UNITED STATES OF AMERICA
CIVIL AERONAUTICS BOARD
WASHINGTON, D. C.

Civil Air Regulations Amendment 4b-2
Effective: August 25, 1955
Adopted: July 20, 1955

AIRPLANE AIRWORTHINESS - TRANSPORT CATEGORIES

MISCELLANEOUS AMENDMENTS

This amendment includes a number of significant changes which are considered to represent the initial step in the development of airworthiness requirements more specifically applicable to turbine-powered transport category airplanes. These entail revisions to the flight, structural, and powerplant installation provisions and in most cases are generally applicable to transport category airplanes, irrespective of the type of powerplant used. The most significant changes in the flight provisions which cater to turbine-powered airplanes deal with the establishment of limiting climb speeds for the all-engine-operating landing configuration in § 4b.119 and for the one-engine-inoperative approach configuration in § 4b.120. No limiting speeds are prescribed for these configurations in the currently effective regulations. In view of the fact that the best climb speeds for jet-powered airplanes might be considerably higher than the operational landing speed, these changes are designed to assure a reasonable relationship between the climb speeds and the landing speed. Other revisions of the flight provisions include changes in the take-off speed requirements of § 4b.114, in the trim requirements of §§ 4b.141 and 4b.142, and in the stability requirements of §§ 4b.154 and 4b.155.

Among the changes in the structural requirements is a new provision in § 4b.216 (a) which is more specifically applicable to turbine-propeller-powered airplanes. It prescribes taking into account the high torque which might occur from possible unwanted feathering of a propeller under full power.

In addition there are other changes to the structural provisions which are generally applicable. These involve a requirement in new § 4b.216 (d) which prescribes consideration of the unsymmetrical tail loads which might be caused by propeller drag as a result of possible time delay between engine failure and feathering of the propeller, a requirement in § 4b.210 (b) (4) allowing the applicant to limit V_c at altitudes where V_d is limited by Mach number, and a requirement in § 4b.231 (a) which prescribes an investigation of the landing gear for loads resulting from the higher contact speeds at altitudes and during downwind landings when the approval of landings above 5,000 feet or landings in downwinds exceeding 10 mph, respectively, is sought.

There are included amendments with respect to the installation of smoke detectors in cargo compartments. The currently effective rules in Part 4b require the installation of smoke detectors in cargo compartments "B", "C", and "D". In addition, the currently effective provisions in the air carrier operating parts of the Civil Air Regulations require, on all passenger airplanes with engines of over 600 horsepower, the installation of smoke detectors in "B" and "C" compartments. On the other hand, pending further development of reliable smoke detectors, Special Civil Air Regulation No. SR-401 permits noncompliance with the smoke detector provisions in Part 4b and in the operating parts of the regulations until April 1, 1956. This amendment revises §§ 4b.383 (b) (2), (c) (1) (i), and (d), so that heat-type fire detectors may be installed in lieu of smoke detectors in compartments "B" and "C" and no detectors need be installed in compartments "D." Concurrently with this amendment, Parts 40, 41, and 42 are being amended so that heat-type fire detectors may be installed in lieu of smoke detectors in compartments "B" and "C."

A number of significant changes are included in connection with the powerplant installational requirements for the purpose of making them more specifically applicable to turbine-powered airplanes. In this regard changes are made to §§ 4b.460, 4b.480, 4b.483, 4b.486, 4b.488, and 4b.490. These changes entail several new provisions designed mainly for the protection against fire in turbine powerplant installations. They include provisions against overflow of combustible fluids in the induction system, provisions which specify the compressor and accessory section of the turbine engine as designated fire zones, and provisions making certain requirements of the presently effective regulations for designated fire zones applicable to the combustion, turbine, and tail pipe sections.

In addition, § 4b.640 is being amended to incorporate a comprehensive and detailed set of standards intended to provide protection in types of icing conditions which might be reasonably anticipated during normal operations.

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There is also included an amendment which changes § 4b.740 so that each airplane need not be furnished with an Airplane Flight Manual if such a manual is not required by the operating parts of the Civil Air Regulations. Concurrently with this amendment, Parts 40, 41, and 42 are being amended to require the carriage of an approved Airplane Flight Manual only when the airplane does not carry an operators' manual containing all the information as required for the Airplane Flight Manual.

In addition to the foregoing substantive changes, there are included a number of miscellaneous minor changes most of which are editorial or of a clarifying nature.

Interested persons have been afforded an opportunity to participate[1/] in the making of this amendment, and due consideration has been given to all relevant matter presented.

In consideration of the foregoing, the Civil Aeronautics Board hereby amends Part 4b of the Civil Air Regulations (14 CFR Part 4b, as amended) effective August 25, 1955.

1. By amending § 4b.1 (b) by adding new subparagraphs (7) and (8) to read as follows:

4b.1 Definitions. * * *

(b) General design. * * *

(7) Continuous maximum icing. The maximum continuous intensity of atmospheric icing conditions 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 4b-24a. The limiting icing envelope in terms of altitude and temperature is given in Figure 4b-24b. The inter-relationship of cloud liquid water content with drop diameter and altitude is determined from Figures 4b-24a and 4b-24b. The cloud liquid water content for continuous maximum icing conditions of a horizontal extent other than twenty miles is determined by the value of liquid water content of Figure 4b-24a multiplied by the appropriate factor from Figure 4b-24c. (See § 4b.640.)

(8) Intermittent maximum icing. The intermittent maximum intensity of atmospheric icing conditions 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 4b-25a. The limiting icing envelope in terms of altitude and temperature is given in Figure 4b-25b. The inter-relationship of cloud liquid water content with drop diameter and altitude is determined from Figures 4b-25a and 4b-25b. The cloud liquid water content for intermittent maximum icing conditions of a horizontal extent other than three miles is determined by the value of cloud liquid water content of Figure 4b-25a multiplied by the appropriate factor in Figure 4b-25c. (See § 4b.640.)

