

*7. Revise Icing Rates in Footnotes, as They Are Not Realistic or Not Consistent With Certification Standards*

(a) An icing rate of ¼-inch in five minutes, which would be severe based on these definitions, would not be considered hazardous with regard to the effect on aircraft flight characteristics on certain types of regional aircraft.

The FAA concurs. The FAA now agrees that it is incorrect to assign an icing rate to severe. The FAA proposes to re-instate the term heavy for the greatest icing rate category. The FAA recommends that the term severe (without any icing rate attached) be retained to cover the situation where the ice protection system is inadequate, no matter what the icing rate.

(b) What is the basis for the numerical icing rates assigned to the different intensities?

The icing rates that were given in the footnotes were taken from the technical paper, "A Workable, Aircraft-Specific Icing Severity Scheme," AIAA-98-0094 (Jan. 1998) by R. Jeck. While the reference rates are admittedly arbitrary, and are primarily based on the traditional operation of the pneumatic deicing boots, the AIAA paper clearly explains the rationale behind these rates and gives several application examples. Interested readers are referred to this paper.

In AIAA-98-0094, occasional is interested as once every 15 minutes to an hour. Similarly, for moderate icing, which the present definitions associate with (frequent) use of deicers, the word frequent is interpreted as once every 5 to 15 minutes. Severe (or preferably heavy) icing rates must require even more usage, which would have to be more often than once every 5 minutes. In tabular form, the proposed rates have the following relationships:

*Light:* ¼-inch accumulation in 15–60 minutes, which is equivalent to 0.1–0.4 mm./min, or ¼ to 1 inch per hour.

*Moderate:* ¼-inch accumulation in 5–15 minutes, which is equivalent to 0.4–1.3 mm/min, or 1 to 3 inches to hour.

*Heavy:* ¼-inch accumulation in less than 5 minutes, which is equivalent to more than 1.3 mm/min, or more than 3 inches per hour.

This scheme preserves the "1-hour" separation between light and moderate intensities, as mentioned in the present definitions. It also relates the onset of heavy icing conditions with a rate that would, if continued, produce a 3-inch accumulation in an hour.

Three inches of ice on unprotected surfaces is considered to be a critical accumulation for design, test, and certification purposes.

(c) Commenters suggests changing the footnotes to read 30–60 minutes for light, 15–30 minutes for moderate, and 5–15 minutes for heavy.

The FAA does not occur. The commenter may be uncomfortable with the proposed 45 minutes spread in time allowed for light icing intensities, and prefer a 30 minute spread instead. But the commenter has not provided any justification for his preference.

(d) Severe icing is (presumably) a condition outside of the Continuous Maximum envelope because, by rule, the (icing-certificated) aircraft must have protection throughout this envelope. But "severe icing" can be found on the Continuous Maximum icing chart in 14 CFR part 25, Appendix C. This is inconsistent.

The FAA concurs that inconsistency could arise with the previous definition of severe for some conditions within the continuous maximum icing envelope. However, the FAA now agrees that it is incorrect to assign an icing rate to severe, so any inconsistency has been eliminated. The rate previously assigned to "severe icing" is not assigned to "heavy icing." Depending on the airspeed of the aircraft and the collection efficiency of the monitored surface, the heavy icing rate can occur for some points within the continuous maximum icing envelope, particularly for shorter encounters. For encounters exceeding about 20 minutes, a heavy icing rate would ordinarily not be experienced in continuous maximum conditions by most aircraft because of the envelope correction reducing liquid water content for sustained encounters.

*8. Base Icing Rates in Footnotes in Unprotected Surfaces to Preferably on a Representative Ice Detector Surface or Probe*

Base icing rates in footnotes on unprotected surfaces or preferably on a representative ice detector surface or probe. (That is, if the wing and tailplane are ice protected, then the pilot cannot observe or judge icing rates there while the protection systems are preventing or removing the ice. Therefore, only a separate probe or an unprotected part of the wing will be useful or observing ice accretion rates.)

The FAA concurs. The outer wing may be used unless otherwise specified. The outer wing and tailplane were suggested as standard reference locations so that everyone involved (pilots, forecasters) would all be focused on the same spot on the airplane.

Naturally, these locations may not even be observable due to darkness or line-of-sight obstruction, for example. Heated wings would not be expected to accumulate any ice anyway. In that case, the pilot would not report any icing intensity. Icing conditions may exist, but for adequately heated wings there should be no accretion and therefore no intensity! If the protected parts of the aircraft do collect ice, then it would be reported as severe if the equipment is unable to control it. This would apply to the windshield too, if it iced over uncontrollably.

In any case, there is no substitute for a good measurement, and the proposed definitions anticipate the eventual use of icing rate meters for obtaining the measurements. Icing rate measurements on a probe can be converted to corresponding rates on the wing or tail. In the absence of an icing rate meter, the pilot is encouraged to estimate an accretion rate with the outer wing or tailplane in mind. This is no different from the present situation where pilots are instructed in the AFM to estimate when ¼-inch of ice has accreted as a signal for inflating the boots. Admittedly, without an icing rate meter there is no easy way to estimate ice accretion rates or amounts. This is a problem even with the current definitions. But by focusing on the same ice-critical components of the airplane, there can be uniformity in reporting and eventually in forecasting.

*9. Retain the Term Trace Icing*

(a) The NTSB (A-98-88) did not recommend eliminating trace icing, but only to eliminate the "not hazardous" wording.

The FAA does not concur and has decided to delete the term Trace ice for the following reasons:

- Trace icing is not forecast.
- Trace icing is not governed by the regulations.
- Identification of trace icing is dependent on the capability of the pilot to judge. The FAA considers that estimating an ice accretion of a quarter of an inch or less per hour is outside the judgment of a pilot and questions how the instrumentation would handle it.
- The definition of trace icing implies continued flight in icing by unprotected aircraft is acceptable.
- An interpretation of 135.227 suggests that the proposed change may negate the current practice of flight in IFR icing conditions by unprotected aircraft and aircraft certified for icing under older rules (CAR-3, prior to amendment 23-14).