

maximum limit torque loads imposed by each of the following:

a. Sudden engine deceleration due to a malfunction which could result in a temporary loss of power or thrust.

b. The maximum acceleration of the engine.

2. For auxiliary power unit installations: The power unit mounts and adjacent supporting airframe structure must be designed to withstand 1g level flight loads acting simultaneously with the maximum limit torque loads imposed by each of the following:

a. Sudden auxiliary power unit deceleration due to malfunction or structural failure.

b. The maximum acceleration of the auxiliary power unit.

3. For an engine supporting structure: An ultimate loading condition must be considered that combines 1g flight loads with the transient dynamic loads resulting from each of the following:

a. The loss of any fan, compressor, or turbine blade.

b. Where applicable to a specific engine design, and separately from the conditions specified in paragraph 3.a., any other engine structural failure that results in higher loads.

4. The ultimate loads developed from the conditions specified in paragraphs 3.a. and 3.b. above must be multiplied by a factor of 1.0 when applied to engine mounts and pylons and multiplied by a factor of 1.25 when applied to adjacent supporting airframe structure.

Operation Without Normal Electrical Power. In lieu of compliance with 14 CFR 25.1351(d), the following special conditions apply:

It must be demonstrated by test or by a combination of test and analysis, that the airplane can continue safe flight and landing with inoperative normal engine and APU generator electrical power (in other words, without electrical power from any source, except for the battery and any other standby electrical sources). The airplane operation should be considered at the critical phase of flight and include the ability to restart the engines and maintain flight for the maximum diversion time capability being certified.

Interaction of Systems and Structures: In lieu of compliance with 14 CFR 25.1351(d), the following special conditions apply:

1. **General:** For airplanes equipped with systems that affect structural performance, either directly or as a result of a failure or malfunction, the influence of these systems and their failure conditions must be taken into

account when showing compliance with the requirements of 14 CFR part 25, subparts C and D. The following criteria must be used for showing compliance with these special conditions for airplanes equipped with flight control systems, autopilots, stability augmentation systems, load alleviation systems, flutter control systems, and fuel management systems. If these special conditions are used for other systems, it may be necessary to adapt the criteria to the specific system.

(a) The criteria defined herein address only the direct structural consequences of the system responses and performances and cannot be considered in isolation but should be included in the overall safety evaluation of the airplane. These criteria may in some instances duplicate standards already established for this evaluation. These criteria are only applicable to structures whose failure could prevent continued safe flight and landing. Specific criteria that define acceptable limits on handling characteristics or stability requirements when operating in the system degraded or inoperative modes are not provided in these special conditions.

(b) Depending upon the specific characteristics of the airplane, additional studies that go beyond the criteria provided in these special conditions may be required in order to demonstrate the capability of the airplane to meet other realistic conditions, such as alternative gust or maneuver descriptions, for an airplane equipped with a load alleviation system.

(c) The following definitions are applicable to these special conditions.

Structural performance: Capability of the airplane to meet the structural requirements of 14 CFR part 25.

Flight limitations: Limitations that can be applied to the airplane flight conditions following an in-flight occurrence and that are included in the flight manual (e.g., speed limitations, avoidance of severe weather conditions, etc.).

Operational limitations: Limitations, including flight limitations that can be applied to the airplane operating conditions before dispatch (e.g., fuel, payload, and Master Minimum Equipment List limitations).

Probabilistic terms: The probabilistic terms (probable, improbable, extremely improbable) used in these special conditions are the same as those used in § 25.1309.

Failure condition: The term failure condition is the same as that used in § 25.1309; however, these special conditions apply only to system failure

conditions that affect the structural performance of the airplane (e.g., system failure conditions that induce loads, lower flutter margins, or change the response of the airplane to inputs such as gusts or pilot actions).

2. *Effects of Systems on Structures.*

The following criteria will be used in determining the influence of a system and its failure conditions on the airplane structure.

(a) System fully operative. With the system fully operative, the following apply:

(1) Limit loads must be derived in all normal operating configurations of the system from all the limit conditions specified in subpart C, taking into account any special behavior of such a system or associated functions, or any effect on the structural performance of the airplane that may occur up to the limit loads. In particular, any significant nonlinearity (rate of displacement of control surface, thresholds, or any other system nonlinearities) must be accounted for in a realistic or conservative way when deriving limit loads from limit conditions.

(2) The airplane must meet the strength requirements of part 25 (static strength, residual strength), using the specified factors to derive ultimate loads from the limit loads defined above. The effect of nonlinearities must be investigated beyond limit conditions to ensure the behavior of the system presents no anomaly compared to the behavior below limit conditions. However, conditions beyond limit conditions need not be considered when it can be shown that the airplane has design features that will not allow it to exceed those limit conditions.

(3) The airplane must meet the aeroelastic stability requirements of § 25.629.

(b) System in the failure condition. For any system failure condition not shown to be extremely improbable, the following apply:

(1) At the time of occurrence. Starting from 1-g level flight conditions, a realistic scenario, including pilot corrective actions, must be established to determine the loads occurring at the time of failure and immediately after failure.

(i) For static strength substantiation, these loads multiplied by an appropriate factor of safety that is related to the probability of occurrence of the failure are ultimate loads to be considered for design. The factor of safety (FS) is defined in Figure 1.

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