NOTE: There is some indication that the upper altitude limit might extend to 30,000 feet pressure altitude, and the lower limit of ambient temperature may be as low as -40° F. Because of this, the portions in this region of Figures 4b-25a and 4b-25b are shown by dashed lines.

2. By amending § 4b.1 (d) by adding a new subparagraph (21) to read as follows:

4b.1 Definitions. * * *

(d) Speeds. * * *

(21) M: Mach number is the ratio of true airspeed to the speed of sound.

3. By amending § 4b.114 (b) (1) and (2) to read as follows:

4b.114 Take-off speeds. * * *

(b) * * *

(1) $1.2V_{S_1}$ for two-engine propeller-driven airplanes and for airplanes without propellers which have no provisions for obtaining a significant reduction in stalling speed with power on (one engine inoperative).

(2) $1.15V_{S_1}$ for propeller-driven airplanes having more than two engines and for airplanes without propellers which have provisions for obtaining a significant reduction in stalling speed with power on (one engine inoperative).

1/ 20 F.R. 369, January 15, 1955.

4. By amending § 4b.119 (b) by adding a new subparagraph (7) to read as follows:

4b.119 Climb; all engines operating. * * *

(b) Landing configuration. * * *

(7) A climb speed not in excess of $1.4V_{s_0}$.

5. By amending § 4b.120 (d) by adding a new subparagraph (8) to read as follows:

4b.120 One-engine-inoperative climb. * * *

(d) Flaps in approach position. * * *

(8) A climb speed not in excess of $1.5V_{s_1}$.

6. By amending § 4b.141 to read as follows:

4b.141 Lateral and directional trim. The airplane shall maintain lateral and directional trim under the most adverse lateral displacement of the center of gravity within the relevant operating limitations, under all normally expected conditions of operation, including operation at any speed from $1.4V_{s_1}$ to V_{NO} or to M_{NO}, whichever is the lesser.

7. By amending § 4b.142 (c) to read as follows:

4b.142 Longitudinal trim. * * *

(c) During level flight at any speed from $1.4V_{s_1}$ to V_{NO} or to M_{NO}, whichever is the lesser, with the landing gear and wing flaps retracted, and from $1.4V_{s_1}$ to V_{LE} with the landing gear extended.

8. By amending § 4b.154 (d) to read as follows:

4b.154 Stability during climb. * * *

(d) 75 percent of maximum continuous power for reciprocating-engine-powered airplanes; and maximum power thrust selected by the applicant as an operating limitation for use during climb (see § 4b.718) for turbine-engine-powered airplanes,

9. By amending § 4b.155 (a) (3) and (4) to read as follows:

4b.155 Stability during cruising.

(a) Landing gear retracted. * * *

(3) 75 percent of maximum continuous power, or the maximum cruising power selected by the applicant as an operating limitation (see § 4b.718), whichever is the greater, except that the power need not exceed that required at V_{NO},

(4) The airplane trimmed for level flight with the power specified in subparagraph (3) of this paragraph.

10. By amending § 4b.155 (b) (3) to read as follows:

4b.155 Stability during cruising. * * *

(b) Landing gear extended. * * *

(3) 75 percent of maximum continuous power, or the maximum cruising power selected by the applicant as an operating limitation, whichever is the greater, except that the power need not exceed that required for level flight at V_{LE},

11. By amending § 4b.210 (b) (4) by deleting the last sentence and inserting in lieu thereof the following: "At altitudes where V_D is limited by Mach number, it shall be acceptable to limit V_C to a Mach number selected by the applicant."

12. By amending § 4b.212 by designating the introductory paragraph as paragraph (a) and by redesignating paragraphs (a) and (b) as subparagraphs (1) and (2) of paragraph (a), and by adding a new paragraph (b) to read as follows:

4b.212 Effect of high lift devices. * * *

(b) When flaps or similar high lift devices are intended for use in en route conditions (e.g., as speed brakes) the airplane shall be assumed to be subjected to symmetrical maneuvers and gusts, with flaps in the appropriate position at the supplementary V_{FG} speed established in accordance with § 4b.714 (c), resulting in limit load factors, within the range determined by the following conditions:

(1) Maneuvering to a positive limit load factor of 2.5,

(2) Positive and negative 30 fps nominal intensity gusts acting normal to the flight path in level flight.

13. By amending § 4b.216 (a) by deleting "(1) and (2)" from the first sentence and inserting in lieu thereof "(1) through (3)".

14. By amending § 4b.216 (a) by adding a new subparagraph (3) to read as follows:

4b.216 Supplementary flight conditions. * * *

(a) Engine torque effects. * * *

(3) For turbine propeller installations, in addition to the conditions specified in subparagraphs (1) and (2) of this paragraph, the limit torque corresponding with take-off power and propeller speed multiplied by a factor of 2.0 shall be considered to act simultaneously with 1g level flight loads.

15. By amending § 4b.216 by adding a new paragraph (d) to read as follows:

4b.216 Supplementary flight conditions. * * *

(d) The tail shall be designed for unsymmetrical loads resulting from failure of one engine.

16. By amending § 4b.221 (a) by adding "(a)" after the reference "§ 4b.212".

17. By amending § 4b.226 (a) to read as follows:

4b.226 Ground gust conditions. * * *

(a) The control system between the stops nearest the surfaces and the cockpit controls shall be designed for loads corresponding with the limit hinge moments H of paragraph (b) of this section, except that these loads need not exceed those corresponding with the maxima of Figure 4b-5 for each pilot alone, or with 75 percent of these maxima for each pilot when the pilots act in conjunction.

18. By amending § 4b.231 (a) by inserting after the first sentence the following: "When approval of landings downwind exceeding 10 mph or landings at elevations higher than 5,000 feet is sought, the effect of increased contact speeds shall be investigated."

