

Code of Federal Regulations

Sec. C25.1

Part 25 AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES

Appendix C	
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Appendix C.

(a) *Continuous maximum icing.* The maximum continuous intensity of atmospheric icing conditions (continuous maximum icing) is defined by the variables of the cloud liquid water content, the mean effective diameter of the cloud droplets, the ambient air temperature, and the inter-relationship of these three variables as shown in figure 1 of this appendix. The limiting icing envelope in terms of altitude and temperature is given in figure 2 of this appendix. The inter-relationship of cloud liquid water content with drop diameter and altitude is determined from figures 1 and 2. The cloud liquid water content for continuous maximum icing conditions of a horizontal extent, other than 17.4 nautical miles, is determined by the value of liquid water content of figure 1, multiplied by the appropriate factor from figure 3 of this appendix.

(b) *Intermittent maximum icing.* The intermittent maximum intensity of atmospheric icing conditions (intermittent maximum icing) is defined by the variables of the cloud liquid water content, the mean effective diameter of the cloud droplets, the ambient air temperature, and the interrelationship of these three variables as shown in figure 4 of this appendix. The limiting icing envelope in terms of altitude and temperature is given in figure 5 of this appendix. The inter-relationship of cloud liquid water content with drop diameter and altitude is determined from figures 4 and 5. The cloud liquid water content for intermittent maximum icing conditions of a horizontal extent, other than 2.6 nautical miles, is determined by the value of cloud liquid water content of figure 4 multiplied by the appropriate factor in figure 6 of this appendix.

[(c) *Takeoff maximum icing.* The maximum intensity of atmospheric icing conditions for takeoff (takeoff maximum icing) is defined by the cloud liquid water content of 0.35 g/m³, the mean effective diameter of the cloud droplets of 20 microns, and the ambient air temperature at ground level of minus 9 degrees Celsius (-9(C). The takeoff maximum icing conditions extend from ground level to a height of 1,500 feet above the level of the takeoff surface.]

Figure 1 - Continuous Maximum (Stratiform Clouds)
Atmospheric Icing Conditions
Liquid Water Content vs. Mean Effective Drop Diameter

