UNITED STATES OF AMERICA
CIVIL AERONAUTICS BOARD
WASHINGTON, D.C.

Civil Air Regulations Amendment 6-2
Effective: August 12, 1957
Adopted: July 8, 1957

ROTORCRAFT AIRWORTHINESS; NORMAL CATEGORY

MISCELLANEOUS AMENDMENTS RESULTING FROM THE 1956 ANNUAL AIRWORTHINESS REVIEW

There are contained herein amendments stemming from the 1956 Annual Airworthiness Review.

The currently effective provisions governing the design loading conditions for landing gears are applicable principally to landing gears having two wheels aft and one or two wheels forward. In view of the development of tail-wheel and skid type gears, it is necessary to incorporate into the regulations appropriate design criteria which are specifically applicable to such gears. These criteria are set forth in new § 6.246 for tail-wheel gears and in new § 6.247 for skid gears.

There are also included herein several changes of a minor nature.

Interested persons have been afforded an opportunity to participate in the making of this amendment (21 F.R. 9217), and due consideration has been given to all relevant matter presented.

In consideration of the foregoing the Civil Aeronautics Board hereby amends Part 6 of the Civil Air Regulations (14 CFR Part 6, as amended) effective August 12, 1957.

1. By amending the note under § 6.237 (a) by inserting a new definition between the definitions "$W_1 = W$" and "$W = W_t$" to read as follows: "$W = W_t$ for tail-wheel units (pounds); (1) equal to the static weight of the tail-wheel with the rotorcraft resting on all wheels; (2) equal to the vertical component of the ground reaction which would occur at the tail-wheel assuming the mass of the rotorcraft acting at the center of gravity and exerting a force of lg downward with the rotorcraft in the maximum nose-up attitude considered in the nose-up landing conditions. (See § 6.246 (c).)"

2. By adding a new § 6.246 to read as follows:

6.246 Tail-wheel type landing gear ground loading conditions. The structure of a rotorcraft equipped with landing gears arranged such that two wheels are located forward and one wheel is located aft of the center of gravity shall be assumed to be subjected to the loading conditions in accordance with paragraphs (a) through (h) of this section:

(a) Level landing on forward gear only. The rotorcraft shall be assumed to be in the level landing attitude with only the forward wheels contacting the ground.

(1) Vertical loads shall be applied in accordance with the provisions of § 6.230.

(2) The vertical loads specified in subparagraph (1) of this paragraph shall be combined with a drag load at each wheel axle of not less than 25 percent of the respective vertical load.

(3) In the conditions of subparagraphs (1) and (2) of this paragraph, unbalanced pitching moments shall be assumed resisted by angular inertia forces.

(b) Level landing; all wheels contacting simultaneously. The rotorcraft shall be assumed to be in the level landing attitude with all wheels contacting the ground simultaneously.

(1) Vertical loads shall be applied in accordance with the provisions of § 6.230.

(2) The vertical loads specified in subparagraph (1) of this paragraph shall be combined with a drag load at each wheel axle of not less than 25 percent of the respective vertical load. Unbalanced pitching moments shall be assumed resisted by angular inertia forces.

(c) Nose-up landing condition. The rotorcraft shall be assumed to contact the ground on the rear wheel only at the maximum nose-up attitude to be expected under all operational landing conditions including landings in autorotation. The conditions of this paragraph need not be applied if it can be demonstrated that the probability of landing with initial contact on the rear wheel is extremely remote. In determining the applicable ground loads, it shall be acceptable to use a rational method to account for the distance between the direction of the rear wheel ground reactions and the rotorcraft c.g.

(1) Vertical loads shall be applied in accordance with the provisions of § 6.230.

(2) The vertical loads specified in subparagraph (1) of this paragraph shall be combined with a drag load at the wheel axle of not less than 25 percent of the vertical load.

(d) One-wheel landing condition. The rotorcraft shall be assumed in the level attitude to contact the ground on one of the wheels located forward of the c.g. The vertical load shall be the same as that obtained on the one side in the condition specified in paragraph (a) (1) of this section. Unbalanced moments shall be assumed resisted by angular inertia forces.

(e) Side load landing condition. The rotorcraft shall be assumed in the landing attitudes of paragraphs (a) and (b) of this section. Side loads in combination with one-half the maximum vertical ground reactions obtained in the landing conditions of paragraphs (a) (1) and (b) (1) of this section shall be applied at each wheel. The magnitude of the side loads on the forward wheels in each case shall be 0.8 of the vertical reaction (on one side) acting inward and 0.6 of the vertical reaction (on the other side) acting outward. The magnitude of the side load on the rear wheel shall be equal to 0.8 of the vertical reaction. These loads shall be applied at the ground contact point, unless the landing gear is of the full-swiveling type in which case the loads shall be applied at the center of the axle. When a lock, steering device, or shimmy damper is provided, the swiveled wheel shall also be assumed to be in the trailing position with the side load acting at the ground contact point.

(f) Braked roll condition. The rotorcraft attitudes shall be assumed to be the same as those prescribed in paragraphs (a) and (b) of this section with the shock absorbers deflected to their static position. The limit vertical load shall be based upon a load factor of 1.33. A drag load equal to the vertical load multiplied by a coefficient of friction of 0.8 shall be applied at the ground contact point of each wheel equipped with brakes, except that the drag load need not exceed the maximum value based on limiting brake torque.