19. By amending § 4b.356 (b) by adding after the second sentence the following parenthetical note:

(NOTE: It is not the intent to prohibit the use of inward opening doors if sufficient measures are provided to prevent occupants from crowding against the door to an extent which would interfere with the opening of the door.)

20. By amending § 4b.373 by revising the parenthetical reference at the end of the section to read "(See also §§ 4b.216 (c) and 4b.352, and the oxygen requirements of the appropriate operating parts of the Civil Air Regulations.)"

21. By amending § 4b.383 (b) (2) by deleting the words "other than a heat detector".

22. By amending § 4b.383 (c) (1) (i) by deleting the words "other than heat detector".

23. By amending § 4b.383 (d) by deleting subparagraph (1) and by redesignating subparagraphs (2), (3), (4), and (5) as subparagraphs (1), (2), (3), and (4), respectively.

24. By amending § 4b.386 (a) (3) by adding the following words at the end thereof "except that no fire extinguishment need be provided in cabin ventilating air passages".

25. By amending § 4b.401 (c) by deleting the first sentence and inserting in lieu thereof the following: "Means shall be provided for individually stopping and restarting the rotation of any engine in flight, except that for turbine engine installations means for stopping the rotation need be provided only if such rotation could jeopardize the safety of the airplane."

26. By amending § 4b.404 (c) by deleting the word "propeller" between the words "the" and "speed" and inserting in lieu thereof the word "engine".

27. By amending § 4b.417 (a) (1) to read as follows:

4b.417 Fuel system hot weather operation.

(a) * * *

(1) For reciprocating-engine-powered airplanes, all engines shall operate at maximum continuous power, except that take-off power shall be used for the altitude range extending from 1,000 feet below the critical altitude through the critical altitude. The time interval during which take-off power is used shall not be less than the take-off time limitation. For turbine-engine-powered airplanes, all engines shall operate at take-off power for the time interval selected by the applicant in demonstrating the take-off flight path and thereafter shall operate at maximum continuous power for the duration of the climb.

28. By amending § 4b.418 (a) to read as follows:

4b.418 Flow between interconnected tanks.

(a) Where tank outlets are interconnected and permit flow through the interconnection due to gravity or flight accelerations, it shall not be possible for fuel to flow between tanks in quantities sufficient to cause an overflow of fuel from the tank vent with the tanks full when the airplane is operated as prescribed in § 4b.416 (b) except that weights greater than the landing weight shall be acceptable if necessary because of the fuel loading.

29. By amending § 4b.420 by deleting paragraph (e) and by redesignating paragraph (f) as paragraph (e).

30. By deleting §§ 4b.455 through 4b.457.

31. By amending § 4b.460 by adding a new paragraph (f) to read as follows:

4b.460 General. * * *

(f) For turbine-engine-powered airplanes, provisions shall be made to prevent hazardous quantities of fuel leakage or overflow from drains, vents, or other components of flammable fluid systems to enter the engine intake system.

32. By amending § 4b.480 (a) by adding a new subparagraph (6) to read as follows:

4b.480 Designated fire zones. * * *

(a) * * *

(6) Compressor and accessory sections of turbine engines.

33. By amending § 4b.481 (c) to read as follows:

4b.481 Flammable fluids. * * *

(c) If absorbent materials are located in proximity to flammable fluid system components which might be subject to leakage, such materials shall be covered or treated to prevent the absorption of hazardous quantities of fluids.

34. By amending the introductory paragraph of § 4b.483 to read as follows:

4b.483 Lines and fittings. All lines and fittings carrying flammable fluids or gases in designated fire zones or in the combustion, turbine, or tail pipe sections of turbine engines shall comply with the provisions of paragraphs (a) through (c) of this section.

35. By amending § 4b.484 (a) by adding a note at the end of subparagraph (1) to read as follows:

NOTE: Induction systems for reciprocating engines are considered to be located in a designated fire zone, and therefore subject to the fire extinguisher protection provisions unless tests or experience with the particular type of induction and carburetion systems shows that fuel burning in the induction system passages is not likely to occur.

36. By amending the introductory paragraph of § 4b.486 to read as follows:

4b.486 Fire walls. All engines, auxiliary power units, fuel-burning heaters, and other combustion equipment which are intended for operation in flight as well as the combustion, turbine, and tail pipe sections of turbine engines shall be isolated from the remainder of the airplane by means of fire walls, shrouds, or other equivalent means. The following shall apply:

37. By amending § 4b.487 (e) by deleting the first sentence and inserting in lieu thereof the following: "The airplane shall be so designed and constructed that, in the event of fire originating in the engine power or accessory sections, the probability is extremely remote for fire to enter either through openings or by burning through external skin into any other zone of the nacelle where such fire could create additional hazards."

38. By amending § 4b.488 to read as follows:

4b.488 Engine accessory section diaphragm. Unless equivalent protection can be shown by other means, a diaphragm shall be provided on air-cooled engines to isolate the engine power section and all portions of the exhaust system from the engine accessory compartment and on turbine engines to isolate the combustion, turbine, and tail pipe sections from the compressor and the accessory sections. This diaphragm shall comply with the provisions of § 4b.486.

39. By amending § 4b.489 (a) to read as follows:

4b.489 Drainage and ventilation of fire zones.

(a) Complete drainage of all portions of designated fire zones shall be provided to minimise the hazards resulting from failure or malfunctioning of components containing flammable fluids. The drainage provisions shall be effective under conditions expected to prevail when drainage is needed and shall be so arranged that the discharged fluid will not cause an additional fire hazard.

40. By amending § 4b.490 by redesignating the introductory paragraph as paragraph (a) and by adding a new paragraph (b) to read as follows:

4b.490 Protection of other airplane components against fire. * * *

(b) Consideration shall be given to the effect on adjacent parts of the airplane of heat within designated fire zones and within the combustion, turbine, and tail pipe sections of turbine engines.