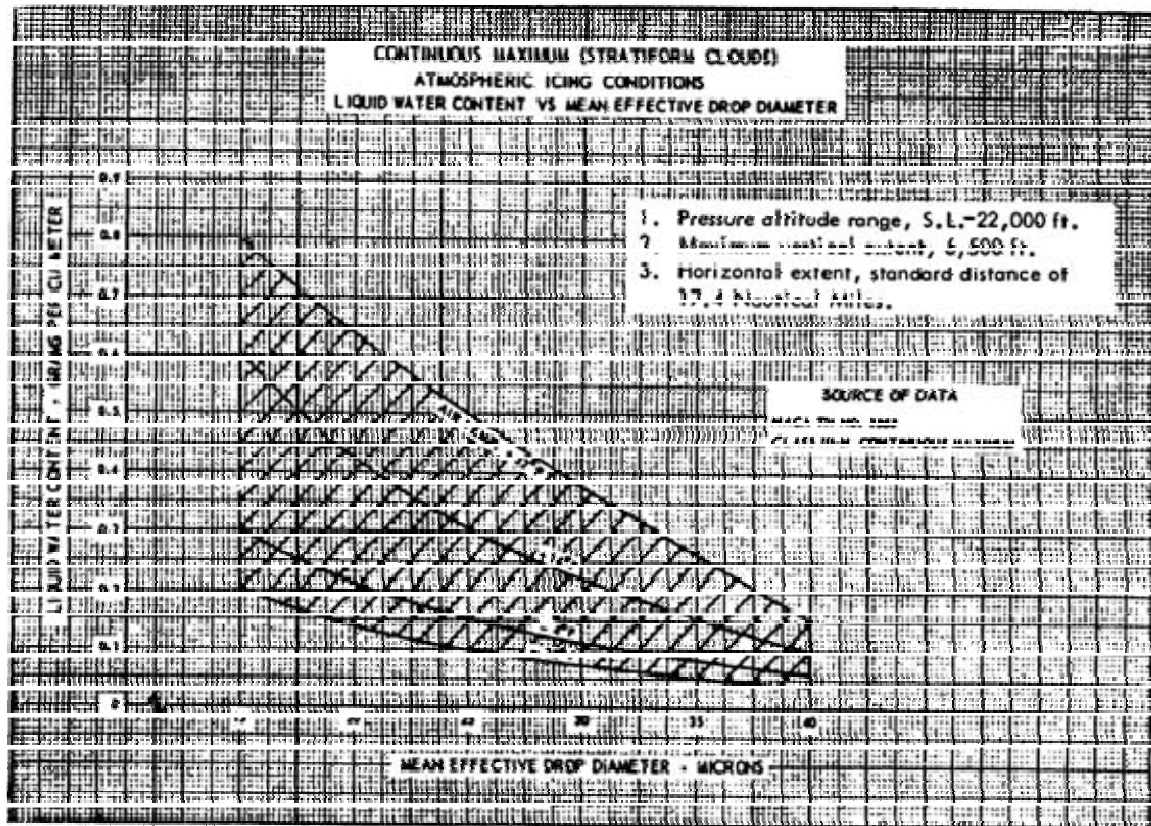


Figure 2 - Continuous Maximum (Stratiform Clouds)
Atmospheric Icing Conditions
Ambient Temperature vs. Pressure Altitude

