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MILITARY SPECIFICATION

HEATING AND VENTIATING SYSTEMS, AIRCRAFT GENERAL SPECIFICATION FOR

This specification has been approved by the Bureau of Aeronautics, Department of the Navy.

1. SCOPE

1.2 Scope - This specification covers the general requirements for aircraft heating and ventilating systems.

1.2 Classification - Aircraft heating equipments shall be furnished in any of the following types, at the discrimination of the aircraft manufacturer, unless otherwise required by the detail airplane specifications (See 6.2).

-Type I - Combustion heating
Type II - Engine Exhaust heating
Type III - Engine Bleed Air heating
Type IV - Electric heating

2. APPLICABLE DOCUMENTS

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

SPECIFICATION

FEDERAL

L-T-101	Tape, Shielding and Identification, Pressure Sensitive Type
QQ-P-416	Plating, Cadmium (Electrodeposited)
QQ-Z-325	Zinc Plating (Electrodeposited)

MILITARY

JAN-A-669	Compound, Anti-Sieze; White Lead Base, General Purpose (For Threaded Fittings)
MIL-S-5002	Surface Treatments (Except Priming and Painting) for Metal and Metal Parts in Aircraft
MIL-B-5005	Breakdown; Provisioning Parts and Illustrated Parts for Aeronautical Articles
MIL-C-5015	Connectors, Electrical "AN" Type
MIL-B-5087	Bonding; Electrical (For Aircraft)
MIL-W-5088	Wiring, Aircraft, Installation of
MIL-H-5471(ASG)	Handbook, Operation and Maintenance Instructions (For Aircraft Equipment)
MIL-H-5484	Heaters, Aircraft, Combustion Type
MIL-E-5557	Enamel, Heat Resisting, Glyceryl Phthalate, Black

MIL-T-5842	Transparent Areas, Anti-Icing, Defrosting and Defogging Systems, General Specification for
MIL-I-6051	Interference Limits and Methods of Measurement; Aircraft Radio and Electronic Installation
MIL-H-6738	Handbooks, Overhaul Instructions with Parts Breakdown (For Relatively Simple Accessories and Equipment)
MIL-L-6805	Lacquer, Camouflage
MIL-P-6808 (ASG)	Primer, Zinc Chromate, For Aircraft Use, Application of
MIL-H-6813	Handbooks, Overhaul Instruction, (For Aircraft Accessories, Aircraft Engine Accessories and Related Equipment)
MIL-P-6906	Plates; Information and Identification
MIL-P-6992 (Aer)	Pump Assemblies; Fuel Electrically Driven, Aircraft Heater
MIL-E-7080	Electrical Equipment; Piloted Aircraft Installation and Selection of General Specification for
MIL-P-7105	Pipe Threads, Taper, Aeronautical National Form Symbol ANPT
MIL-I-7171 (ASG)	Insulation Blanket; Thermal Acoustical
MIL-F-7179	Finishes and Castings; General Specification for Protection of Aircraft and Aircraft Parts
MIL-S-7742	Screw Threads, Standard, Aeronautical
MIL-G-7762	Compasses Installation of
MIL-E-7894(ASG)	Metric Power, Aircraft, Characteristic of
MIL-P-8585	Primer, Zinc Chromate, Low Moisture Sensitivity
MIL-M-8609 (ASG)	Motors; Direct Current, 28 volt System, Aircraft, General Specification for Class A and B.
MIL-A-8625(ASG)	Anodic Coatings for Aluminum and Aluminum Alloys
MIL-I-8670 (Aer)	Installation of Fixed Guns and Associated Equipment in Naval Aircraft
MIL-I-8671(Aer)	Installation of Droppable Stores and Associated Release Systems
MIL-I-8673{Aer)	Installation and Test of Aircraft Flexible Weapons Systems
MIL-I-8677 (Aer)	Installation of Armament Control Systems and Associated Equipment in Naval Aircraft
MIL-H-8796(ASG)	Hose, Air Duct, Flexible, Aircraft
MIL-F-17874 (Aer)	Fuel Systems; Aircraft, Installation and Test of
MIL-C-18591 (Aer)	Carbon Monoxide, Elimation, Requirements for

MIL-T-18606(Aer)	Test Procedures for Aircraft Cabin Pressurizing and Air Conditioning Systems
MIL-T-18607(Aer)	Thermal Anti-Icing Equipment, Wing and expennage

STANDARDS

AND-10375	Colors - Fluid Line Identification
MS-3102	Receptacles - Electrial Connector, Box Mouning
MC-16051(Aer)	Coupling, Ground Cooling, Combat Type Aircraft
MS-16052(Aer)	Air Inlet Combat Aircraft, Ground Cooling
MS-33678	Connector, Receptacle. Electrical, Integral Mounting

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 of this specification and applicable spedicifications may be obtained upon application to the Commanding Officer U.S. Naval Aviation Supply Depot, 700 Robbins Avenue, Philadelphia 11, Pennsylvania, Attention Code ODPT).

