

- (c) Be installed according to limitations specified for that equipment; and
- (d) Function properly when installed.

#### § 29.1303 Flight and navigation instruments.

The following are required flight and navigational instruments:

- (a) An airspeed indicator. For Category A rotorcraft with  $V_{NE}$  less than a speed at which unmistakable pilot cues provide overspeed warning, a maximum allowable airspeed indicator must be provided. If maximum allowable airspeed varies with weight, altitude, temperature, or r.p.m., the indicator must show that variation.
- (b) A sensitive altimeter.
- (c) A magnetic direction indicator.
- (d) A clock displaying hours, minutes, and seconds with a sweep-second pointer or digital presentation.
- (e) A free-air temperature indicator.
- (f) A non-tumbling gyroscopic bank and pitch indicator.
- (g) A gyroscopic rate-of-turn indicator combined with an integral slip-skid indicator (turn-and-bank indicator) except that only a slip-skid indicator is required on rotorcraft with a third attitude instrument system that—
  - (1) Is usable through flight attitudes of  $\pm 80$  degrees of pitch and  $\pm 120$  degrees of roll;
  - (2) Is powered from a source independent of the electrical generating system;
  - (3) Continues reliable operation for a minimum of 30 minutes after total failure of the electrical generating system;
  - (4) Operates independently of any other attitude indicating system;
  - (5) Is operative without selection after total failure of the electrical generating system;
  - (6) Is located on the instrument panel in a position acceptable to the Administrator that will make it plainly visible to and useable by any pilot at his station; and
  - (7) Is appropriately lighted during all phases of operation.
- (h) A gyroscopic direction indicator.
  - (i) A rate-of-climb (vertical speed) indicator.
  - (j) For Category A rotorcraft, a speed warning device when  $V_{NE}$  is less than the speed at which unmistakable over-

speed warning is provided by other pilot cues. The speed warning device must give effective aural warning (differing distinctively from aural warnings used for other purposes) to the pilots whenever the indicated speed exceeds  $V_{NE}$  plus 3 knots and must operate satisfactorily throughout the approved range of altitudes and temperatures.

(Secs. 313(a), 601, 603, 604, and 605 of the Federal Aviation Act of 1958 (49 U.S.C. 1354(a), 1421, 1423, 1424, and 1425); and sec. 6(c), Dept. of Transportation Act (49 U.S.C. 1655(c)))

[Doc. No. 5084, 29 FR 16150, Dec. 3, 1964, as amended by Amdt. 29-12, 41 FR 55474, Dec. 20, 1976; Amdt. 29-14, 42 FR 36972, July 18, 1977; Amdt. 29-24, 49 FR 44438, Nov. 6, 1984; 70 FR 2012, Jan. 12, 2005]

#### § 29.1305 Powerplant instruments.

The following are required powerplant instruments:

- (a) For each rotorcraft—
  - (1) A carburetor air temperature indicator for each reciprocating engine;
  - (2) A cylinder head temperature indicator for each air-cooled reciprocating engine, and a coolant temperature indicator for each liquid-cooled reciprocating engine;
  - (3) A fuel quantity indicator for each fuel tank;
  - (4) A low fuel warning device for each fuel tank which feeds an engine. This device must—
    - (i) Provide a warning to the crew when approximately 10 minutes of usable fuel remains in the tank; and
    - (ii) Be independent of the normal fuel quantity indicating system.
  - (5) A manifold pressure indicator, for each reciprocating engine of the altitude type;
  - (6) An oil pressure indicator for each pressure-lubricated gearbox.
  - (7) An oil pressure warning device for each pressure-lubricated gearbox to indicate when the oil pressure falls below a safe value;
  - (8) An oil quantity indicator for each oil tank and each rotor drive gearbox, if lubricant is self-contained;
  - (9) An oil temperature indicator for each engine;
  - (10) An oil temperature warning device to indicate unsafe oil temperatures in each main rotor drive gearbox,