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FIGURE 2

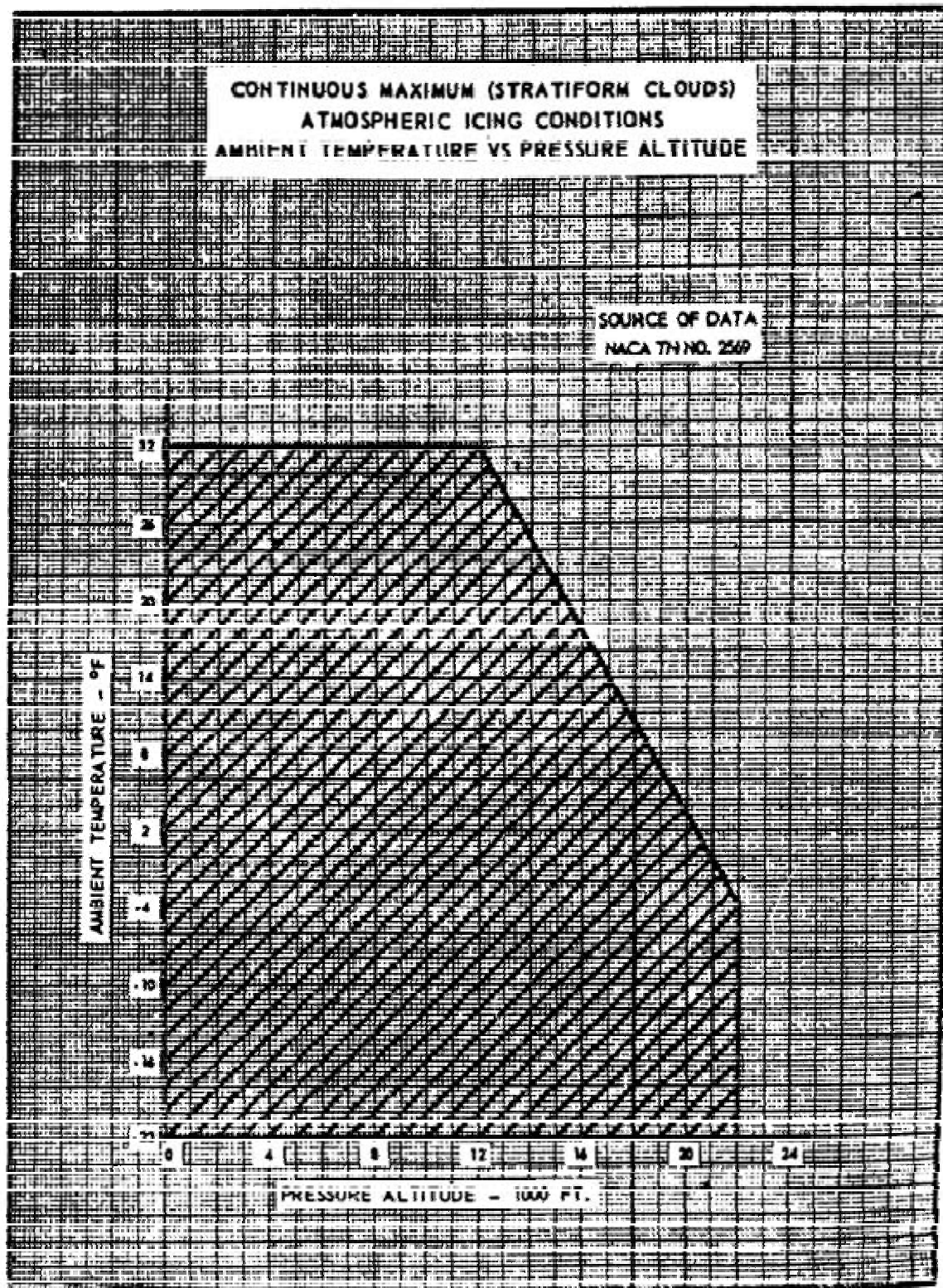


Figure 3 - Continuous Maximum (Stratiform Clouds)
 Atmospheric Icing Conditions
 Liquid Water Content Factor vs. Cloud Horizontal Distance

