F.I.E.

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ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

SUBJECT: USE OF OXYGEN BY GENERAL AVIATION PILOTS/PASSENGERS

1. PURPOSE. This circular provides general aviation personnel with information concerning the use of oxygen.

2. CANCELLATION. Advisory Circular 91-8 dated 16 May 1965, is cancelled.

3. REFERENCES. Federal Aviation Regulation Part 135 contains oxygen requirements pertaining to air taxi and commercial operations of small aircraft. FAR Part 121 contains oxygen requirements for all air carrier operations and commercial operators of large aircraft.
* FAR Part 91 contains oxygen requirements for general aviation pilots and passengers. The Federal Aviation Administration publications: Aviation Medical Handbook for Pilots (still in preparation and not yet avialable); the FAA Office of Aviation Medicine Report, AM 66-28, Oxygen in General Aviation; the FAA Flight Instructor's Handbook, AC 61-16; and the FAA Airman's Information Manual provide further detailed information regarding the use of oxygen in general aviation aircraft. *

4. BACKGROUND. In recent years general aviation aircraft and equipment suitable for operation at the higher altitudes have become more prevalent. Slow or rapid decompression is a possibility in all pressurized aircraft. There are indications that a lack of knowledge exists concerning the use of oxygen and oxygen equipment. Accordingly, there are certain considerations that are appropriate to discuss when flight at an altitude of 12,500 feet or above is contemplated.

5. DISCUSSION.

   a. Aviation physiology encompasses several critical aspects including atmospheric pressure, temperature and other environmental characteristics. To avoid a publication of considerable length, we will confine this discussion to problems associated with atmospheric (or barometric) pressures.

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b. The air we breathe contains approximately 21 percent oxygen and 78 percent nitrogen. This relative percentage is present up to approximately 70,000 feet. At sea level, an air pressure of 760 millimeters of mercury (14.7 p.s.i. or one atmosphere) exists. As altitude increases, the pressure of the atmosphere decreases. The partial pressure exerted by the oxygen on the pilots lung/blood is the important factor in flights at altitude, since the molecular concentration of oxygen in the breathed air determines the availability of gas to the body.

c. With normal respiration at sea level the partial pressure of oxygen in the air is higher than it is in the blood; therefore, the atmospheric oxygen diffuses from the lungs into the bloodstream. When the partial pressure of oxygen lowers as it does at the higher altitudes, less oxygen passes into the blood and the tissues of the body receive insufficient oxygen. Consequently, the brain stimulates the breathing depth and rate.

d. As the partial pressure of oxygen decreases in the atmosphere, there is a decrease in the amount of oxygen absorbed into the bloodstream during respiration. When this amount decreases to such a level that it results in a 90 percent oxygen saturation of arterial blood, there is a definite lack of oxygen in the tissues of the body. Oxygen saturation levels of 90 percent or lower result in the body under normal conditions when flying at altitudes of 12,500 feet or above, especially in flights where greater physical or mental exercise is necessary. When a blood oxygen saturation level of 90 percent or less is present, a state of hypoxia, a term meaning deficiency of oxygen in the body, develops.

e. Hypoxia has an insidious beginning. Most pilots who are trained to understand the subjective effects of hypoxia will notice that fatigue, sleepiness, or headaches develop at an early stage. As symptoms progress, breathlessness and an abnormal feeling of well-being appear. Further effects on vision, mental processes, personality traits and body motor functions progressively occur. Occasionally there are no subjective considerations up to the time of unconsciousness. Additional knowledge about these effects can be obtained by a careful study of the documents referenced in paragraph 3.

f. There is a wide, individual variation in the susceptibility to hypoxia. All persons begin to deteriorate in alertness and mental efficiency when exposed for more than 30 minutes at altitudes between 12,500 and 14,000 feet without supplemental oxygen. As one ascends above 14,000 feet, distinct impairment of mental functions occurs. This is especially true of mathematical and reasoning capabilities.

6. SUGGESTIONS.

a. The Federal Aviation Administration offers a one-day training course

for pilots concerning oxygen, hypoxia, and the appropriate use of oxygen equipment. This training is available in certain locations throughout the United States. It is suggested that interested pilots take advantage of this training. Additional information regarding this course may be obtained by writing to the Chief, Civil Aeromedical Institute, Attention: Aeromedical Education Branch, Aeronautical Center, P.O. Box 25082, Oklahoma City, Oklahoma, 73125.

*b. When flying in general aviation aircraft with unpressurized cabins, at cabin pressure altitudes above 12,500 feet (MSL) up to and including 14,000 feet (MSL), it is required that the minimum flight crew be provided with and use supplemental oxygen for that part of the flight at those altitudes that is of more than 30 minutes duration. *

c. It is suggested that pilots of aircraft with pressurized cabins periodically include "training exercises" simulating decompression and the emergency use of oxygen equipment in the manner recommended by the aircraft or oxygen equipment manufacturer. Prior to high altitude operation of aircraft with pressurized cabins, it is further suggested that if passengers are to be carried, they should be given a briefing on the use of the emergency oxygen equipment. This briefing should include a demonstration of all the procedures to be followed if decompression is experienced at altitude.

d. Aviation oxygen equipment has been designed for use in general aviation aircraft. It is suggested that the procedures and limitations specified by the manufacturer for the use of oxygen and associated equipment be used. The recommended oxygen flow rates provided by the manufacturer serve as a baseline to provide more than 90 percent blood oxygen saturation, which is desirable at all times during flight.

e. EFFECTIVE OXYGEN PROCEDURES ARE ALWAYS PRACTICED BY SAFE PILOTS.

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