(g) Rear wheel turning condition. The rotorcraft shall be assumed to be in the static ground attitude with the shock absorbers and tires deflected to their static position. A vertical ground reaction equal to the static load on the rear wheel in combination with a side component of equal magnitude shall be assumed. When a swivel is provided, the rear wheel shall be assumed to be swiveled 90 degrees to the rotorcraft longitudinal axis with the resultant load passing through the axle. When a lock, steering device, or shimmy damper is provided, the rear wheel shall also be assumed to be in the trailing position with the side load acting at the ground contact point.

(h) Taxying condition. The rotorcraft and its landing gear shall be designed for loads which occur when the rotorcraft is taxied over the roughest ground which it is reasonable to expect in normal operation.

3. By adding a new § 6.247 to read as follows:

6.247 Skid gear ground loading condition. The structure of a rotorcraft equipped with skid type landing gear shall be assumed to be subjected to the loading conditions in accordance with paragraphs (a) through (d) of this section.

(a) The design weight, center of gravity, and load factor shall be in accordance with the provisions of § 6.230. Structural yielding of the elastic spring member under the limit loading conditions shall be

acceptable. The design ultimate loads considered for the elastic spring member need not exceed those obtained in a drop test of the skid gear from a drop height equal to 1.5 times that specified in § 6.237 (a).

(b) The ground loads resulting from the landing conditions specified in paragraph (c) of this section shall be applied to the skid gear in its most critically deflected position for the particular landing condition being considered and a rational distribution of the ground reactions along the skid tube bottom shall be made.

(c) The following landing conditions shall be considered:

(1) Level landing; vertical reaction. The rotorcraft shall be assumed to contact the ground along the bottom of both skids. Vertical ground reactions shall be applied in accordance with the provisions of paragraphs (a) and (b) of this section.

(2) Level landing with drag. The rotorcraft shall be assumed to contact the ground along the bottom of both skids with vertical ground reactions in combination with a horizontal drag reaction equal to 50 percent of the vertical reaction applied at the ground. The resultant ground load shall be equal to the vertical load specified in subparagraph (1) of this paragraph and shall be directed through the center of gravity of the rotorcraft.

(3) Level landing with side load. The rotorcraft shall be assumed to contact the ground along the bottom of both skids with vertical ground reactions in combination with a horizontal side reaction equal to 25 percent of the vertical ground reaction. The vertical ground reaction shall be equal to the vertical load specified in subparagraph (1) of this paragraph and shall be equally divided between the two skids. The total side load shall be applied along the length of one skid only. Unbalanced moments shall be assumed resisted by angular inertia forces. Both the inward and outward acting side loading conditions of the skid gear shall be investigated.

(4) One-skid landing condition. In the level attitude, the rotorcraft shall be assumed to contact the ground on one skid only. The vertical load shall be the same as that obtained on the one side in the condition specified in subparagraph (1) of this paragraph. Unbalanced moments shall be assumed to be resisted by angular inertia forces.

(d) Special conditions for the skid gear

(1) A ground reaction load equal to 1.33 times the maximum weight of the rotorcraft acting up and aft at an angle of 45 degrees to the horizontal shall be assumed. The load shall be distributed symmetrically between the two skids and shall be assumed concentrated at the forward end of the straight portion of the skid tube. This loading condition shall apply only to the forward end of skid tube and its attachment to the rotorcraft.

(2) A vertical ground reaction load equal to one-half the vertical load of § 6.247 (c) (1) shall be assumed with the rotorcraft in the level attitude. This load shall be applied to the skid tube and shall be assumed concentrated at a point midway between the skid tube attachments. This loading condition shall apply only to the skid tube and its attachment to the rotorcraft.

4. By amending § 6.383 (c) by adding a new sentence at the end thereof to read as follows: "In addition to the components provided for normal continuous control of air temperature, air flow, and fuel flow, means independent of such components shall be provided for each heater to automatically shut off and hold off the ignition and fuel supply to the heater at a point remote from the heater when the heat exchanger temperature or ventilating air temperature exceeds safe limits or when either the combustion air flow or the ventilating air flow becomes inadequate for safe operation."

5. By amending § 6.425 (e) to read as follows:

6.425 Fuel system lines and fittings. * * *

(e) Rotorcraft with suction lift fuel systems or other fuel system features conducive to vapor formation shall be demonstrated to be free from vapor lock when using fuel at a temperature of 110°F. under critical operating conditions.

6. By amending § 6.441 (c) by adding a new sentence at the end thereof to read as follows: "It shall not be possible inadvertently to fill the oil tank expansion space when the rotorcraft is in the normal ground attitude."

(Sec. 205 (a), 52 Stat. 984, as amended; 49 U.S.C. 425 (a). Interpret or apply secs. 601, 603, 52 Stat. 1007, 1009 as amended; 49 U.S.C. 551, 553)

By the Civil Aeronautics Board:

/s/ M. C. Mulligan

M. C. Mulligan

Secretary

(SEAL)

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