3. REQUIREMENTS

3.1 Materials - When materials are used which are not specifically designated herein, they shall be of the best quality, of the lightest possible weight, and fully suitable for the purpose. The specification to be used for the procurement of the applicable materials and products shall be in accordance with the policty outlined in ANA Bulletin No. 143.

3.1.1 Dissimilar Metals - The use of dissimilar metals, especially brass copper, or steel in intimate metal-to-metal. contact with aluminum or aluminum alloy shall be avoided except when absolutely necessary and when used, adequate steps should be taken wherever possible to insulate the metals from each other to prevent electrolytic corrosion in accordance with the requirements of specification MIL-F-7179.

3.1.2 Corrosion - When materials are used which are subject to corrosion in salt air, or other atmospheric conditions likely to occur during service usage, they shall be protected against such corrosion in accordance with the requirements of Specification MIL-F-7179 and in a manner which will in no way prevent compliance with the requirements of this specification.

3.1.3 Magnesium Alloy - The use of magnesium alloy is not desired and its use shall be subject to the approval of the Bureau of Aeronautics.

3-.2 Construction

3.2.1 Ruggedness - The component parts of the heating and ventilating system as specified herein shall be sufficiently rugged to withstand the mechanical shocks, vibrations and stresses incident to its use in the airplane in which it is installed,

3.2.2. Assembly - The design and location of the component parts of the heating and ventilating system shall be such as to facilitate disassembly and reassembly for the purpose of repair or replacement of parts, preferably without the use of special tools or movement of other parts. If special tools. are required for servicing, one complete set of such tools shall be furnished per installation for inclusion in the airplane tool kit.

3.3 Interchangeabilty

3.3.1 Dimensions - Dimensional limits and tolerance shall be such that all parts built to the same drawing will be interchangeable so that selective fits will not be necessary.

3.3.2 Standard Parts - Army-Navy standard parts and the applicable numbers thereof shall be used when available. When AN parts are not available, the specification to be used for procurement of parts shall be in accordance with the policy outlined in ANA Bulletin No.143.

3.3.3 Threads - Machine- screw threads shall conform to Specification MIL-S-7742. Pips threads shall conform to Specification MIL-P-7105.

3.4 Finish

3.4.1 Anodized Parts - Aluminum alloy parts shall be anodized in accordance with the requirements of Specification MIL-A-8625(ASG).

3.4.2 Surface Treatment - Corrosion resisting a11oy and best resisting alloy parts shall receive surface treatment in accordance with Specifications MIL-S-5002. All other steel parts and those copper and nickel alloy parts in contact with aluminum or plated steel parts shall be cadmium plated in accordance with Specifcation QQ-P-461 or zinc plated in accordance with Specification QQ-Z-325.

3.4.3 Printed Surfaces - Exposed corrosion and heat resisting steel parts need not be painted. All other exposed metal surfaces shall be coated with one coat of zinc chromate primer, Specification MIL-P-8585 finished with one coat of ML-E-5557 enamel.

3.5 Heating - Aircraft heating systems shall be capable of maintaining a temperature of +60°F in occupied spaces, during flight in atmospheric conditions where the outside air temperature is -65°F or above. At lower outside air temperatures, the heating system shall be capable of maintaining a temperature rise of 125°F above outside air temperature. At outside air tempumtures above -55°F the heating and ventilating system shall automatically regulate the air temperature to 70°F plus or minus 5°F in occupied spaces.

3.5.1 Temperature Variation - In each space to be heated the temperature between any two points shall not vary more than 10°F.

3.5.2 Insulation - Attention shall be given to the use of thermal insulation in conjunction with heating equipment in order to prevent excessive heat loss from compartments, and to reduce the weight of equipment necessary to provide heat for the aircraft. Thermal insulation shall conform with the requirements of Specification MIL-I-7171(ASG).

3.5.3 Ground Operations - In multi-engine seaplanes, airships and amphibious airplanes the heating system shall be designed to operate While the aircraft is on the ground or on water where the engines are not operating.

3.6 Fuel Vapors and Flammable Gases - Concentration of fuel vapors and other flammable gases in any part of the airplane shall not exceed the following percentages of the lower explosive limit of the mixture, except that there shall be no conflict with the requirements of Specification MIL-G-38591(Aer) for gases contaminated with carbon monoxide

Location	% LEL (Av.)
Any compartment occupied by personnel (Extended periods)	2-1/2
Any compartment intended for occupancy for periods up to five minutes in duration	7-1/2
Any part of the airplane	20

3.7 Cooling - Adequate ventilation shall be provided under all possible flight conditions to prevent a rise in temperature exceeding 10°F above ambient temperature within occupied compartments.

