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AEROSPACE RECOMMENDED PRACTICE

ARP 292A

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AIR CONDITIONING, HELICOPTERS, GENERAL REQUIREMENTS FOR

1. PURPOSE:

1.1 The purpose of this recommended practice is to provide the aircraft industry with a standard to which helicopter air conditioning systems may be designed for civil aircraft.

1.2 The detailed recommendations are based on practical engineering requirements for the design, installation, and operation of heating and ventilating equipment used on helicopters.

2. SCOPE: These recommendations are written to cover the general requirements of helicopter air conditioning and are subdivided as follows:

2.1 Air Conditioning System: Dealing with the general design aspects.

2.2 Air Conditioning Equipment: Design requirements for satisfactory system function and performance.

2.3 Desirable Design Features: General information for use of those concerned in meeting requirements contained herein.

2.4 Winterization and Pre-heating.

3. AIR CONDITIONING SYSTEM:

3.1 Definition:

3.1.1 A helicopter air conditioning system should consist of at least the following:

a. A source of heat
b. A source of ventilating air
c. Distribution system
d. Exhaust system
e. Temperature control

3.1.2 The system may also include one or more of the following:

a. Cooling unit
b. Filters
   1) Dust
   2) Smoke
   3) Odor (or counter agents)
c. Recirculating fan
d. Dehumidifier
e. Humidifier
f. Cabin temperature indicator
g. Cabin humidity indicator

3.2 General Recommendations:

3.2.1 The design of the air conditioning system should be such as to preclude CO concentration in excess of 1 part in 20,000 or .005 of 1% under all operating conditions.

3.2.2 The air conditioning system should provide adequate ventilation for all flight and ground conditions.

3.2.3 The duct distribution system including the air inlets to the occupied space should be such as to provide for a minimum of temperature variation and should provide air movement in accordance with values hereinafter recommended, within the air conditioned space.

3.2.4 An adequate means should be provided for removal of exhaust air. Emergency provisions should be made to remove smoke or other contaminants resulting from equipment malfunction or fire.

3.2.5 A temperature control system, either manual or automatic, should be included which will provide a means for regulating the temperature within the air conditioned space independent of engine or helicopter operation.

3.2.6 The helicopter heating and ventilating requirement should be met at all speeds, directions of flight, hovering, and altitudes of the helicopter.

3.2.7 Consideration should be given to materials utilized and to the location of components and connections to assure a minimum fire hazard from the heating system, (i.e., insulation, location of the fuel drains, tank vents, etc.). See applicable portions of ARP 266.

3.2.8 The consideration of minimum weight is of extreme importance in the design of the air conditioning system and component equipment for helicopters.

4. AIR CONDITIONING EQUIPMENT:

4.1 Component parts of the air conditioning equipment should be constructed of materials which are considered acceptable for the particular use, and should be made and furnished with the degree, uniformity and grade of workmanship generally accepted in the aircraft industry.

4.2 Component equipment should be designed to start and operate satisfactorily at design temperatures of minus 65F to plus 160F, local environmental conditions and minus 65F to plus 120F ambient atmospheric temperatures. Special installations may require consideration of a broader temperature range for environmental conditions. If required, these would be stipulated in the detail specification.

4.2.1 Cabin and crew compartment temperatures should not be less than 70F at minus 40F outside ambient temperature.

4.2.2 The distribution of heat within any crew station and all spaces normally occupied by passengers should not cause undue discomfort to any occupants. Accordingly, the temperature of the warm air entering the occupied compartments should not exceed 200F.

4.2.3 The distribution of heat within the crew compartment and passenger cabin should be adequate to prevent air temperature variations in excess of 10F from foot to head level of seated personnel and from the forward to aft section of the compartment.

4.2.4 Baggage compartment temperatures should be maintained above 32F.

4.3 Ventilating Requirements:

4.3.1 Air Quantities:

4.3.1.1 The ventilating system should be capable of supplying a minimum of 1.0 lb/min of fresh air per occupant during all normal flight conditions.

4.3.1.2 During warm weather the system should be capable of supplying at least 40 cfm of fresh air per occupant. The quantity of ventilation air should be sufficient to limit cabin temperatures to within 10F above ambient.

4.3.1.3 In addition to the minimum quantity of fresh air stipulated, an additional quantity of cabin air may be recirculated in order to provide proper temperature distribution and lower air inlet temperatures during heating.

