CIVIL AERONAUTICS BOARD
BUREAU OF SAFETY
WASHINGTON, D. C.

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March 27, 1958

CIVIL AIR REGULATIONS DRAFT RELEASE NO. 58-7

SUBJECT: Supplementary Oxygen Requirements

The Bureau of Safety has under consideration amendments to Parts ~~40, 40~~, 41, and ~~42~~ of the Civil Air Regulations. The reasons therefor are set forth in the explanatory statement of the attached proposal which is being published in the Federal Register as a notice of proposed rule making concurrently with the issuance of this draft release.

The Bureau desires that all persons who will be affected by the requirements of this proposal be fully informed as to its effect upon them and is therefore circulating copies in order to afford interested persons ample opportunity to submit to the Bureau such comments as they may desire.

Because of the large number of comments which we anticipate receiving in response to this draft release, we will be unable to acknowledge receipt of each reply. However, you may be assured that all comment will be given careful consideration.

It should be noted that comments must be submitted in duplicate and in order to insure consideration must be received by the Bureau not later than May 5, 1958.

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CIVIL AERONAUTICS BOARD

[14 CFR Parts 4b, 40, 41, 427]

SUPPLEMENTARY OXYGEN REQUIREMENTS

NOTICE OF PROPOSED RULE MAKING

Pursuant to authority delegated by the Civil Aeronautics Board to the Bureau of Safety, notice is hereby given that the Bureau will propose to the Board the adoption of amendments to Parts 4b, 40, 41, and 42 of the Civil Air Regulations as hereinafter set forth.

Interested persons may participate in the making of the proposed rules by submitting such written data, views, or arguments as they may desire. Communications should be submitted in duplicate to the Civil Aeronautics Board, attention Bureau of Safety, Washington 25, D. C. In order to insure their consideration by the Board before taking further action on the proposed rules, communications must be received by May 5, 1958. Copies of such communications will be available after May 7, 1958, for examination by interested persons at the Docket Section of the Board, Room 5412, Department of Commerce Building, Washington, D. C.

Heretofore the supplemental oxygen requirements for transport category airplanes have been based primarily upon the needs of airplanes certificated for operations at altitudes at or below 25,000 feet. Current requirements have proved to be satisfactory for operations within this limit; however, deficiencies appear when the existing provisions are retained to meet the needs of higher altitudes. To

overcome these deficiencies, revisions to Part 4b of the Civil Air Regulations are being proposed, and revisions of the appropriate sections of Parts 40, 41, and 42 are being proposed to maintain consistency with the airworthiness requirements and for clarification.

The advent of turbine-powered airplanes which operate at higher altitudes than airplanes powered by reciprocating engines requires that some changes be made in the supplementary oxygen requirements for airplanes utilizing these higher altitudes. Flight at these higher altitudes increases the severity of the problems which are associated with the use of supplemental oxygen. Because of the operational demands of turbine engines, flight altitudes as high as 40,000 feet and above must be anticipated. Cabin depressurization at these altitudes would rapidly affect all occupants of the airplane and require that immediate aid in the form of adequate supplemental oxygen be available to avoid high casualty rates. In addition to the immediate oxygen problems associated with depressurization, these airplanes are further faced with the possibility of being forced by fuel consumption factors to continue flight at altitudes that would require supplemental oxygen to be furnished all occupants.

In the event of cabin depressurization at altitudes above 25,000 feet, the urgent need for supplemental oxygen would require that it be furnished to all occupants during the descent to a habitable environment. This oxygen dispensing equipment must be readily available and of a type which can be utilized by the occupants without delay. The oxygen flow rate provided by this equipment must be adequate to insure that adverse physiological reaction to low atmospheric pressures is not significant.

Fuel consumption factors often require operations for an extended period of time at an altitude requiring supplemental oxygen and thereby necessitating that a large quantity of oxygen be carried aboard the airplane. The oxygen flow rate now prescribed by Figure 4b-21 of Part 4b has been found to be greater than necessary for these conditions. The new oxygen flow rate prescribed by this proposed amendment is generally agreed to be adequate and is defined in terms that specify the oxygen pressure as delivered at the point of usage rather than the pressure when delivered from the system. Since this requirement is for sustained flight at an altitude where oxygen is required, it will be applicable to all airplanes flying at cabin pressure altitudes greater than 10,000 feet.

