AC 27.351. § 27.351 YAWING CONDITIONS.

a. Definitions.

(1) Suddenly. For the purpose of this section, 'suddenly' is defined as an interval not to exceed 0.2 seconds for complete control input. A rational analysis may be used to substantiate an alternative value.

(2) Zero Yaw. Normal, 1-g, level flight condition with either zero bank angle or zero sideslip.

b. b. Explanation. The rule requires a rotorcraft "structural" yaw or sideslip design envelope. This sideslip envelope must cover minimum forward speed, or hover, to V_H or V_{NE}, whichever is less. The rotorcraft must be structurally safe for the thrust capability of the directional control system.

(1) The rotorcraft structure must be designed to withstand the loads for the specified yawing conditions. The standard does not require a structural flight demonstration. It is a structural design standard.

(2) This standard applies only to power-on conditions. Autorotations need not be considered.

(3) This standard requires the maximum allowable rotor RPM consistent with the flight conditions, including special operational rotor settings.

(4) For the purposes of this section, the analysis may be performed at international standard atmosphere (ISA) sea level conditions.

(5) The rotorcraft structure must be designed to withstand the loads for the specified sideslip conditions. This includes, but is not limited to:

(i) Main cabin, tailboom, and vertical control surfaces.

(ii) Tail rotor structures, including the fitting attachments to the frame.

(iii) Windows, doors, and other transparencies.

(iv) Landing gear and retracting mechanism.

(v) Fairings and cowlings.

(6) Maximum displacement of the directional control, except as limited by pilot effort (§ 27.397(a)), is required for the conditions cited in the rule. Control system limiting devices may be used, however the probability of failure or malfunction of these system(s) should be considered (see Figure AC 27.351-2). This evaluation may include Flight Manual Limitations, if failure of the system is reliably indicated to the crew.

(7) Both right and left yaw conditions should be evaluated.

(8) For vertical stabilizers, the airloads may be assumed independent of the tail rotor thrust (superpositioning).

(9) Loads associated with sideslip angles exceeding the values of Figure AC 27.351-1 do not need to be considered. The corresponding points of the maneuver may be deleted.

c. Procedure. The design loads should be evaluated within the limits of Figure AC 27.351-1 or the maximum capability of the rotorcraft, whichever is less; at speeds from zero to V_H or V_{NE}, whichever is less, for the following phases of the maneuver:

(1) With the rotorcraft at an initial trim condition (1 g level flight and zero yaw), the cockpit directional control is suddenly displaced to the maximum deflection limited by the control stops or by the maximum pilot force specified in § 27.397(a). This is intended to generate a high tail rotor thrust.

(2) While maintaining maximum cockpit directional control deflection, within the limitation specified in c(1) of this AC paragraph, allow the rotorcraft to yaw to the maximum transient sideslip angle or to the value defined in Figure AC 27.351-1, whichever is less. This is intended to generate high aerodynamic loads.

(3) Allow the rotorcraft to stabilize at the maximum steady-state sideslip angle. In the event that the maximum steady state angle is greater than the value defined in Figure AC 27.351-1, the rotorcraft should be trimmed to the value of the angle using less than maximum cockpit directional control deflection.

(4) With the rotorcraft yawed to the static equilibrium sideslip angle specified in c(3) of this AC paragraph, the cockpit control is suddenly returned to its initial trim position. This is intended to combine a high tail rotor thrust and high aerodynamic restoring forces.

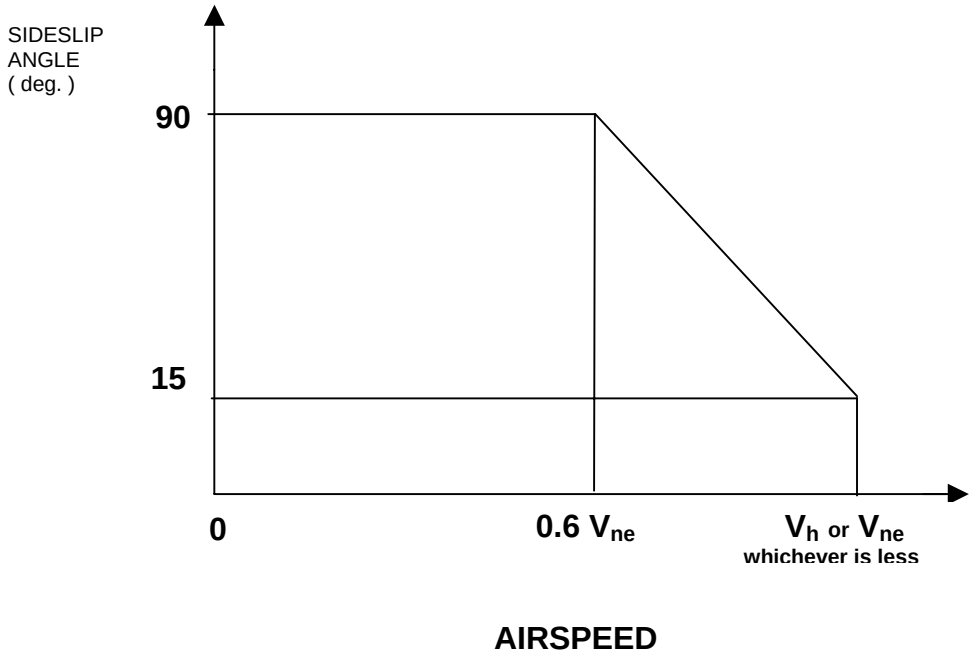
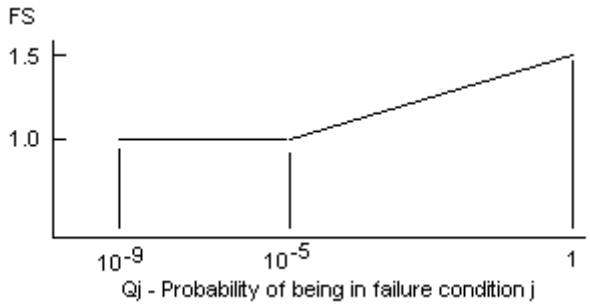


Figure AC 27.351-1

- For static strength substantiation, each part of the structure should be able to withstand without failure, the loads generated by the maneuver described in the rule multiplied by a factor of safety depending on the probability of being in this failure state. The factor of safety is defined in the figure below:



$Q_j = (T_j)(P_j)$

where:

T_j = Average flight time spent with a failed control limiting system j (in hours)

P_j = Probability of occurrence of failure of the control limiting system j (per hour)

<u>Note</u>: If P_j is greater than 10^{-3} per flight hour then a 1.5 factor of safety should be applied to all limit load conditions specified in this standard.

Figure AC 27.351-2