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AEROSPACE STANDARD

SAE AS18607 REV. A

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Thermal Anti-Icing Equipment, Wing and Empennage

CANCELLATION NOTICE

This document has been declared "CANCELLED" as of July 2001. By this action, this document will remain listed in the Numerical Section of the Aerospace Standards Index.

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FOREWORD

This document has been taken directly from U.S. Military Specification MIL-T-18607 and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards.

The original Military Specification was adopted as an SAE standard under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of government specifications and standards. TSB rules provide for (a) the publication of portions of unrevised government specifications and standards without consensus voting at the SAE Committee level, (b) the use of the existing government specification or standard format, and (c) the exclusion of any qualified product list (QPL) sections.

1. SCOPE:

1.1 Scope:

This specification covers the general requirements for the design, installation, and performance of thermal anti-icing equipment for the wings and empennage surfaces in aircraft.

1.2 Classification:

There shall be no restriction as to the type of thermal anti-icing equipment used. It is considered that either a system using the exhaust heat of the engine, or combustion heaters will be acceptable for use as the prime source of heat. For clarity, thermal anti-icing systems shall be designated as:

Exhaust Heat Exchanger Anti-Icing System
Combustion Heater Anti-Icing System
Compressor Bleed Air Anti-Icing System

2. APPLICABLE DOCUMENTS:

2.1 The following specifications, standards, and publications of the issue in effect on date of invitation for bids, form a part of this specification.

SPECIFICATIONS

FEDERAL

L-T-101	Tape, Shielding and Identification; Pressure Sensitive
QQ-P-416	Plating, Cadmium (Electrodeposited)
WW-T-787	Tubing, Aluminum Alloy 52S, Round Seamless, Drawn

MILITARY

JAN-A-669	Compound; Anti-seize; White Lead Base, General Purpose (for Threaded Fittings)
MIL-C-5015	Connectors; Electrical, "AN" type
MIL-B-5087	Bonding; Electrical (for Aircraft)
MIL-W-5088	Wiring, Aircraft, Installation
MIL-E-5272	Environmental Testing, Aeronautical Equipment, General Specification
MIL-H-5484	Heaters; Aircraft, Combustion Type
MIL-F-5509	Fittings, Fluid Connection
MIL-E-5557	Enamel; Heat Resisting, Glycerol Phthalate, Black
MIL-F-5572	Fuel; Aircraft Reciprocating Engine Grades 80, 91/96, 100/130, 115/145
MIL-I-6051	Interference Limits and Methods of Measurement; Aircraft Radio and Electronic Installations
MIL-P-6889	Primer, Zinc Chromate, for Aircraft Use
MIL-E-7080	Electrical Equipment; Installation of Aircraft, General Specification
MIL-P-7105	Pipe Threads, Taper, Aeronautical National Form, Symbol ANTP
MIL-S-7742	Screw Threads, Standard, Aeronautical
MIL-A-8625 (ASG)	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-F-17874 (Aer)	Fuel Systems; Aircraft, Installation and Test of
MIL-C-18591 (Aer)	Carbon Monoxide Elimination; Requirement for
MIL-H-18609 (Aer)	Heating and Ventilating Equipment, Aircraft; Installation of
MIL-E-25109 (ASG)	Engines, Aircraft, Reciprocating, General Specification for

NAVY DEPARTMENT

General Specifications for Inspection of Material

2.1 (Continued):

STANDARDS

AIR FORCE - NAVY AERONAUTICAL

AND-10375 Colors; Fluid Line Identification

PUBLICATIONS

AIR FORCE - NAVY AERONAUTICAL (BULLETIN)

ANA-143 Specifications and Standards, Use of

(When requesting specifications, standards, drawings, and publications refer to both title and number. Copies may be obtained upon application to the Commanding Officer, U.S. Naval Air Station, Johnsville, Pennsylvania, Attention Technical Records Division)

2.2 Other Publication:

The following document forms a part of this specification. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

NACA T.N. No. 1472 "The Calculation of the Heat Required for Wing Thermal Ice Prevention in Specified Icing Conditions."

Carr B. Neal, Jr., Norman R. Bergum, David Sukoff, and Bernard A. Schloff, December 1947.

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington 25, D.C.)

3. REQUIREMENTS:

3.1 Surfaces to be protected:

The anti-icing system shall protect the surfaces of the aircraft against the accumulation of ice as outlined in the following paragraphs.