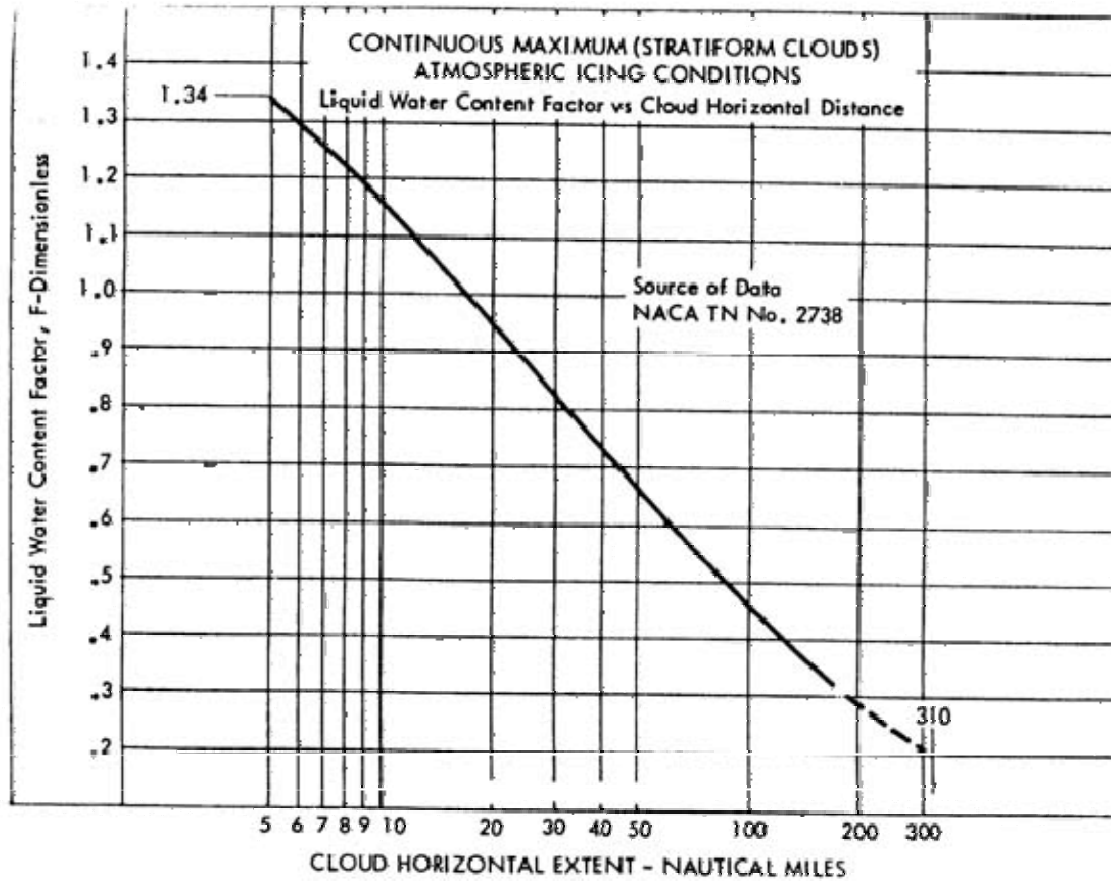


Figure 4 - Intermittent Maximum (Cumuliform Clouds)
 Atmospheric Icing Conditions
 Liquid Water Content vs. Mean Effective Drop Diameter

