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Society of Automotive Engineers, Inc.
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New York City

AERONAUTICAL RECOMMENDED PRACTICE

ARP 266

INSTALLATION, HEATERS, AIRPLANE, INTERNAL COMBUSTION HEATER EXCHANGER TYPE

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Revised

1. PURPOSE: To provide a recommended practice covering the recommended safety and performance practices found desirable in service in the installation of combustion heaters, as specified in Society of Automotive Engineers Aeronautical Standard AS 143 and certain auxiliary devices which are considered necessary to the safety and performance of the heaters as used in certain aircraft.

2. SCOPE: This recommended practice is written to cover the installation of combustion heaters used in the following applications.

2.1 Fuselage Compartment Heating: (All occupied regions, cargo space, and transparent area heating).

2.2 Thermal Ice Prevention System:

2.3 Engine and Accessory Heating: (When heater is installed as part of the aircraft).

3. GENERAL REQUIREMENTS:

3.1 Heater: An internal combustion heater that meets the requirements of the SAE Aeronautical Standard AS 143.

3.2 Materials and Workmanship:

3.2.1 The installation should be made with materials throughout which are considered acceptable for the particular use intended and should be made and furnished with a degree, uniformity, and grade of workmanship generally accepted within the aircraft industry.

3.2.2 Consideration should be given for ducting, shrouding, insulation, and connections in the immediate vicinity of the heater to assure a minimum fire hazard from the installation.

3.2.3 Any material or sealing compounds should be free from smoke and not be susceptible to ignition under highest temperatures that can be expected during any operation of the heater which would not cause the heater to be shut down. Insulation exposed to hydraulic oil should be treated to avoid wicking action, which would result in a smoke or fire hazard.

3.3 Design Features:

3.3.1 To prevent a heater from overheating either itself, the discharge air, or the surrounding structure, the desirable practice is to provide a ventilating airflow across the heat exchanger in a quantity that will not allow excessive temperatures with the normal temperature control equipment inoperative.

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3.3.2 The sealing materials on the duct work should be so installed that the inadvertent flowing of the sealant will not result in clogging of the air passages and subsequent high temperatures. The duct work joints should be so designed that airflow restrictions cannot occur. It should not be possible for inflammable materials to receive excessive heat by radiation or conduction, thereby causing ignition.

3.3.3 The installation should be such that all of the equipment will operate within normal ranges of power, fuel, air supply, and specified leakage of the system.

3.3.4 When used in the system supplying heat to a pressurized cabin, the heater system should not be adversely affected by the failure of the cabin pressurizing system. In such case an alternate to ram air or blower supplied source should be available for the operation of the heating system.

3.3.5 The heater should be readily installable in the airplane and in such a manner that it may be readily accessible for inspection, service, and removal.

3.3.6 It is desirable that any heater installed in the fuselage be readily accessible for visual inspection in flight by a crew member.

3.3.7 Consideration should be given to the possibility of moisture condensation within accessories used in conjunction with the heating system. Where such condensation may affect performance adequate drainage should be provided.

4. DETAILED REQUIREMENTS:

4.1 Air Supply:

4.1.1 Air inlets should be so located that they will preclude any concentrations of toxic or combustible fluids from the aircraft, such as exhaust gases, de-icer fluids, gasoline, oil, or the fumes therefrom, entering the ventilating air system or combustion air system during flight, or on the ground during normal and cross-wind conditions or during propeller reversal conditions.

4.1.2 If a means should be required to prevent cold air from being ducted to a heated region due to an inoperative heater, the control should be combined with a provision for insuring that the heater fuel supply will be shut off simultaneously with the ventilating air supply.

4.1.3 The ducting system supplying the combustion air should be designed to withstand the explosion pressures as called out in AS 143, paragraphs 5.4.4 and 6.1.6.

4.1.4 The ventilating and combustion air should be separated to the extent that any malfunctioning of the combustion process of the heater will not introduce a hazardous condition within the heating system.

4.1.5 The air supply should be protected from ice formation by some suitable means.

4.2 Exhaust:

4.2.1 The exhaust system should be located and/or shrouded to prevent overheating any other portion of the airplane. The surface temperature of the exhaust system or shrouding should be below the autogenous temperature of any fluids that may come in contact with it.

4.2.2 The exhaust system should be designed to withstand the explosion pressures caused by the heater as specified in AS 143, paragraphs 5.4.4 and 6.1.6.

4.2.3 The exhaust should discharge overboard at a point of neutral or negative static pressure and should be so located that the exhaust gas does not pass over drain outlets and/or re-enter any portion of the airplane.

4.2.4 The exhaust should discharge overboard in such a location that the combustion air flow will not be restricted by collection and subsequent freezing of rain water or melting snow during periods when the heater is inoperative.

4.3 Fuel Supply and Drains:

4.3.1 The heater should be provided with positive drains that will prevent the collection of unburned fuel within the heater or combustion air ducting regardless of the attitude of the heater or airplane (three point - level flight, climb or dive). Experience has shown that drain lines should not be less than 5/16 inch inside diameter to prevent freezing in low temperature. Care should be exercised in their location that fuel drained from them cannot re-enter other parts of the airplane or be ignited. Consideration should also be given the possibility of fuel burning in the drain lines.

4.3.2 Fuel supply lines should have the fittings that are located within the fuselage shrouded and drained to the outside of the airplane. Any joints which are frequently disconnected should be provided with sufficient flexibility to assure that lines will not be inadvertently fractured.

4.3.3 At any point where multiple connections of various fuel, air vent, or drain lines are made, care should be taken to minimize any possibility of crossing lines at the disconnect points.

4.3.4 If electrically operated magnetic fuel valves are used for stopping the flow of fuel, two valves connected electrically in parallel and hydraulically in series should be used, or equivalent means should be provided to prevent malfunction of any one fuel control valve from creating a hazardous condition.

4.3.5 All fuel valves used for cycling and/or otherwise controlling the flow of fuel to the heater should have a suitable fuel filter installed or have other equivalent means of protection against malfunction causes by foreign particles in the fuel preventing the valves from closing. This should include protection against iron oxide particles in sizes less than five microns.

4.3.6 Suitable filtering provisions should be made to prevent water in the fuel from icing the heater nozzle.

4.4 Lines and Fittings:

4.4.1 All pipes and tubing fittings should comply with applicable AN standards.

4.4.2 Fuel lines in the vicinity of the heater shall be of fireproof material. Drain lines should be 18-8 stainless steel or the equivalent.

4.4.3 Other fittings and lines not included in 4.4.2 above shall conform to accepted aircraft practice.

4.5 Electrical Equipment:

4.5.1 All electrical equipment, including wiring, instruments, motors, insulation, shielding, relays, etc. should conform to acceptable aircraft practice. Electrical equipment should be located as remotely as possible from fuel and hydraulic lines and equipment and above them to minimize fire hazard.

4.5.2 Consideration should be given to the minimum voltage at which each electrical component would operate both on decreasing and on increasing voltage to detect possible dangerous combinations of failed and operating equipment due to voltage variations.

4.5.3 When ignition power is obtained from a source other than that used for heater control, protection against ignition power failure should be included by electrically inter-locking the ignition and fuel control circuits.

4.6 Controls:

4.6.1 Operating Controls:

4.6.1.1 Adequate indication for heater fuel pressure and/or heater air temperature should be installed to provide indication of heater operations consistent with the purpose for which the installation is intended.

4.6.1.2 Temperature sensing devices used for the purpose of controlling or indicating ventilating air temperature should be so located or shielded as not to sense radiant heat from the heater. This provision tends to insure accurate control or indication of the ventilating air temperature.