41. By amending § 4b.610 by adding a note at the end of the section to read as follows:

NOTE: It may be necessary to duplicate certain instruments at two or more crew stations to meet the instrument visibility requirements prescribed in § 4b.611, or when required by the operating rules of the Civil Air Regulations for reliability or cross-check purposes in particular types of operations. In the latter case, independent operating systems would be required in accordance with the provisions of § 4b.612 (f).

42. By amending § 4b.612 (d) (1) to read as follows:

4b.612 Flight and navigational instruments. * * *

(d) Automatic pilot system. * * *

(1) The system shall be so designed that the automatic pilot can be either quickly and positively disengaged by the human pilots to prevent it from interfering with their control of the airplane, or be overpowered by one human pilot to enable him to control the airplane.

43. By amending § 4b.612 (d) (3) by changing the word "pilot" to "pilots".

44. By amending § 4b.612 (f) by deleting the first sentence and inserting in lieu thereof the following: "If duplicate flight instruments are required by the operating parts of the Civil Air Regulations (see note under § 4b.610), the operating system for a duplicate instrument shall be completely independent of the operating system for the duplicated instrument."

45. By amending § 4b.632 (e) (1) and (2) to read as follows:

4b.632 Position light system installation. * * *

(e) Flasher. * * *

(1) The flashing frequency shall not be less than 65 and not more than 85 flashes per minute.

(2) The flashing sequence of position lights shall conform to either one of the following:

(i) The forward position lights and fuselage lights flashing simultaneously at the rate specified in subparagraph (1) of this paragraph, with the rear red position light flashing simultaneously with one flash of the forward position and fuselage lights and the rear white position light flashing simultaneously with the next flash of the forward position and fuselage lights, or

(ii) The forward position lights and fuselage lights flashing alternately at the rate specified in subparagraph (1) of this paragraph, with the rear white position light flashing simultaneously with the forward position lights and the rear red position light flashing simultaneously with the fuselage lights.

46. By amending § 4b.634 (b) (3) to read as follows:

4b.634 Position light distribution and intensities. * * *

(b) Forward and rear position lights. * * *

(3) Overlaps between adjacent signals. The intensities in overlaps between adjacent signals shall not exceed the values given in Figure 4b-20, except that higher intensities in the overlaps shall be acceptable with the use of main beam intensities substantially greater than the minima specified in Figures 4b-18 and 4b-19 if the overlap intensities in relation to the main beam intensities are such as not to affect adversely signal clarity.

47. By amending the note under Figure 4b-20 to read as follows:

NOTE: Area A includes all directions in the adjacent dihedral angle which pass through the light source and which intersect the common boundary plane at more than 10 degrees but less than 20 degrees. Area B includes all directions in the adjacent dihedral angle which pass through the light source and which intersect the common boundary plane at more than 20 degrees.

48. By amending § 4b.640 to read as follows:

4b.640 Ice protection. Compliance with this section is optional. The requirements of this section are intended to provide for safe flight in icing conditions. When compliance is shown with the provisions of this section, the type certificate shall include certification to that effect. When an airplane is certificated to include ice protection provisions, the recommended procedures for the use of the ice protection equipment shall be set forth in the Airplane Flight Manual (see 4b.742 (a)). It shall be shown, as prescribed in paragraphs (a) and (b) of this section, that the airplane is capable of operating safely in continuous maximum and intermittent maximum icing conditions as defined in §§ 4b.1 (b) (7) and 4b.1 (b) (8).