3.1.1 All portions of the wing(s) and stabilizing surfaces which are exposed to ice accumulations during flight under the conditions specified in 3.2, 3.3, 3.3.1, 3.3.2 and 3.3.3 shall be protected by the anti-icing system.

3.1.1.1 Wing areas adjacent to fuel cells: Wing areas adjacent to integral fuel cells need not be heated.

3.1.2 Stabilizing surfaces: All parts of the aircraft stabilizing surfaces which are exposed to ice accumulation during flight shall be protected by the anti-icing system.

3.1.3 The entrance to each air scoop which must function during icing conditions shall be protected against ice accumulations. Protection shall also be provided for the guide vanes or at abrupt changes in direction of ducts leading from these scoops to permit unrestricted airflow in these ducts.

3.1.4 Protection of antenna masts, hinge fairings, spoilers, dive brakes, struts, and other miscellaneous ice accreting parts shall depend upon the effects of: (1) ice accumulation on the normal functioning of the individual part, and (2) increased drag on aircraft performance.

3.2 Icing conditions:

The thermal anti-icing system shall be designed to preclude the forming of ice on the protected surfaces of the aircraft in atmospheric conditions at least as severe as to those in which the free air temperature is not over 15 degrees Fahrenheit, the moisture content is at least 0.5 grams per cubic meter, and the average size of the water droplets is at least 15 microns in diameter.

3.3 Flight conditions:

The thermal anti-icing system shall be designed to preclude the forming of ice on the protected surfaces of the aircraft during the following conditions:

3.3.1 Altitude: The anti-icing system shall function satisfactorily from sea level to 20,000 feet or to the ceiling of the airplane, whichever is lower.

3.3.2 Attitude: The anti-icing system shall function satisfactorily with the aircraft in any permissible flight attitude.

3.3.3 Speed: The anti-icing system shall function satisfactorily at any speed between design stalling and the design level flight speeds of the aircraft.

3.3.4 Vibration and acceleration: The functioning of the anti-icing system shall not be aversely affected by acceleration or vibration of the aircraft.

3.4 Thermal requirements:

3.4.1 Flight temperatures: The anti-icing system shall be capable of maintaining the skin of the protected surface as outlined herein.

3.4.1.1 Conditions: Readings shall be made under the following conditions:

3.4.1.1.1 Normal rated power: The aircraft shall be in a level flight in clear air with the engines operating at normal rated power.

3.4.1.1.2 Ambient temperature: The ambient air temperature shall be 15 degrees Fahrenheit.

3.4.1.1.3 Solar radiation: The specified temperatures shall be obtained independently of the effect of solar radiation.

3.4.1.2 Spar at 20 percent chord point: When the spar is located immediately aft of the 20 percent chord point, the temperature of the leading edge skin forward of the spar shall be not less than 50 degrees Fahrenheit.

3.4.1.3 Spar at 15 percent chord point: When the spar is located immediately aft of 15 percent chord point, the temperature of the leading edge skin forward of the spar shall be not less than 85 degrees Fahrenheit.

3.4.1.4 Spar at 10 percent chord point: When the spar is located immediately aft of the 10 percent chord point, the temperature of the leading edge skin forward of the spar shall be not less than 120 degrees Fahrenheit.

3.4.2 Temperature Distribution: The maximum variation in skin temperature between any two points along the surface span at a given percentage of chord shall not exceed 20 degrees Fahrenheit.

3.4.3 Fuel temperature: Operation of the anti-icing system under any flight condition shall not raise the temperature of the fuel in any portion of the fuel system more than 10 degrees Fahrenheit.

3.4.4 Temperature of structure: Operation of the anti-icing system shall not result in raising the temperature of any structural member of the aircraft to a value in excess of 250 degrees Fahrenheit.

3.5 General requirements:

3.5.1 Weight: The airplane weight empty shall not be increased more than one percent (1.0 percent) due to installation of the thermal anti-icing system. The weight of the anti-icing system shall be included in the weight empty of the airplane.

3.5.2 Accessibility: All operating components of the anti-icing installation shall be readily accessible for inspection, adjustment and repair.

3.5.3 Removability:

3.5.3.1 Heaters, heat exchangers and accessories: All heaters, heat exchangers and accessories used therewith shall be readily removable. It shall not require more than 8 man-hours to remove and replace each heat exchanger or heater.

