§ 33.31 (d) The means, or the provision for a means, of paragraphs (c)(2) and (c)(3) of this section must not be capable of being reset in flight.

(e) The applicant must make provision for the installation of instrumentation necessary to ensure operation in compliance with engine operating limitations. Where, in presenting the safety analysis, or complying with any other requirement, dependence is placed on instrumentation that is not otherwise mandatory in the assumed aircraft installation, then the applicant must specify this instrumentation in the engine installation instructions and declare it mandatory in the engine approval documentation.

(f) As part of the System Safety Assessment of §33.28(e), the applicant must assess the possibility and subsequent effect of incorrect fit of instruments, sensors, or connectors. Where necessary, the applicant must take design precautions to prevent incorrect configuration of the system.

(g) The sensors, together with associated wiring and signal conditioning, must be segregated, electrically and physically, to the extent necessary to ensure that the probability of a fault propagating from instrumentation and monitoring functions to control functions, or vice versa, is consistent with the failure effect of the fault.

(h) The applicant must provide instrumentation enabling the flight crew to monitor the functioning of the turbine cooling system unless appropriate inspections are published in the relevant manuals and evidence shows that:

(1) Other existing instrumentation provides adequate warning of failure or impending failure;

(2) Failure of the cooling system would not lead to hazardous engine effects before detection; or

(3) The probability of failure of the cooling system is extremely remote.


Subpart C—Design and Construction; Reciprocating Aircraft Engines

§ 33.31 Applicability.

This subpart prescribes additional design and construction requirements for reciprocating aircraft engines.

§ 33.33 Vibration.

The engine must be designed and constructed to function throughout its normal operating range of crankshaft rotational speeds and engine powers without inducing excessive stress in any of the engine parts because of vibration and without imparting excessive vibration forces to the aircraft structure.

§ 33.34 Turbocharger rotors.

Each turbocharger rotor must be designed and constructed to be able to contain fragments of a compressor or turbine that fails at the highest speed that is obtainable with normal speed control devices inoperative.

[Amdt. 33–22, 72 FR 50860, Sept. 4, 2007]

§ 33.35 Fuel and induction system.

(a) The fuel system of the engine must be designed and constructed to supply an appropriate mixture of fuel to the cylinders throughout the complete operating range of the engine under all flight and atmospheric conditions.

(b) The intake passages of the engine through which air or fuel in combination with air passes for combustion purposes must be designed and constructed to minimize the danger of ice accretion in those passages. The engine must be designed and constructed to permit the use of a means for ice prevention.

(c) The type and degree of fuel filtering necessary for protection of the engine fuel system against foreign particles in the fuel must be specified. The applicant must show that foreign particles passing through the prescribed filtering means will not critically impair engine fuel system functioning.

(d) Each passage in the induction system that conducts a mixture of fuel and air must be self-draining, to prevent a liquid lock in the cylinders, in
§ 33.43 Vibration test.

(a) Each engine must undergo a vibration survey to establish the torsional and bending vibration characteristics of the crankshaft and the propeller shaft or other output shaft, over the range of crankshaft speed and engine power, under steady state and transient conditions, from idling speed to either 110 percent of the desired maximum continuous speed rating or 103 percent of the maximum desired takeoff speed rating, whichever is higher. The survey must be conducted using, for airplane engines, the same configuration of the propeller type which is used for the endurance test, and using, for other engines, the same configuration of the loading device type which is used for the endurance test.

(b) The torsional and bending vibration stresses of the crankshaft and the propeller shaft or other output shaft may not exceed the endurance limit stress of the material from which the shaft is made. If the maximum stress in the shaft cannot be shown to be below the endurance limit by measurement, the vibration frequency and amplitude must be measured. The peak amplitude must be shown to produce a stress below the endurance limit; if not, the engine must be run at the condition producing the peak amplitude until, for steel shafts, 10 million stress reversals have been sustained without fatigue failure and, for other shafts, until it is shown that fatigue will not occur within the endurance limit stress of the material.

(c) Each accessory drive and mounting attachment must be loaded, with the loads imposed by each accessory used only for an aircraft service being the limit load specified by the applicant for the drive or attachment point.

(d) The vibration survey described in paragraph (a) of this section must be repeated with that cylinder not firing which has the most adverse vibration effect, in order to establish the conditions under which the engine can be operated safely in that abnormal state. However, for this vibration survey, the