



U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

Subject: Ground Gust Conditions

Date: 12/12/14

AC No: 25.415-1

Initiated By: ANM-115

1 **PURPOSE.**

This advisory circular (AC) describes acceptable means for showing compliance with the requirements of Title 14, Code of Federal Regulations (14 CFR) 25.415, *Ground gust conditions*. Section 25.415 specifies the gust load conditions that are assumed to occur while the airplane is taxiing and when parked. These load conditions apply to the flight control systems and surfaces.

2 **APPLICABILITY.**

2.1 The guidance provided in this document is directed to airplane manufacturers, modifiers, foreign regulatory authorities, and Federal Aviation Administration (FAA) transport airplane type certification engineers and their designees.

2.2 This material in this AC is neither mandatory nor regulatory in nature and does not constitute a regulation. While these guidelines are not mandatory, they are derived from extensive FAA and industry experience in determining compliance with the relevant regulations. These means are issued, in the interest of standardization, for guidance purposes and to outline a method that has been found acceptable in showing compliance with the standards set forth in the rule. If, however, we become aware of circumstances that convince us that following this AC would not result in compliance with the applicable regulations, we will not be bound by the terms of this AC, and we may require additional substantiation or design changes as a basis for finding compliance.

2.3 The material in this AC does not change or create any additional regulatory requirements, nor does it authorize changes in, or permit deviations from, existing regulatory requirements.

3 **RELATED 14 CFR REGULATIONS.**

Section 25.519, *Jacking and tie-down provisions*.

4 **BACKGROUND.**

- 4.1 The requirement to consider the effects of ground gusts has been applied to transport airplanes since 1950. The purpose of the requirement is to protect the flight control system from excessive peak ground wind loads while the airplane is parked or while taxiing downwind. For developing the original regulation, the control surface load distribution was considered to be triangular, with the peak at the trailing edge representing reversed flow over the control surface. This assumption, along with assumptions about the wind approach angle and typical control surface geometries, were developed into a table of hinge moment factors and set forth in the regulation. These hinge moment factors have been carried forward to the existing table in § 25.415. The maximum design wind speed was originally set at 88 feet per second (52 knots) under the presumption that higher speeds were predictable storm conditions and the airplane owner could take additional precautions beyond engaging the standard gust locks.
- 4.2 Amendment 25-91 incorporated a new requirement, § 25.519, for jacking and tie-down loads. This requirement was similar to existing Joint Aviation Requirement 25.519 and required consideration of the airplane in a moored or jacked condition in wind speeds up to 65 knots. In order to be consistent in the treatment of ground winds, the wind speed requirement in § 25.415 was increased to 65 knots at the same time.
- 4.3 There have been several incidents and accidents caused by hidden damage that had previously occurred in ground gust conditions. Although many of these events were for airplanes that had used the lower wind speeds from earlier rules, analysis indicates that the most significant contributor to the damage was the dynamic load effect. The dynamic effects were most significant for control system designs in which the gust locks were designed to engage the control system at locations far from the control surface horn. Based on these events, Amendment 25-141 revised § 25.415 to include additional factors for use in those portions of the system and surfaces that could be affected by dynamic effects.
- 4.4 The flight control system and surface loads prescribed by § 25.415 are limit loads based on a peak wind speed of 65 knots equivalent airspeed. In operation, the peak wind speed would most often be caused by an incremental fluctuation in velocity imposed on top of a less rapidly changing mean wind speed. Therefore, an appropriate peak wind speed limitation should be reflected in the applicable documents when there is a potential risk of structural damage.

5 **COMPLIANCE.**

- 5.1 The ground gust requirements take into account the conditions of the airplane parked and while taxiing. For airplanes equipped with control system gust locks, the taxiing condition is evaluated with the controls locked and unlocked, and the parked condition is evaluated with the controls locked. In either of the locked conditions, the control surface loads are assumed to be reacted at the control system locks. In the unlocked

condition while taxiing, the pilot is assumed to be at the controls, and the controls are assumed to be powered, if applicable. In the latter condition, the control surface loads are assumed to be reacted, if necessary, at the flight deck controls by the pilot(s) up to the limits of the maximum pilot forces and torques given in § 25.397(c).

- 5.2 Where loads are eventually reacted at the flight deck controls, the loads in those parts of the control system between the control system stops nearest the control surfaces and the flight deck controls need not exceed those that would result from the application of the specified maximum pilot effort forces. However, higher loads can be reacted by the control system stops. Those parts of the control system from the control surfaces to the control system stops nearest the surfaces should be designed to the resultant limit loads including dynamic effects, if applicable, and regardless of pilot effort limitations. Similarly, pilot effort limitations would not apply to parts of control systems where the loads are not eventually reacted at the flight deck controls; for example, an aileron control system where the right-hand side aileron loads are reacted by the left-hand side aileron, without participation by the pilot(s).
- 5.3 In either the taxiing condition or the parked condition, if the control system flexibility is such that the rate of load application in the ground gust conditions might produce transient stresses appreciably higher than those corresponding to static loads, the effects of this rate of application must be considered. Manually powered control systems and control systems where the gust lock is located remotely from the control surface are examples of designs that might fall in this category. In such cases, § 25.415(e) requires the control system loads be increased by an additional factor over the standard factor of 1.25.

If you have any suggestions for improving this AC, you may use the Advisory Circular Feedback form at the end of this AC.



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Advisory Circular Feedback

If you find an error in this AC, have recommendations for improving it, or have suggestions for new items/subjects to be added, you may let us know by (1) emailing this form to 9-AWA-AVS-AIR500-Coord@faa.gov or (2) faxing it to the attention of the Aircraft Certification Service Directives Management Officer at (202) 267-3983.

Subject: _____ Date: _____

Please check all appropriate line items:

An error (procedural or typographical) has been noted in paragraph _____ on page _____.

Recommend paragraph _____ on page _____ be changed as follows:

In a future change to this AC, please cover the following subject:
(Briefly describe what you want added.)

Other comments:

I would like to discuss the above. Please contact me.

Submitted by: _____ Date: _____