During normal flight or following depressurization, some passengers may suffer varying degrees of disability which will require undiluted oxygen for first-aid purposes. For this contingency, a requirement for a quantity of first-aid oxygen is contained in this proposal.

A requirement for a positive visual and aural alarm indicating the need for supplemental oxygen by the occupants of the airplane is proposed because of the necessity for the immediate use of oxygen following depressurization at high altitudes.

It is essential that the flight crew be alert, mentally efficient, and in good physical condition at all times. To insure this, a greater amount of oxygen than that necessary for passengers is required. In the event of unexpected cabin depressurization at altitudes above 25,000 feet, there is a real danger that neither the pilot nor the copilot would be able to use his oxygen equipment within a safe period of time unless at least one of them wears his oxygen mask at all times when

flying at such altitudes. A requirement is, therefore, proposed which would require that one flight crew member at the controls of the airplane wear an oxygen mask at all times or have one immediately available when flight is conducted above 25,000 feet.

The flight attendants, in the course of their normal duties, may be at any place in the cabin at the time of depressurization. Since at altitudes above 25,000 feet sufficient time may not be available for them to return to a designated oxygen station, it is necessary that either a portable oxygen supply be carried by each attendant or that sufficient additional outlets and units of dispensing equipment be available throughout the cabin to insure that it will be attainable at all times. In view of the fact that turbine-powered airplanes will probably be required to continue operations at flight altitudes requiring supplemental oxygen, it will be necessary to provide portable oxygen equipment for the cabin attendants in order to insure mobility of these attendants so that they may give assistance to passengers as needed even though portable oxygen equipment is not required to satisfy the emergency descent provisions.

Since it is possible that an adult and a child might be in a lavatory at the time of a depressurization, a requirement that two units of oxygen dispensing equipment be provided in each lavatory is included in these proposed amendments.

In view of the foregoing, notice is hereby given that the Bureau proposes to recommend to the Board that Parts 4b, 40, 41, and 42 of the Civil Air Regulations be amended:

1. By amending § 4b.375 (f) of Part 4b to read as follows:

4b.375 Pressure control. * * *

(f) Visual and aural warning devices shall be provided to indicate when the safe limits of cabin pressure differential, absolute cabin pressure, and rate of change of absolute pressure are exceeded. These visual and aural warning devices and the instruments required by § 4b.375 (e) shall be located in a group at the pilot or flight engineer station.

2. By deleting figure 4b-21.

3. By amending § 4b.651 (a), (b), (d), and (e) to read as follows:

4b.651 Oxygen equipment and supply. * * *

(a) General. The oxygen system installed shall be free from hazards in itself, in its method of operation, and in its effect upon other components of the airplane. Means shall be provided to enable the crew to determine the quantity of oxygen available in each source of supply. These indicators shall be located in the same group as or adjacent to the instruments required by § 4b.375 (e) and (f).

(b) Required minimum mass flow of supplemental oxygen. The minimum mass flow of supplemental oxygen required per person at various cabin pressure altitudes shall be that necessary to comply with the following requirements as applicable:

(1) Where continuous flow equipment is used by flight crew members in an aircraft certificated to operate at flight altitudes not exceeding 25,000 feet, the minimum mass flow of supplemental oxygen required for each crew member shall not be less than that which

will maintain a tracheal oxygen partial pressure of 149 mm Hg. when breathing 15 liters per minute, BTPS, and having a maximum tidal volume of 700 cc. with a constant time interval between respirations.

(2) Where demand equipment is used by flight crew members in an aircraft certificated to operate at flight altitudes not exceeding 40,000 feet, the minimum mass flow of supplemental oxygen required for each crew member shall be not less than that which will maintain a tracheal oxygen partial pressure of 122 mm Hg. to and including a flight altitude of 35,000 feet and 95 percent oxygen between flight altitudes of 35,000 and 40,000 feet, when breathing 20 liters per minute, BTPS.

(3) Where continuous flow equipment is used by the passengers and cabin attendants, the minimum mass flow of supplemental oxygen required for each person at various cabin pressure altitudes shall be not less than that which will maintain the following tracheal oxygen partial pressures when using the oxygen equipment provided including masks:

(i) A tracheal oxygen partial pressure of 100 mm Hg. when breathing 15 liters per minute, BTPS, and having a tidal volume of 700 cc. with a constant time interval between respirations.