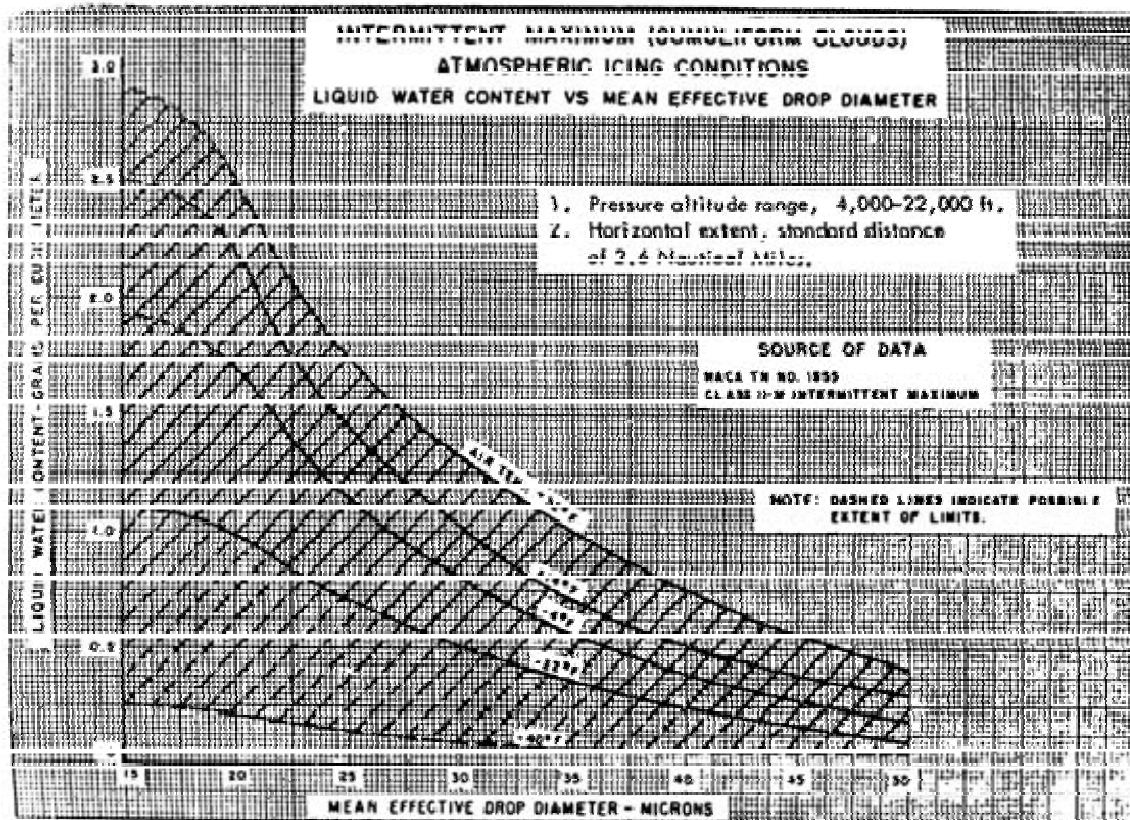


Figure 5 - Intermittent Maximum (Cumuliform Clouds)
 Atmospheric Icing Conditions
 Ambient Temperature vs. Pressure Altitude