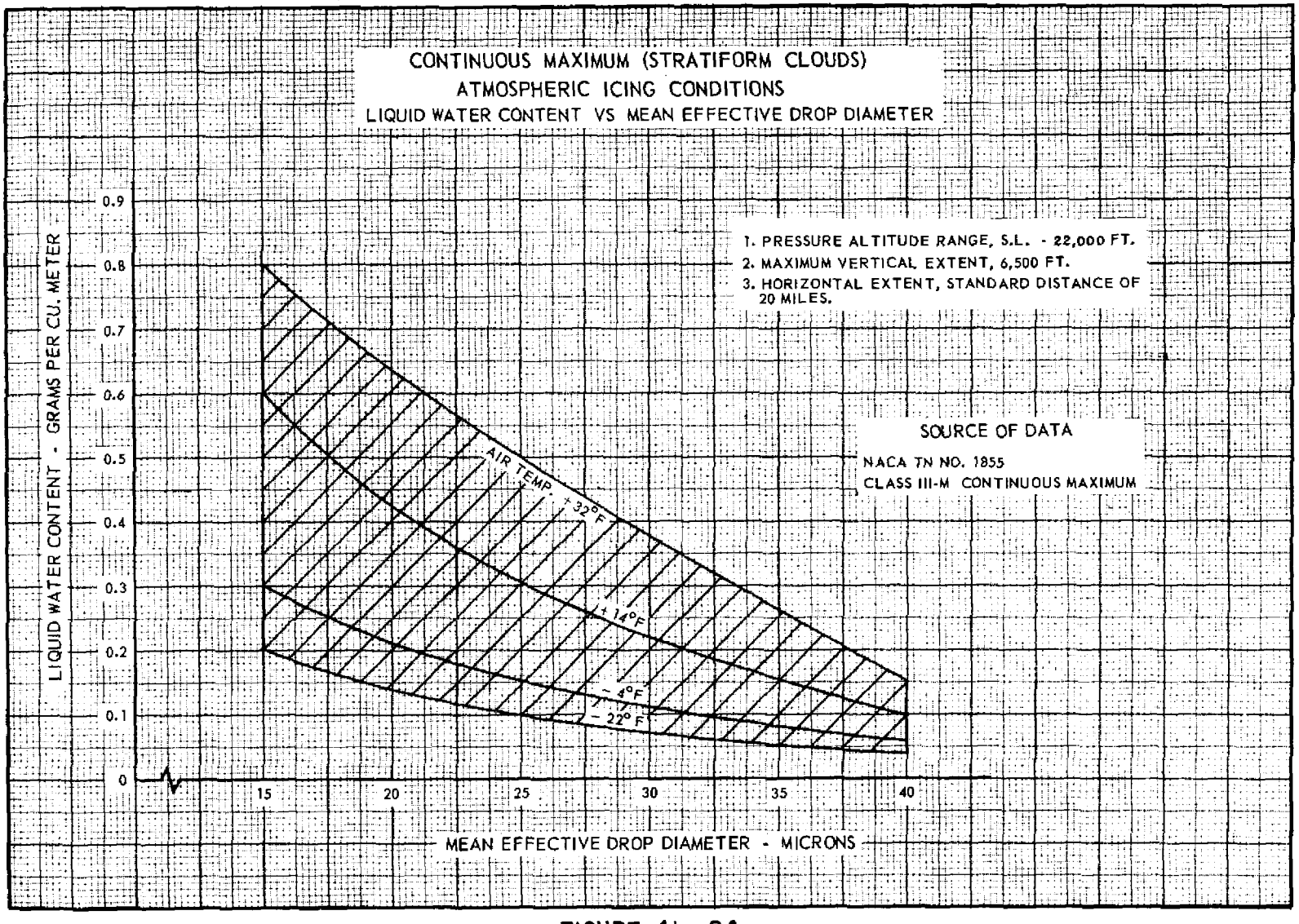

FIGURE 4b-24o

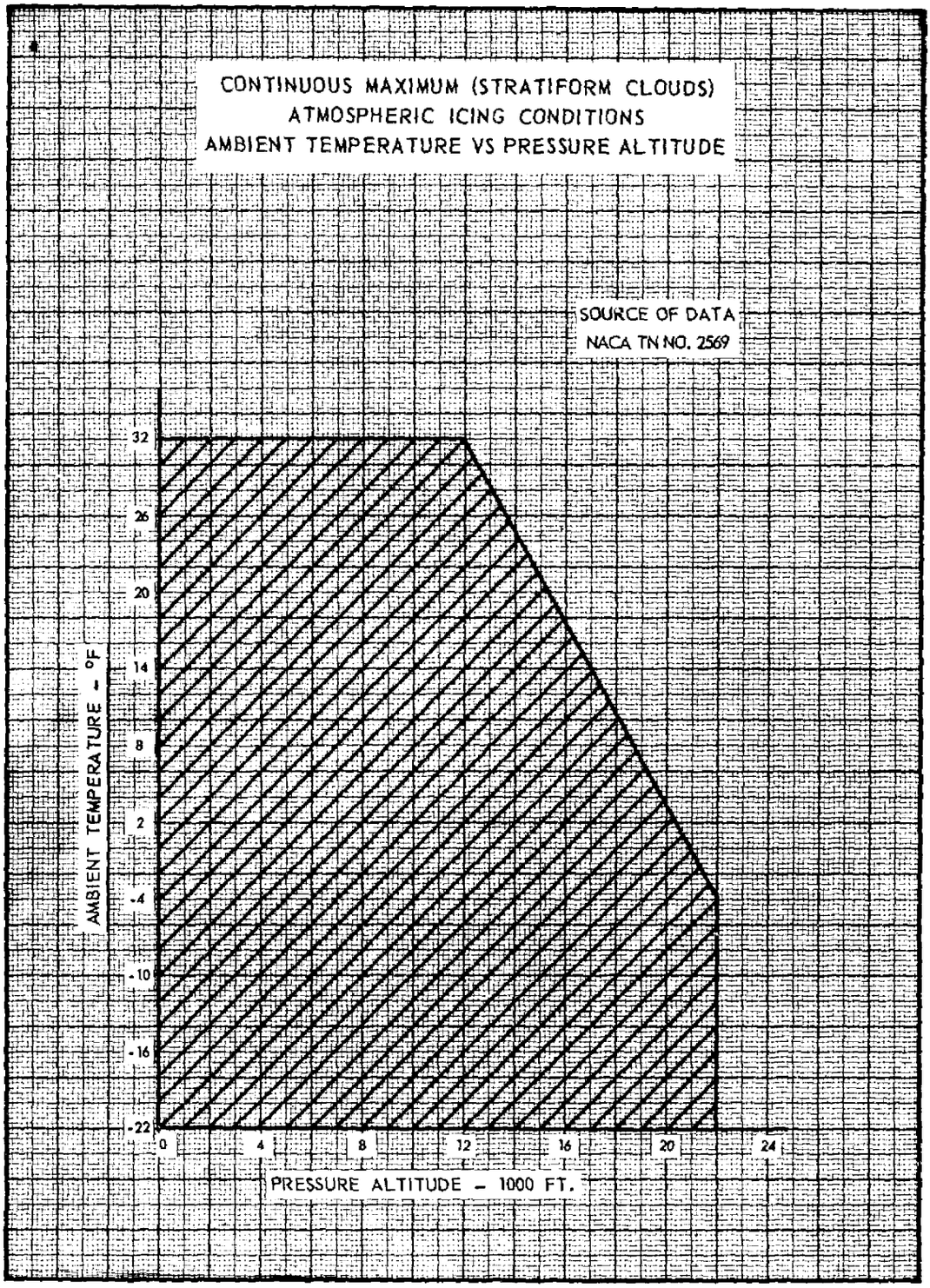

FIGURE 4b-24 b

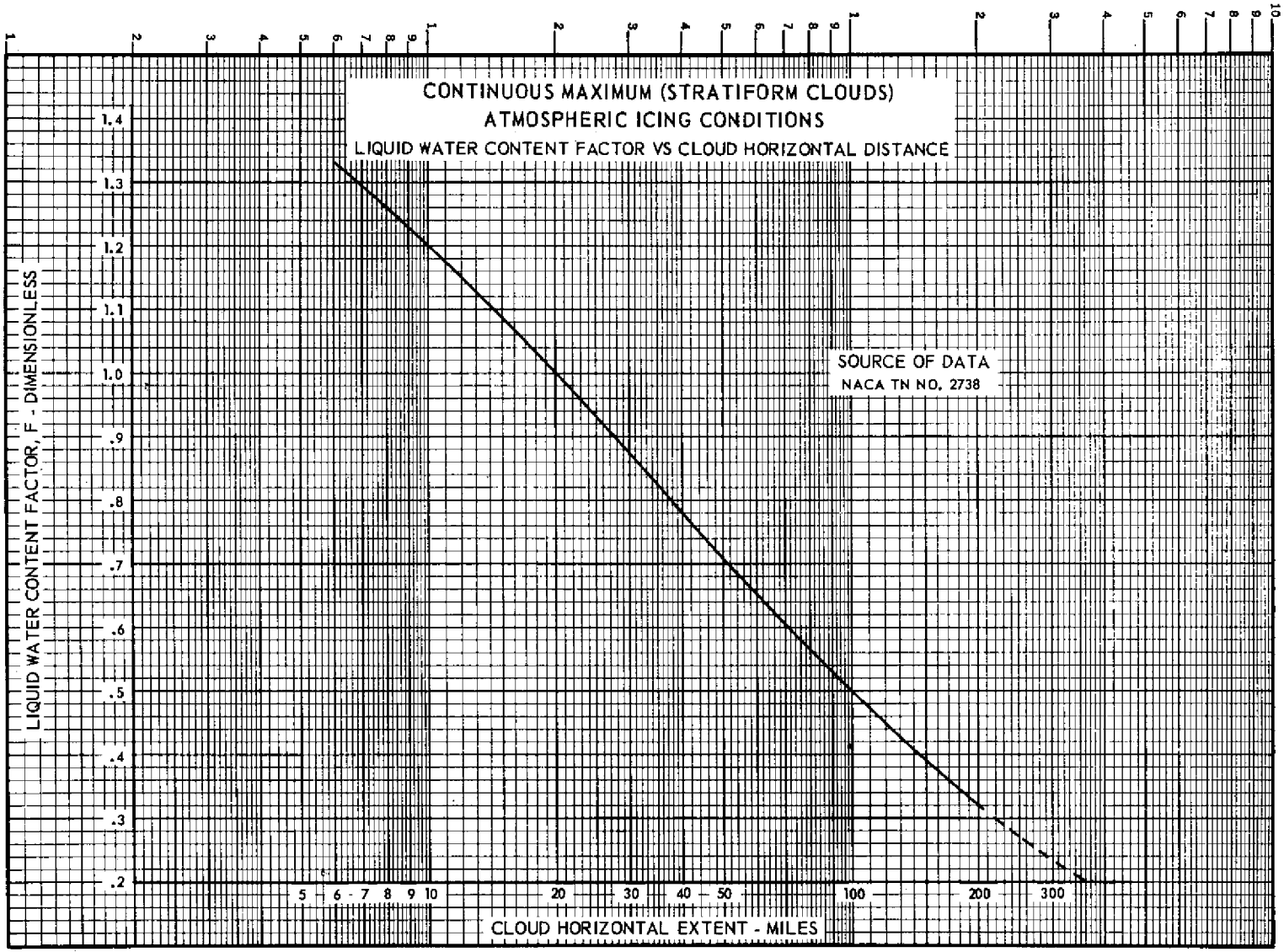

FIGURE 4b-24c

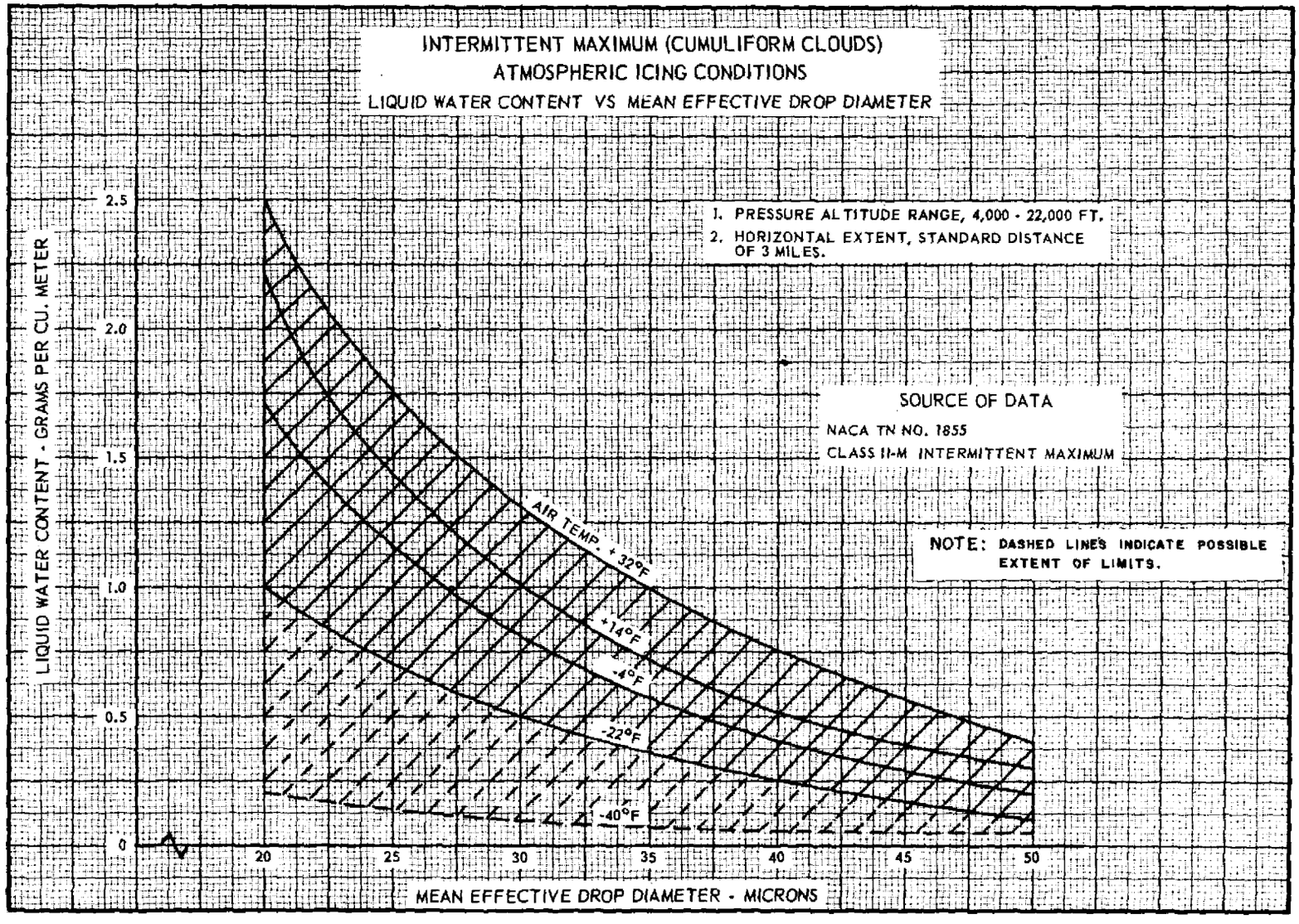

FIGURE 4b-25a

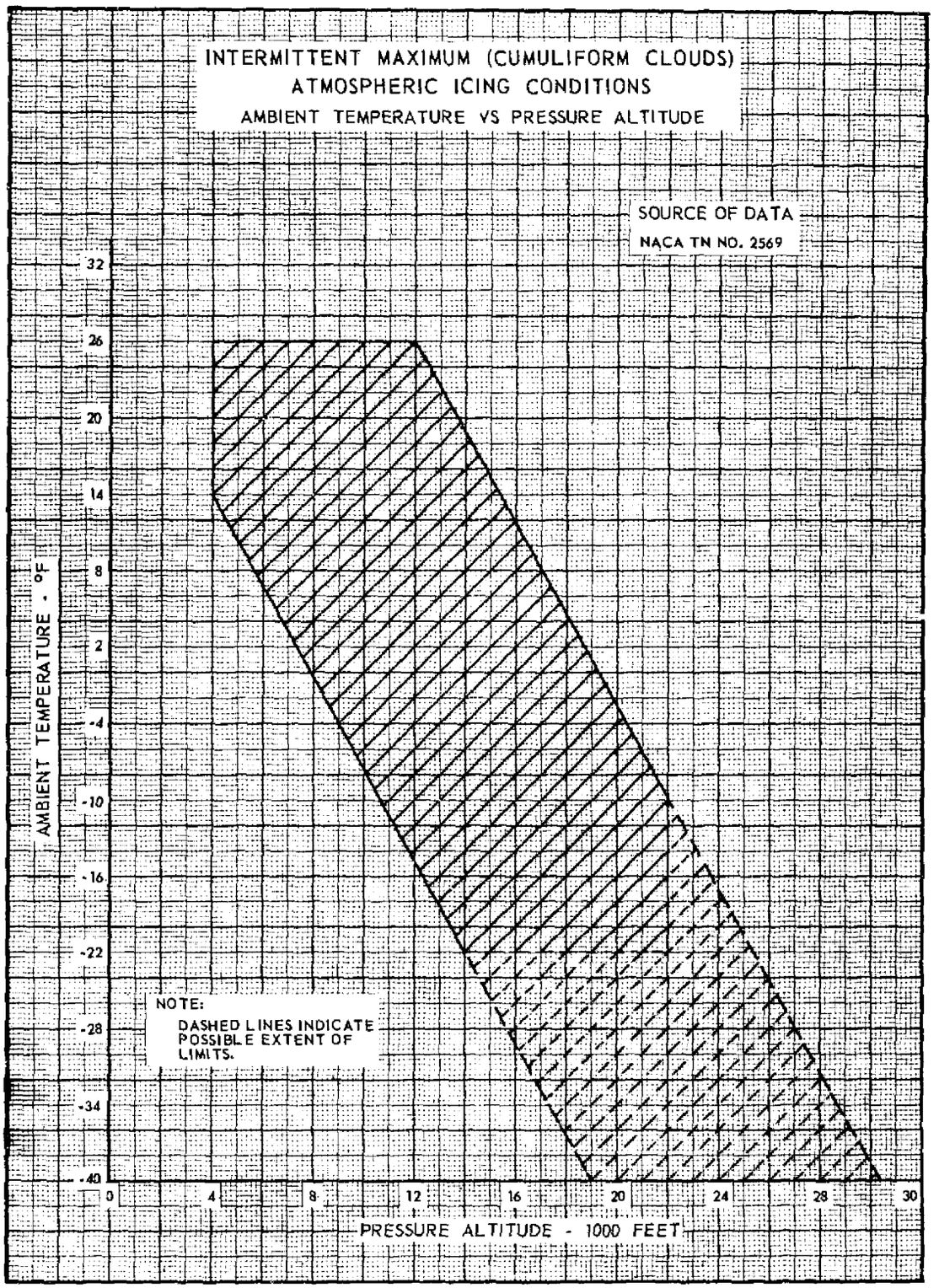

FIGURE 4b-25b

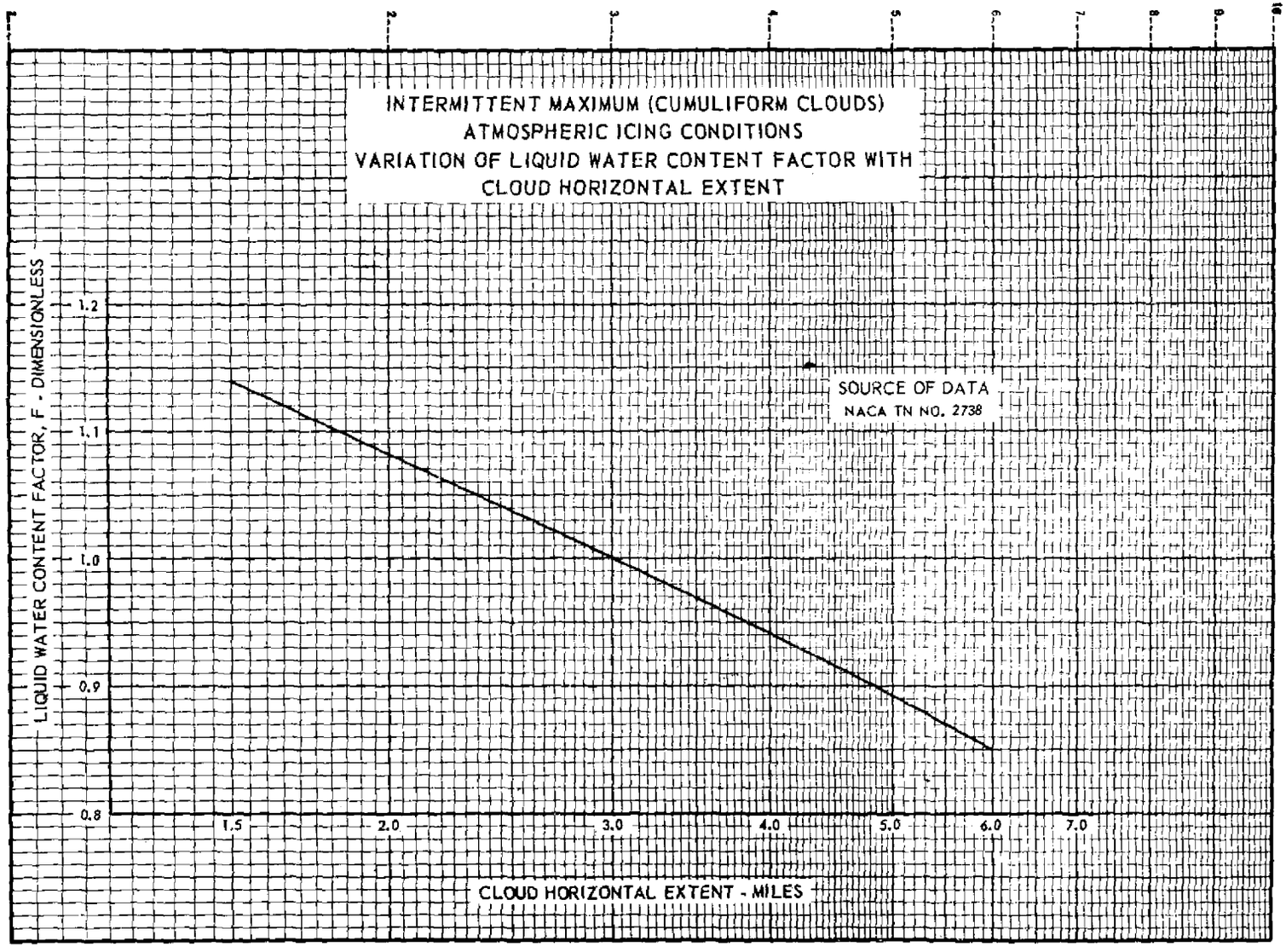

FIGURE 4b-25c

(a) An analysis shall be performed to establish, on the basis of the airplane's operational needs, the adequacy of the ice protection system for the various components of the airplane.

(b) In addition to the analysis and physical evaluation prescribed in paragraph (a) of this section, the effectiveness of the ice protection system and its components shall be shown by one or more of the following means:

(1) Laboratory dry air and/or simulated icing tests of the actual components or models thereof.

(2) Flight dry air tests of the ice protection system as a whole, or of its components individually.

(3) Flight tests of the airplane or its components in measured simulated icing conditions.

(4) Flight tests of the airplane in measured natural atmospheric icing conditions.

NOTE: For turbine-powered airplanes, the ice protection provisions of this section are considered to be primarily applicable to the airframe, including engine inlet duct lips and surfaces. For the powerplant installation, certain additional provisions of Subpart E of this Part may be found applicable.

49. By amending § 4b.643 by deleting from the last sentence the words "specified in § 4b.260 (a)" and inserting in lieu thereof the words "equal to those specified in § 4b.260 (a) multiplied by a factor of 1.33".

50. By amending § 4b.712 by adding a new paragraph (c) to read as follows:

4b.712 Normal operating limit speed, V_{NO}. * * *

(c) At altitudes where V_{NE} is limited by compressibility, a spread between V_{NO} and V_{NE} shall not be required; i.e., M_{NO} equal to the lesser of M_{NE} or M_C shall be acceptable.

51. By amending § 4b.732 by deleting the first sentence of the introductory paragraph and inserting in lieu thereof the following: "The following markings shall be placed on the air-speed indicator in terms of IAS."

52. By amending § 4b.740 (a) to read as follows:

4b.740 General.

(a) An Airplane Flight Manual shall be prepared by the applicant for the type certificate and shall be furnished with each airplane except with those airplanes which specifically are not required by the operating parts of the Civil Air Regulations to carry such manual.

(Sec. 205 (a), 52 Stat. 984; 49 U.S.C. 425 (a). Interpret or apply secs. 601, 603, 52 Stat. 1007, 1009, as amended; 49 U.S.C. 551, 553)

By the Civil Aeronautics Board:

/s/ M. C. Mulligan

M. C. Mulligan
Secretary

(SEAL)

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