(ii) At flight altitudes not exceeding 25,000 feet, a tracheal oxygen partial pressure of 83.8 mm Hg. when breathing 30 liters per minute, BTPS, and having a tidal volume of 1100 cc. with a constant time interval between respirations.

(iii) Above flight altitudes of 25,000 feet but not exceeding 32,000 feet, a tracheal oxygen partial pressure of 149 mm Hg.

and above flight altitudes of 32,000 feet but not exceeding 40,000 feet 95 percent oxygen when breathing 30 liters per minute, BTPS and having a tidal volume of 1100 cc. with a constant time interval between respirations.

* * *

(d) Equipment standards for dispensing units. Where oxygen dispensing units are required, they shall comply with the provisions of subparagraphs (1) through (3) of this paragraph.

(1) An individual dispensing unit shall be provided for each occupant for whom supplemental oxygen is required to be furnished. All units shall be designed to cover the nose and mouth. (For crew masks to be used for protective breathing purposes, see paragraph (h) of this section.)

(2) In airplanes certificated to operate at flight altitudes not exceeding 25,000 feet, there shall be available to and within reach of each flight crew member an oxygen supply terminal and unit of oxygen dispensing equipment to provide for the immediate use of oxygen by such crew member. For all other occupants the supply terminals and dispensing equipment shall be located so as to provide for a timely use of oxygen as required by the operating rules.

(3) In airplanes certificated to operate above 25,000 feet flight altitude, the provisions of subdivisions (i) through (iii) of this subparagraph shall apply:

(i) An oxygen dispensing unit shall be immediately and automatically available to each occupant wherever seated;

(ii) Not less than two outlets and units of dispensing equipment shall be located in each lavatory; and

(iii) Portable oxygen equipment shall be available for each cabin attendant.

(e) Means for determining use of oxygen. Means shall be provided to enable the crew to determine whether oxygen is being delivered to each user and to indicate whether the automatic presentation system functions properly. These indications shall be located in the same group as or adjacent to the instrumentation for the oxygen system and pressurization system required by §§ 4b.375 (f) and 4b.651 (a).

4. By amending § 40.202 of Part 40 to read as follows and by similarly amending §§ 41.24 of Part 41 and 42.26 of Part 42:

40.202 Supplemental oxygen for sustenance and first-aid. Sustaining and first-aid oxygen and dispensing equipment shall be furnished by the air carrier for use as set forth in this section. The amount of oxygen provided shall be at least that quantity which will be necessary to comply with paragraphs (a), (b), and (c) of this section. As used in the oxygen requirements hereinafter set forth, "cabin pressure altitude" shall mean the pressure altitude corresponding with the pressure in the cabin of the airplane, and "flight altitude" shall mean the altitude above sea level at which the airplane is operated; for airplanes not equipped with pressurized cabins, "cabin pressure altitude" and "flight altitude" shall be considered identical. The amount of sustaining and first-aid oxygen required for a particular operation to comply with the rules in this part shall be determined on the basis of cabin pressure altitudes and flight duration consistent

with the operating procedures established for each such operation and route. The requirements for airplanes with pressurized cabins shall be determined on the basis of cabin pressure altitude and the assumption that a cabin pressurization failure will occur at a time during flight which is most critical from the standpoint of oxygen need, and that after such failure the airplane will descend without exceeding its operating limitations to a flight altitude that will permit successful termination of the flight. Following such failure the cabin pressure altitude shall be the same as flight altitude.

(a) Crew members. It shall be shown that a supply of oxygen for crew members is provided in accordance with the following requirements:

(1) At cabin pressure altitudes above 10,000 feet and not exceeding 12,000 feet, oxygen shall be provided for and used by each member of the flight crew on flight deck duty and provided for all other crew members during the portion of the flight in excess of 30 minutes within this range of altitudes.

(2) At cabin pressure altitudes above 12,000 feet, oxygen shall be provided for and used by each member of the flight crew on flight deck duty and provided for all other crew members during the entire flight at such altitudes.

(b) Passengers. The air carrier shall show that a supply of oxygen for passenger safety is provided in accordance with the following requirements:

(1) For flights at cabin pressure altitudes above 10,000 feet but not exceeding 14,000 feet, a supply of oxygen shall be provided for the duration of flight in excess of 30 minutes to 10 percent of the number of passengers carried.