4.3.1.4 An air exhaust system should be provided for toilets. Exhaust provisions should be designed to preclude odors and to prevent circulation of air from the toilet area to the passenger compartment.

4.3.2 Air Velocity in Occupied Spaces:

4.3.2.1 During heating the maximum air velocity over occupants should not exceed 75 feet per minute.

4.3.2.2 During forced air ventilation the velocity over occupants should not exceed 200 feet per minute.

4.3.3 Air Inlets:

4.3.3.1 General air supply inlets to occupied spaces should be through openings which may be adjustable if desired, provided that such adjustment does not appreciably affect the overall balance of the distribution system.

4.4 Temperature Control:

4.4.1 A minimum of the following temperature controls should be provided:

a. Overheat safety switch associated with the heat source in the air conditioning system.
b. Duct temperature limit switch to conform with the requirements of paragraph 4.2.2.
c. A control device to maintain the occupied space at the desired temperature level.

4.4.2 The controls of the entire system should be accessible only to the crew members.

4.4.3 The applicable portions of ARP 89 on temperature control equipment should be considered.

4.4.4 If an automatic temperature control is used, provision should be made for a simple means of manually overriding such controls for emergency operation.

4.5 Heater Installation:

4.5.1 In helicopter air conditioning systems where a combustion type heater is used as the source of heat, the installation requirements as presented in SAE ARP 266 are applicable. In addition, the pertinent sections of ARP 86 on exhaust gas heat exchangers are applicable.

4.6 Defogging and Defrosting:

4.6.1 If the air conditioning system is used for defogging and defrosting cockpit transparencies then the system should be capable of maintaining adequate visibility for all conditions of helicopter operation.

5. DESIRABLE DESIGN FEATURES:

5.1 Heating System:

5.1.1 Without the helicopter propulsion engines operating, the system should be capable of ground operation with only external electrical power provided.

5.1.2 Consideration should be given to maintaining all occupied compartment surface temperatures below that objectionable to touch.

5.2 Ventilation:

5.2.1 Consideration should be given to providing individual air inlets in passenger type aircraft. These inlets should be controllable as to discharge angle and quantity of air delivered. Air velocity over the occupant with the inlet fully open should be between 600 and 750 feet per minute. The minimum velocity of 600 feet per minute should be maintained with all inlets open.

5.2.2 Outside fresh air intakes should be located so that the flow characteristics will not be materially affected by the altitude, direction of flight, and hovering of the helicopter.

5.2.2.1 In addition, ventilating air intake locations should be such that they will preclude entrance of objectionable quantities of any toxic or combustible fluids from the aircraft, such as exhaust gases, de-icer fluids, gasoline, oil or the fumes therefrom, from entering the ventilating air system (or the combustion air system in installations utilizing combustion type heaters). In determining the location of air intakes a careful analysis should be made of engine exhaust gas distribution created by recirculation by the rotor(s). The CO concentration should not exceed that given in paragraph 3.2.1 under all flight conditions and ground maneuvering.

5.2.2.2 In addition, infiltration of engine exhaust gases through the fuselage should be precluded by means such as adequate sealing or providing a slight positive pressure within the occupied spaces, taking into consideration the pressure distribution around the fuselage.

5.2.2.3 Consideration should be given to location and design so that rain or objectionable foreign matter will not enter the opening. If such location is impractical, then a particle separator should be installed in the duct system immediately after the inlet.

5.3 Cooling for Transport Type Aircraft:

5.3.1 Consideration should be given to the use of mechanical cooling systems for passenger transport helicopters.

5.3.1.1 The cooling system should be designed to maintain an Effective Temperature of not more than 75F in the cabin and crew compartment under sea level ambient conditions of 100F dry bulb and 45% relative humidity.

5.3.1.2 Temperature gradient within the airplane should not exceed 10F from foot to head level of seated personnel and from the forward to aft section of the compartment. Air velocity over occupants should not exceed 200 feet per minute, except for that supplied by individual air inlets.

5.3.1.3 The system should be capable of supplying at least 16 to 20 cfm of fresh air per occupant.

5.3.1.4 Means should be provided for the connection of a ground air conditioning truck.

5.3.2 Consideration should be given to applying the forced convection cooling methods outlined in AIR 64 for electronic equipment.