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U.S. AIR FORCE GUIDE SPECIFICATION

ENVIRONMENTAL CONTROL, AIRBORNE

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AIR FORCE GUIDE SPECIFICATION

ENVIRONMENTAL CONTROL, AIRBORNE

This specification is approved for use within Code 11, Department of the Air Force, and is available for use within the distribution limitations noted.

1. SCOPE

1.1 Scope. This specification establishes the basic performance characteristics and verification requirements for an Airborne Environmental Control System and its components. It covers the initial development of an Airborne Environmental Control System as well as subsequent modifications to the original system, and additional cooling systems retrofitted to an aircraft in order to support new aircraft systems not served by the original environmental control system in the aircraft.

1.2 Applicability. The requirements and verifications contained in this specification apply to environmental control equipment developed for USAF aircraft. Any blank or subparagraph marked "N/A" means the particular requirement is not applicable.

1.3 Use. This specification cannot be used for contractual purposes without supplemental information. The supplemental information relates to operational requirements of airborne environmental control systems. The need for this information is identified by blanks within this document. The rationale for requirements, configuration interfaces and constraints, component development requirements, and verification requirements are provided in appendix A.

1.4 Deviation. Any projected design for a given application which will result in improvement of system performance, reduced life cycle cost, or reduced development cost through deviation from this specification, or where the requirements of this specification result in compromise in operational capability, will be brought to the attention of the procuring activity for consideration of change. The burden of proof to substantiate deviations will rest with the contractor and will be evaluated by the procuring activity.

2. APPLICABLE DOCUMENTS

2.1 Government documents

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the *Department of Defense Index of Specifications and Standards* (*DoDISS*) and supplement thereto, cited in the solicitation (see 6.1).

(When this document is used in an acquisition, Government specifications, standards, and handbooks called out in the tailored specification should be listed below.)

SPECIFICATIONS

Federal

Military

30.6.2 Decompression above 50,000 ft breathing oxygen. Experimental human decompressions to altitudes of 50,000 to 55,000 ft have shown that loss of consciousness occurs after an average of 18 sec and that a continuous state of consciousness can be maintained only if oxygen breathing is commenced in less than 7 sec following decompression. Even when oxygen breathing is started immediately after decompression to 38,000 or 40,000 ft, a transient episode of hypoxia severe enough to impair the performance of the flyer temporarily may result. To avoid transient yet possibly severe episodes of hypoxia following sudden loss of cabin pressure, consider the flight altitude, the adequacy of protective oxygen equipment after decompression, and the oxygen concentration in breathing mixtures before decompression occurs. At cabin altitudes below 20,000 ft, provide oxygen concentrations which range from 38 percent at sea level to about 50 percent at 20,000 ft in breathing mixtures before decompression, followed immediately with pure oxygen after decompression to avoid significant levels of hypoxia at 40,000 ft. If cabin pressure failure during flights above 30,000 ft is a possibility, consider the proper choice of gaseous breathing mixtures for the aircrew during the normal portions of the flight before cabin pressure loss. After a decompression to altitudes above 30,000 ft, 100 percent oxygen with safety pressure must be breathed immediately, with pressure breathing required above 40,000 ft. A reliable pressure suit must be worn at altitudes between 43,000 and 50,000 ft if immediate descent to lower altitudes is not practical or possible, and for altitudes above 50,000 ft.

40. Physiological criteria for oxygen at cabin altitude below 10,000 ft. Several inflight situations may require oxygen availability and use by the aircrew at altitudes when classical altitude hypoxia is not usually considered a critical factor.

40.1 Night vision and hypoxia. Night vision is impaired at pressure altitudes between 5,000 and 10,000 ft. Dark adaptation to night vision is perhaps the most sensitive of the neurosensory functions to small decreases in the P_{O_2}. Significant decrements have been measured in unacclimated men at altitudes beginning at about 5,000 to 7,000 ft. Augmentation of oxygen in the breathing supply has been recommended from the ground up for night flying in high performance aircraft. The ability to dark adapt diminishes with increasing age (over 40). Older flyers can be increasingly affected in an additive manner by both the aging process and the hypoxia of altitude. Figure 27 shows the hypoxia decrease in night vision at altitudes above 5,000 ft when ambient air is breathed (bottom scale) and the reported decrease with age when air is breathed at sea level (top scale) in relation to the equivalent hypoxia altitude.

40.2 Carbon monoxide, hypoxia, and cabin air contamination. Small traces of carbon monoxide contamination in the cabin air, or even cigarette smoke, can result in a decrement in night vision (figure 27) with progressively higher concentrations of carbon monoxide leading to more generalized hypoxia symptoms, unconsciousness, and death. Data have shown the decrease in tissue oxygen associated with blood carbon monoxide (carbohemoglobin, HbCO) is the same as that caused by a similar decrease in arterial oxygen saturation (HbO_2) at high altitudes. For example, 5 percent HbCO saturation in arterial blood depresses visual sensitivity to as great an extent as hypoxia at 8,000 to 10,000 ft altitude for the unacclimated man. The combined effect of altitude, breathing air, and carbon monoxide has essentially the same physiologic effect as being at an altitude equivalent to the same combined decrease in arterial oxygen saturation. **Flight at 6,000 ft while air with 0.005 percent (50 PPM) carbon monoxide is breathed results in a physiologic equivalent altitude of about 12,000 ft.** Under these conditions, breathing 100 percent oxygen would improve the blood oxygen considerably and completely eliminate any inspired carbon monoxide. To avoid the possibility of breathing contaminated cockpit air caused, for example, by exhaust on the runways during taxiing and takeoffs, 100 percent oxygen should be breathed during the critical takeoff phase of the flight. **Also consider 100 percent oxygen for night landings and whenever there are indications of smoke or fumes in the cockpit.**