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FIGURE 5

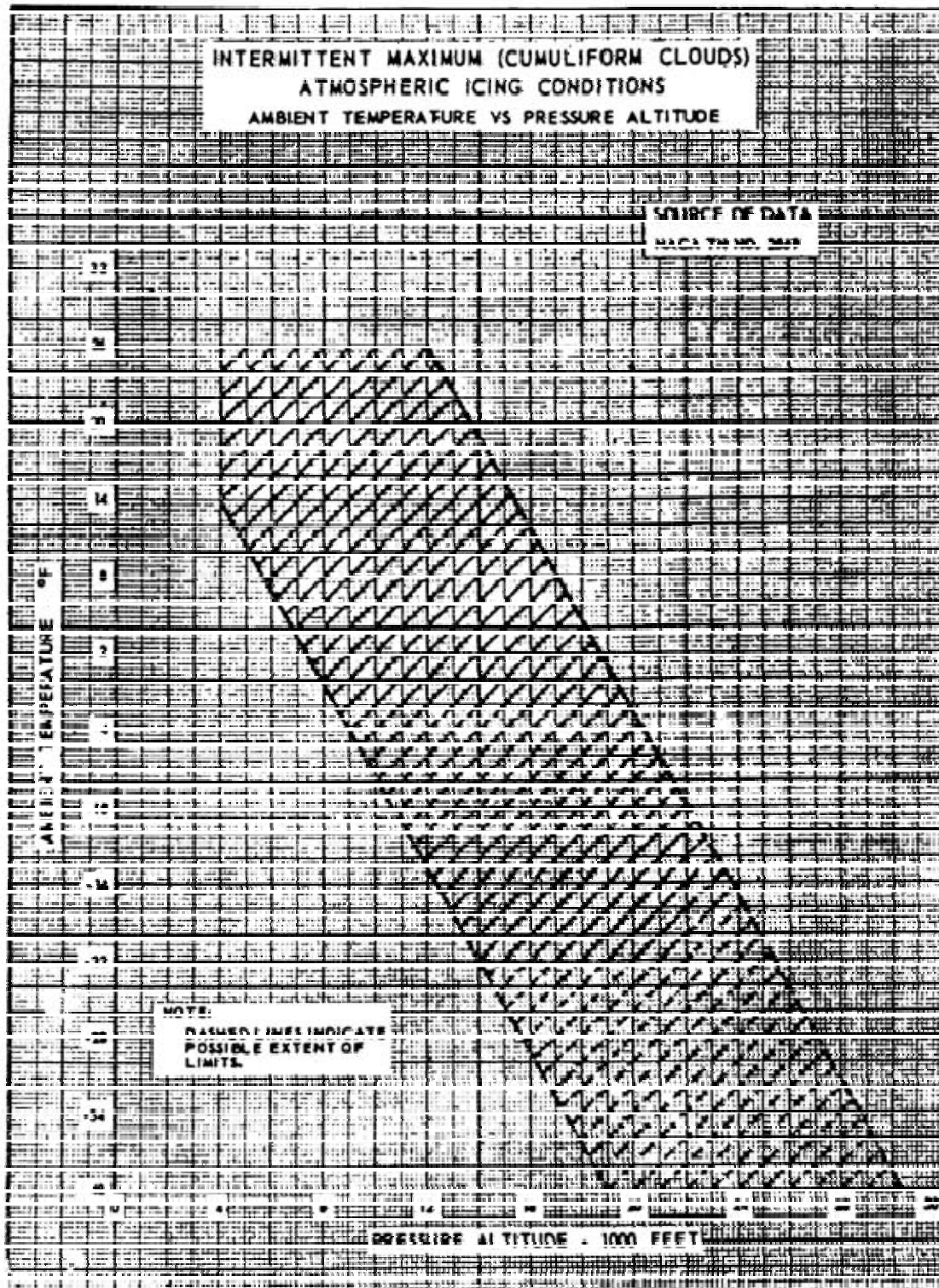
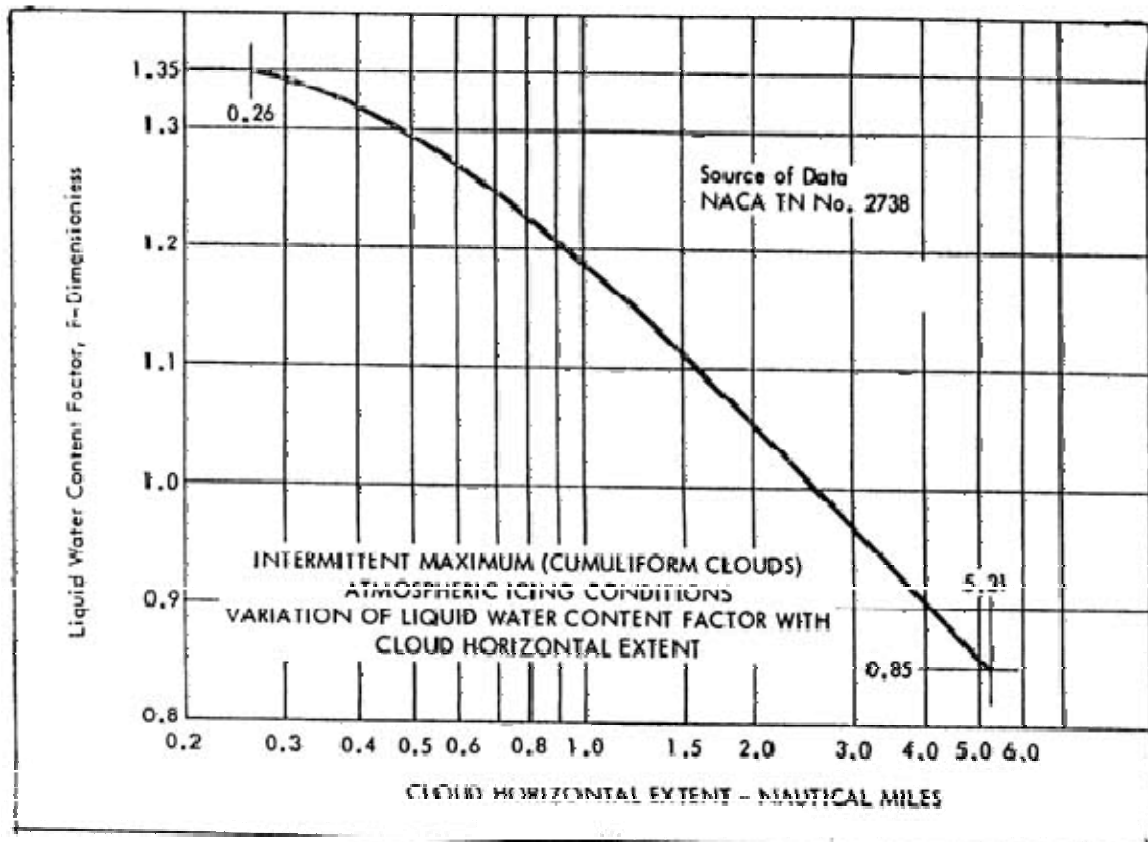


Figure 6 - Intermittent Maximum (Cumuliform Clouds)
Atmospheric Icing Conditions
Variation of Liquid Water Content Factor with
Cloud Horizontal Extent



[Part II--Airframe Ice Accretions for Showing Compliance With Subpart B.