3.5.3.2 Ducts: It is desired that major components of the anti-icing system such as ducts be removable for flight operations where anti-icing equipment will not be required. Provisions shall be made in the aircraft for securing cables, etc., which will be loose when equipment is removed.

3.5.4 Operation of anti-icing system:

3.5.4.1 Cockpit: The following items shall be grouped together in a position convenient to the pilot, copilot or flight engineer.

3.5.4.1.1 Control: For normal operation, the anti-icing system shall be operated by a single control.

3.5.4.1.2 Temperature indicator: A temperature indicator shall be provided which indicates in degrees Fahrenheit the temperature of one typical point on each protected semi-span wing panel and on each protected stabilizing surface (semi-stabilizer and fin), that is most responsive to icing condition.

3.5.4.1.3 Warning signal: A suitable warning signal shall be provided to indicate when actuation of any safety device has stopped the operation of the anti-icing system.

3.5.4.1.4 Operating instructions: A suitable instruction plate shall be provided containing necessary instructions for the operation of the anti-icing system.

3.5.4.2 Temperature control: The temperature of the hot air being supplied to the protected surfaces shall be automatically controlled to prevent overheating of the surfaces.

3.6 Hot air distribution system:

3.6.1 Distribution: The hot air shall be distributed to the leading edges of the protected surfaces by means of suitable ducts. The system shall be designed so that the hot air, after leaving the heat source, may be directed through the system or it may be dumped overboard.

3.6.2 Exhaust gases: Whenever the anti-icing system contains gases from the engine exhaust or the combustion heaters, the system shall be designed to preclude the possibility of toxic gases escaping into occupied compartments in the event of leaks in the heater or heat exchanger, or of corroding any part of the aircraft structure.

3.6.3 Water drains: Provision shall be made to insure the free drainage of any water that may enter the system.

3.7 Heat sources:

3.7.1 Heat exchangers: When heat is to be obtained from engine exhaust, it shall be extracted by one or more heat exchangers.

3.7.1.1 Exhaust back pressure: With heat exchangers installed, the exhaust back pressure shall conform to the requirements of Specification AN-9500.

3.7.2 Combustion heaters: Combustion heaters shall conform with the requirements of Specification MIL-H-5484.

3.7.2.1 Fuel supply: Fuel for the combustion heaters may be obtained from the engine fuel pumps or pumped directly from the aircraft fuel system by electrically-driven pumps.

3.7.2.2 Shut-off valves: Positive shut-off valves shall be incorporated as near as practicable to the fuel sources (engine-driven pumps or fuel tanks).

3.7.2.3 Fuel lines: All lines carrying fuel to the heaters shall be either AN-6264 hose assemblies or aluminum alloy tubing in conformity with the requirements of Specification WW-T-787. Fuel lines shall be marked in accordance with Standard AND-20375.

3.7.2.4 Drain lines: Each heater shall be provided with drain lines to insure that in the event of nonignition, all fuel pumped to the heater will be drained overboard.

3.7.3 Bleed air: In turbo prop and jet aircraft, bleed air from the compressor may be utilized.

3.8 Electrical equipment:

3.8.1 Installation: The electrical installation shall conform to Specification MIL-W-5088 and Specification MIL-E-7080.

3.8.1.1 Quick disconnect connectors: Where equipment is subjected to removal for inspection and servicing, quick disconnect electrical connectors in conformance with Specification MIL-C-5015 shall be provided.

3.8.1.2 Bonding: Electrical bonding shall be in accordance with MIL-B-5087 with special allowance made for flexibility in the bonds to provide for thermal expansion.

3.8.2 Voltage: The equipment shall be designed to operate from the primary electrical power system of the aircraft.

3.8.3 Power: Electrical power consumption of any single heating unit under continuous operation shall not exceed 100 watts.

3.9 Reports and Engineering data:

3.9.1 Anti-icing system data: The airplane manufacturer shall submit to the procuring activity for approval a report on the design of the system showing a complete schematic drawing of the proposed system and complete data on heat requirements and heat available and weight. These data shall be sufficiently detailed to permit evaluation of the accuracy of the methods used and shall contain complete sample calculations for at least one condition. The report shall also contain a word description of system operation. Submission and approval of this report is a prerequisite for any other approvals on the system or equipment.