appropriate documentation.

(6) A list of the instruments necessary for control of the engine, including the overall limits of accuracy and transient response required of such instruments for control of the operation of the engine, must also be stated so that the suitability of the instruments as installed may be assessed.

(b) *Operation instructions.* (1) The operating limitations established by the Administrator.

(2) The power or thrust ratings and procedures for correcting for nonstandard atmosphere.

(3) The recommended procedures, under normal and extreme ambient conditions for—

(i) Starting;

(ii) Operating on the ground; and

(iii) Operating during flight.

(4) For rotorcraft engines having one or more OEI ratings, applicants must provide data on engine performance characteristics and variability to enable the aircraft manufacturer to establish aircraft power assurance procedures.

(5) A description of the primary and all alternate modes, and any back-up system, together with any associated limitations, of the engine control system and its interface with the aircraft systems, including the propeller when applicable.

(c) *Safety analysis assumptions.* The assumptions of the safety analysis as described in § 33.75(d) with respect to the reliability of safety devices, instrumentation, early warning devices, maintenance checks, and similar equipment or procedures that are outside the control of the engine manufacturer.

[Amdt. 33–6, 39 FR 35463, Oct. 1, 1974, as amended by Amdt. 33–9, 45 FR 60181, Sept. 11, 1980; Amdt. 33–24, 47 FR 50867, Sept. 4, 2007; Amdt. 33–25, 73 FR 48123, Aug. 18, 2008; Amdt. 33–26, 73 FR 48284, Aug. 19, 2008]

§ 33.7 Engine ratings and operating limitations.

(a) Engine ratings and operating limitations are established by the Administrator and included in the engine certificate data sheet specified in § 21.41 of this chapter, including ratings and limitations based on the operating conditions and information specified in this section, as applicable, and any other information found necessary for safe operation of the engine.

(b) For reciprocating engines, ratings and operating limitations are established relating to the following:

(1) Horsepower or torque, r.p.m., manifold pressure, and time at critical pressure altitude and sea level pressure altitude for—

(i) Rated maximum continuous power (relating to unsupercharged operation or to operation in each supercharger mode as applicable); and

(ii) Rated takeoff power (relating to unsupercharged operation or to operation in each supercharger mode as applicable).

(2) Fuel grade or specification.

(3) Oil grade or specification.

(4) Temperature of the—

(i) Cylinder;

(ii) Oil at the oil inlet; and

(iii) Turbosupercharger turbine wheel inlet gas.

(5) Pressure of—

(i) Fuel at the fuel inlet; and

(ii) Oil at the main oil gallery.

(6) Accessory drive torque and overhang moment.
(7) Component life.
(8) Turbosupercharger turbine wheel r.p.m.
(c) For turbine engines, ratings and operating limitations are established relating to the following:
(1) Horsepower, torque, or thrust, r.p.m., gas temperature, and time for—
(i) Rated maximum continuous power or thrust (augmented);
(ii) Rated maximum continuous power or thrust (unaugmented);
(iii) Rated takeoff power or thrust (augmented);
(iv) Rated takeoff power or thrust (unaugmented);
(v) Rated 30-minute OEI power;
(vi) Rated 2½-minute OEI power;
(vii) Rated continuous OEI power; and
(viii) Rated 2-minute OEI Power;
(ix) Rated 30-second OEI power; and
(x) Auxiliary power unit (APU) mode of operation.
(2) Fuel designation or specification.
(3) Oil grade or specification.
(4) Hydraulic fluid specification.
(5) Temperature of—
(i) Oil at a location specified by the applicant;
(ii) Induction air at the inlet face of a supersonic engine, including steady state operation and transient overtemperature and time allowed;
(iii) Hydraulic fluid of a supersonic engine;
(iv) Fuel at a location specified by the applicant; and
(v) External surfaces of the engine, if specified by the applicant.
(6) Pressure of—
(i) Fuel at the fuel inlet;
(ii) Oil at a location specified by the applicant;
(iii) Induction air at the inlet face of a supersonic engine, including steady state operation and transient overpressure and time allowed; and
(iv) Hydraulic fluid.
(7) Accessory drive torque and overhang moment.
(8) Component life.
(9) Fuel filtration.
(10) Oil filtration.
(11) Bleed air.
(12) The number of start-stop stress cycles approved for each rotor disc and spacer.
(13) Inlet air distortion at the engine inlet.
(14) Transient rotor shaft overspeed r.p.m., and number of overspeed occurrences.
(15) Transient gas overtemperature, and number of overtemperature occurrences.
(16) Transient engine overtorque, and number of overtorque occurrences.
(17) Maximum engine overtorque for turbopropeller and turboshaft engines incorporating free power turbines.
(18) For engines to be used in supersonic aircraft, engine rotor windmilling rotational r.p.m.
(d) In determining the engine performance and operating limitations, the overall limits of accuracy of the engine control system and of the necessary instrumentation as defined in §33.5(a)(6) must be taken into account.

[Amdt. 33–6, 39 FR 35463, Oct. 1, 1974, as amended by Amdt. 33–10, 49 FR 6850, Feb. 23, 1984; Amdt. 33–11, 51 FR 10346, Mar. 25, 1986; Amdt. 33–12, 53 FR 34220, Sept. 2, 1988; Amdt. 33–18, 61 FR 31328, June 19, 1996; Amdt. 33–26, 73 FR 48284, Aug. 19, 2008; Amdt. 33–30, 74 FR 45310, Sept. 2, 2009]

§33.8 Selection of engine power and thrust ratings.

(a) Requested engine power and thrust ratings must be selected by the applicant.
(b) Each selected rating must be for the lowest power or thrust that all engines of the same type may be expected to produce under the conditions used to determine that rating.

[Amdt. 33–3, 32 FR 3736, Mar. 4, 1967]

Subpart B—Design and Construction; General

§33.11 Applicability.

This subpart prescribes the general design and construction requirements for reciprocating and turbine aircraft engines.

§33.13 [Reserved]

§33.15 Materials.

The suitability and durability of materials used in the engine must—
(a) Be established on the basis of experience or tests; and