

(iv) 120 percent of the r.p.m. at which, while cold spinning, it is subject to operating stresses that are equivalent to those induced at the maximum operating temperature and maximum permissible r.p.m.

(v) 105 percent of the highest speed that would result from failure of the most critical component or system in a representative installation of the engine.

(vi) The highest speed that would result from the failure of any component or system in a representative installation of the engine, in combination with any failure of a component or system that would not normally be detected during a routine preflight check or during normal flight operation.

Following the test, each rotor must be within approved dimensional limits for an overspeed condition and may not be cracked.

[Amdt. 33-10, 49 FR 6851, Feb. 23, 1984]

#### § 33.28 Electrical and electronic engine control systems.

Each control system which relies on electrical and electronic means for normal operation must:

(a) Have the control system description, the percent of available power or trust controlled in both normal operation and failure conditions, and the range of control of other controlled functions, specified in the instruction manual required by § 33.5 for the engine;

(b) Be designed and constructed so that any failure of aircraft-supplied power or data will not result in an unacceptable change in power or thrust, or prevent continued safe operation of the engine;

(c) Be designed and constructed so that no single failure or malfunction, or probable combination of failures of electrical or electronic components of the control system, results in an unsafe condition;

(d) Have environmental limits, including transients caused by lightning strikes, specified in the instruction manual; and

(e) Have all associated software designed and implemented to prevent errors that would result in an unacceptable loss of power or thrust, or other unsafe condition, and have the method

used to design and implement the software approved by the Administrator.

[Doc. No. 24466, 58 FR 29095, May 18, 1993]

#### § 33.29 Instrument connection.

(a) Unless it is constructed to prevent its connection to an incorrect instrument, each connection provided for powerplant instruments required by aircraft airworthiness regulations or necessary to insure operation of the engine in compliance with any engine limitation must be marked to identify it with its corresponding instrument.

(b) A connection must be provided on each turbojet engine for an indicator system to indicate rotor system unbalance.

(c) Each rotorcraft turbine engine having a 30-second OEI rating and a 2-minute OEI rating must have a provision for a means to:

(1) Alert the pilot when the engine is at the 30-second OEI and the 2-minute OEI power levels, when the event begins, and when the time interval expires;

(2) Determine, in a positive manner, that the engine has been operated at each rating; and

(3) Automatically record each usage and duration of power at each rating.

[Amdt. 33-5, 39 FR 1831, Jan. 15, 1974, as amended by Amdt. 33-6, 39 FR 35465, Oct. 1, 1974; Amdt. 33-18, 61 FR 31328, June 19, 1996]

### 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.