(a) Ice accretions--General. The most critical ice accretion in terms of airplane performance and handling qualities for each flight phase must be used to show compliance with the applicable airplane performance and handling requirements in icing conditions of subpart B of this part. Applicants must demonstrate that the full range of atmospheric icing conditions specified in part I of this appendix have been considered, including the mean effective drop diameter, liquid water content, and temperature appropriate to the flight conditions (for example, configuration, speed, angle-of-attack, and altitude). The ice accretions for each flight phase are defined as follows:

(1) Takeoff is the most critical ice accretion on unprotected surfaces and any ice

accretion on the protected surfaces appropriate to normal ice protection system operation, occurring between liftoff and 400 feet above the takeoff surface, assuming accretion starts at liftoff in the takeoff maximum icing conditions of part I, paragraph (c) of this appendix.

(2) Final takeoff ice is the most critical ice accretion on unprotected surfaces, and any ice accretion on the protected surfaces appropriate to normal ice protection system operation, between 400 feet and either 1,500 feet above the takeoff surface, or the height at which the transition from the takeoff to the en route configuration is completed and V_{FTO} is reached, whichever is higher. Ice accretion is assumed to start at liftoff in the takeoff maximum icing conditions of part I, paragraph (c) of this appendix.

(3) En route ice is the critical ice accretion on the unprotected surfaces, and any ice accretion on the protected surfaces appropriate to normal ice protection system operation, during the en route phase.

(4) Holding ice is the critical ice accretion on the unprotected surfaces, and any ice accretion on the protected surfaces appropriate to normal ice protection system operation, during the holding flight phase.

(5) Approach ice is the critical ice accretion on the unprotected surfaces, and any ice accretion on the protected surfaces appropriate to normal ice protection system operation following exit from the holding flight phase and transition to the most critical approach configuration.

(6) Landing ice is the critical ice accretion on the unprotected surfaces, and any ice accretion on the protected surfaces appropriate to normal ice protection system operation following exit from the approach flight phase and transition to the final landing configuration.

(b) In order to reduce the number of ice accretions to be considered when demonstrating compliance with the requirements of Sec. 25.21(g), any of the ice accretions defined in paragraph (a) of this section may be used for any other flight phase if it is shown to be more critical than the specific ice accretion defined for that flight phase. Configuration differences and their effects on ice accretions must be taken into account.

(c) The ice accretion that has the most adverse effect on handling qualities may be used for airplane performance tests provided any difference in performance is conservatively taken into account.

(d) For both unprotected and protected parts, the ice accretion for the takeoff phase may be determined by calculation, assuming the takeoff maximum icing conditions defined in appendix C, and assuming that:

(1) Airfoils, control surfaces and, if applicable, propellers are free from frost, snow, or ice at the start of the takeoff;

(2) The ice accretion starts at liftoff;

(3) The critical ratio of thrust/power-to-weight;

(4) Failure of the critical engine occurs at V_{EF} ; and

(5) Crew activation of the ice protection system is in accordance with a normal operating procedure provided in the Airplane Flight Manual, except that after beginning the takeoff roll, it must be assumed that the crew takes no action to activate the ice protection system until the airplane is at least 400 feet above the takeoff surface.

(e) The ice accretion before the ice protection system has been activated and is

performing its intended function is the critical ice accretion formed on the unprotected and normally protected surfaces before activation and effective operation of the ice protection system in continuous maximum atmospheric icing conditions. This ice accretion only applies in showing compliance to Sec. Sec. 25.143(j) and 25.207(h).]

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