(2) For flights at cabin pressure altitudes above 14,000 feet but not exceeding 15,000 feet, a supply of oxygen shall be provided for the duration of flight at such altitude to 30 percent of the number of passengers carried.

(3) For flights at cabin pressure altitudes above 15,000 feet, a supply of oxygen shall be provided for each occupant carried for the duration of flight at such altitude.

(4) For first-aid treatment of occupants who for physiological reasons might require undiluted oxygen, a supply of oxygen shall be provided to furnish 95 percent oxygen for the duration of flight at cabin pressure altitudes above 8,000 feet to 2 percent of the occupants on flights of 4 hours or less, or to 4 percent of the occupants on flights of more than 4 hours, but in no case to less than 2 persons. An appropriate number of dispensing units shall be provided.

5. By amending § 40.203 to read as follows and by similarly amending §§ 41.24a and 42.27:

40.203 Supplemental oxygen for emergency descent of pressurized cabin airplanes. When operating pressurized cabin airplanes, the air carrier shall furnish oxygen and dispensing equipment necessary to permit compliance with the requirements set forth in this section in the event of cabin pressurization failure.

(a) Crew members. When operating at flight altitudes above 10,000 feet, oxygen shall be provided to permit compliance with § 40.202 except that not less than a 2-hour supply shall be provided for the flight crew members on flight deck duty. The oxygen required by § 40.205 may be included in determining the supply required for flight crew members on flight deck duty in the event of cabin pressurization failure.

(b) Use of oxygen mask by pilot. One pilot at the controls of the airplane shall wear and use an oxygen mask at all times when operating at flight altitudes above 25,000 feet unless it can be shown that the oxygen mask although not in use can be worn by the pilot in a manner that will permit it to be placed on his face in position for use and properly secured and sealed with the use of one hand only, that control of the airplane can easily be maintained while positioning the mask, and that no probable circumstance leading to the loss of cabin pressure will result in the loss of the oxygen mask or its function.

(c) Use of portable oxygen equipment by cabin attendants. Portable oxygen equipment shall be carried by each attendant during the entire time flight is conducted above 25,000 feet unless it is shown that sufficient spare outlets and masks are distributed throughout the cabin to insuro immediate availability of oxygen to the cabin attendants regardless of their location at the time of cabin depressurization.

(d) Passenger cabin occupants. When operating at flight altitudes above 10,000 feet, the following supply of oxygen shall be provided for the use of passenger cabin occupants:

(1) When an airplane is certificated to operate at flight altitudes not exceeding 25,000 feet, oxygen shall be provided for 30 minutes to 10 percent of the number of passenger cabin occupants carried if at any point along the route to be flown the airplane can descend safely to a flight altitude of 14,000 feet or less within 4 minutes.

(2) When an airplane is operated at flight altitudes not exceeding 25,000 feet and cannot descend safely to 14,000 feet within 4 minutes, and when an airplane is operated at flight altitudes above 25,000 feet, oxygen shall be provided for 10 percent of the number of passenger cabin occupants carried for the duration of flight at cabin pressure altitudes above 10,000 feet but not exceeding 14,000 feet and, as applicable, to permit compliance with § 40.202 (b) (2), and (3), except that not less than a 10-minute supply for all passenger cabin occupants shall be provided.

(e) Passenger briefing. Before flight is conducted above 25,000 feet, a crew member shall give the passengers instructions regarding the location and operation of the oxygen dispensing equipment and the necessity of using oxygen in the event of cabin depressurization.

6. By amending § 40.204 by adding "and § 40.203" after the reference "§ 40.202", and by changing "July 20, 1950" to the effective date of the latest amendments applicable to § 4b.651; and by similarly amending §§ 41.24b and 42.28.

These amendments are proposed under the authority of Title VI of the Civil Aeronautics Act of 1938, as amended, and may be changed in the light of comments received in response to this notice of proposed rule making.

(Sec. 205 (a), 52 Stat. 984; 49 U.S.C. 425. Interpret or apply secs. 601-610, 52 Stat. 1007-1012, as amended; 49 U.S.C. 551-560)

Dated at Washington, D. C., March 27, 1958.

By the Bureau of Safety:

/s/ Oscar Bakke

Oscar Bakke
Director

(SEAL)