

changing conditions of airspeed, engine power, and attitude.

(c) If compliance with § 23.145(b)(3) necessitates wing flap retraction to positions that are not fully retracted, the wing flap control lever settings corresponding to those positions must be positively located such that a definite change of direction of movement of the lever is necessary to select settings beyond those settings.

[Doc. No. 4080, 29 FR 17955, Dec. 18, 1964, as amended by Amdt. 23-49, 61 FR 5165, Feb. 9, 1996]

#### § 23.699 Wing flap position indicator.

There must be a wing flap position indicator for—

(a) Flap installations with only the retracted and fully extended position, unless—

(1) A direct operating mechanism provides a sense of “feel” and position (such as when a mechanical linkage is employed); or

(2) The flap position is readily determined without seriously detracting from other piloting duties under any flight condition, day or night; and

(b) Flap installation with intermediate flap positions if—

(1) Any flap position other than retracted or fully extended is used to show compliance with the performance requirements of this part; and

(2) The flap installation does not meet the requirements of paragraph (a)(1) of this section.

#### § 23.701 Flap interconnection.

(a) The main wing flaps and related movable surfaces as a system must—

(1) Be synchronized by a mechanical interconnection between the movable flap surfaces that is independent of the flap drive system; or by an approved equivalent means; or

(2) Be designed so that the occurrence of any failure of the flap system that would result in an unsafe flight characteristic of the airplane is extremely improbable; or

(b) The airplane must be shown to have safe flight characteristics with any combination of extreme positions of individual movable surfaces (mechanically interconnected surfaces are to be considered as a single surface).

(c) If an interconnection is used in multiengine airplanes, it must be designed to account for the unsummetrical loads resulting from flight with the engines on one side of the plane of symmetry inoperative and the remaining engines at takeoff power. For single-engine airplanes, and multiengine airplanes with no slipstream effects on the flaps, it may be assumed that 100 percent of the critical air load acts on one side and 70 percent on the other.

[Doc. No. 4080, 29 FR 17955, Dec. 18, 1964, as amended by Amdt. 23-14, 38 FR 31821, Nov. 19, 1973; Amdt. 23-42, 56 FR 353, Jan. 3, 1991; 56 FR 5455, Feb. 11, 1991; Amdt. 23-49, 61 FR 5165, Feb. 9, 1996]

#### § 23.703 Takeoff warning system.

For all airplanes with a maximum weight more than 6,000 pounds and all jets, unless it can be shown that a lift or longitudinal trim device that affects the takeoff performance of the airplane would not give an unsafe takeoff configuration when selected out of an approved takeoff position, a takeoff warning system must be installed and meet the following requirements:

(a) The system must provide to the pilots an aural warning that is automatically activated during the initial portion of the takeoff role if the airplane is in a configuration that would not allow a safe takeoff. The warning must continue until—

(1) The configuration is changed to allow safe takeoff, or

(2) Action is taken by the pilot to abandon the takeoff roll.

(b) The means used to activate the system must function properly for all authorized takeoff power settings and procedures and throughout the ranges of takeoff weights, altitudes, and temperatures for which certification is requested.

(c) For the purpose of this section, an unsafe takeoff configuration is the inability to rotate or the inability to prevent an immediate stall after rotation.

[Doc. No. 27806, 61 FR 5166, Feb. 9, 1996, as amended by Amdt. 23-62, 76 FR 75757, Dec. 2, 2011]

## § 23.721

### LANDING GEAR

#### § 23.721 General.

For commuter category airplanes that have a passenger seating configuration, excluding pilot seats, of 10 or more, the following general requirements for the landing gear apply:

(a) The main landing-gear system must be designed so that if it fails due to overloads during takeoff and landing (assuming the overloads to act in the upward and aft directions), the failure mode is not likely to cause the spillage of enough fuel from any part of the fuel system to constitute a fire hazard.

(b) Each airplane must be designed so that, with the airplane under control, it can be landed on a paved runway with any one or more landing-gear legs not extended without sustaining a structural component failure that is likely to cause the spillage of enough fuel to constitute a fire hazard.

(c) Compliance with the provisions of this section may be shown by analysis or tests, or both.

[Amdt. 23-34, 52 FR 1830, Jan. 15, 1987]

#### § 23.723 Shock absorption tests.

(a) It must be shown that the limit load factors selected for design in accordance with § 23.473 for takeoff and landing weights, respectively, will not be exceeded. This must be shown by energy absorption tests except that analysis based on tests conducted on a landing gear system with identical energy absorption characteristics may be used for increases in previously approved takeoff and landing weights.

(b) The landing gear may not fail, but may yield, in a test showing its reserve energy absorption capacity, simulating a descent velocity of 1.2 times the limit descent velocity, assuming wing lift equal to the weight of the airplane.

[Doc. No. 4080, 29 FR 17955, Dec. 18, 1964; 30 FR 258, Jan. 9, 1965, as amended by Amdt. 23-23, 43 FR 50593, Oct. 30, 1978; Amdt. 23-49, 61 FR 5166, Feb. 9, 1996]

#### § 23.725 Limit drop tests.

(a) If compliance with § 23.723(a) is shown by free drop tests, these tests must be made on the complete airplane, or on units consisting of wheel, tire, and shock absorber, in their prop-

## 14 CFR Ch. I (1-1-13 Edition)

er relation, from free drop heights not less than those determined by the following formula:

$$h \text{ (inches)} = 3.6 (W/S)^{1/2}$$

However, the free drop height may not be less than 9.2 inches and need not be more than 18.7 inches.

(b) If the effect of wing lift is provided for in free drop tests, the landing gear must be dropped with an effective weight equal to

$$W_e = W \frac{[h + (1 - L)d]}{(h + d)}$$

where—

$W_e$  = the effective weight to be used in the drop test (lbs.);

$h$  = specified free drop height (inches);

$d$  = deflection under impact of the tire (at the approved inflation pressure) plus the vertical component of the axle travel relative to the drop mass (inches);

$W = W_M$  for main gear units (lbs), equal to the static weight on that unit with the airplane in the level attitude (with the nose wheel clear in the case of nose wheel type airplanes);

$W = W_T$  for tail gear units (lbs.), equal to the static weight on the tail unit with the airplane in the tail-down attitude;

$W = W_N$  for nose wheel units (lbs.), equal to the vertical component of the static reaction that would exist at the nose wheel, assuming that the mass of the airplane acts at the center of gravity and exerts a force of 1.0  $g$  downward and 0.33  $g$  forward; and

$L$  = the ratio of the assumed wing lift to the airplane weight, but not more than 0.667.

(c) The limit inertia load factor must be determined in a rational or conservative manner, during the drop test, using a landing gear unit attitude, and applied drag loads, that represent the landing conditions.

(d) The value of  $d$  used in the computation of  $W_e$  in paragraph (b) of this section may not exceed the value actually obtained in the drop test.

(e) The limit inertia load factor must be determined from the drop test in paragraph (b) of this section according to the following formula:

$$n = n_j \frac{W_e}{W} + L$$

where—