3.7.1 Ground Cooling - When required by the airplane detail specification, a ground cooling inlet(s) in accordance with Military Standard qP Standard MS16052(Aer) shall be installed on the airplane fuselage. The inlet(s) shall be located for easy accessibility to ground personnel. Any door or cover required for the inlet shall automatically close and lock after removal of the ground cooling air hose coupling, Military standard MS-16051(Aer). On aircraft designed for carrier deck operation, the cooling air inlet shall be located as near as possible to the lower surface center line of the fuselage to permit external cooling at either a port or starboard ship's Catapult station.

3.7.2 Sun Shields - Sun shields shall be provided for overhead cabin transparencies when required by the airlane detail specifications. Sun sheilds shall be readily movable, shall be of the transparent infra-red reflecting type and shall reduce the transmission of incident infra-red radiant energy at least 60 per cent.

3.8 Defogging, Defrosting - All transparent areas essential to the mission and operation of the aircraft, including windshield, scanning and sighting stations astrodomes, camera windows, etc., shall be completely defogged and defrosted during all operations and all conditions of flight. For combat type aircraft, this includes rapid descent at limit dive speed. For carrier based aircraft, this includes carrier circling and carrier landing operations. The system shall Conform to Specification MIL-T-5842.

3.8.2 Method of Accomplishment - Defogging-defrosting shall be accomplished by maintaining the temperature of the interior surface of the transparency above the dew point by at least 5°F. For purposes of calculation, the relative humidity of the surrounding air shall be assumed to be 100 per cent at any altitude up to ceiling of the airplane and at any selected temperature within the cockpit. Outside air temperature shall be assumed constant at -65°F.

3.9 Defogging and Anti-Icing - Where both defogging and thermal anti-icing are specified, the heating system shall be capable of simultaneously preventing the formation of ice on the exterior of the windshield, and fog and frost on the interior surfaces.

3.9.1 Heat Sources - Heat for defogging and anti-icing may be applied connectively by the flow of clean air, by electrically conductive coatings, or by infra-red radiations applied to the transparencies.

3.9.2 Anti-Icing Heat Requirement - For aircraft operating at the airspace indicated be- the heating system shall be capable of supplying sufficient heat to the exterior surface of windshield to meet the requirements for anti-icing given on a curve defined by the following table

Airspeed (Knots)	Heat Requirements (BTU/hr/ft^2)
100	1200
150	1700
200	1900
250	2000
300	2100
All over 300	2100

3.9.3 Temperature Regulation - In order to prevent overheating of equipment or compartments, automatic regulation to limit the temperature to the values specified hearin shall be provided. These controls shall be of the "fail-safe" type.

3.10 Heating and Ventilating - Heating and ventilating provisions as indicated for the following equipment shall be provided unless otherwise specified in this airplane detailed specification. If the cabin heating system is to be used wholly or in part to provide equipment heating, it shall have sufficient thermal capacity to meet all tne simultaneous requirements of the system

3.10.1 Installed Equipment

3.10.1.1 Flexible Weapons Systems - Inhabited turrets shall be maintained at minimum temperature of +35°F by means of hot air or other approved methods in order to preclude hindering normal operations by turrent occupant due to excessive cold. Heating for uninhabited turrets, if required, shall be as specified in the applicable equipment or airplane detail specification. For additional information concerning general installation requirements of flexible weapons systems, see Specification MIL-I-8673.

3.10.1.2 Gun Gas Elimination - Adequate ventilation shall be provided to prevent excessive accumulations of gun gases, and suitable sealing provisions shall be made to prevent contamination of adjacent compartments in excess of the limits given in Section 3.6 of this specification. For Fixed gun installations, see Specification MIL-I-8670(Aer) and for flexible weapons systems, see Specification MIL-I-8673.

3.10.1.3 Armament Control Systems - Armament control systems are designed to operate satisfactorily in temperature ranges of -70°F to +160°F and the humidity ranges encountered within this teperature

range. However, those areas of the aircraft which contain the equipment and the operator of the equipment shall be maintained at a minimum temperature of +35°F? to preclude hindering normal operation by equipment operator due to excessive cold. For additional information concerning general installation requirements of armament control systems, see MIL-I-8677(Aer).

3.10.1.4 Droppable Stores and Associated Release Systems - External and internal installations of droppable stores and associated release systems require satisfactory operation in temperature ranges of -65°F to +160°F. Specific temperature requirements are determined by the specific store or release system to be installed. For additional Information regarding general installation requirements, see MIL-I-8671{Aer).

3.10.2 Automatic Flight Control and Stabilization Equipment - The minimum allowable temperatures for automatic flight control and stabilization equipment shall be -50°F, except that components installed in the cockpit or cabin of the aircraft shall be Malted to -30°F minimum.

3.10.3 Instruments - The minimum allowable tempemture for all instruments installed in the cockpit or cabin of the aircraft shall be -30°F.

3.10.4 Photographic Equipment - Photographic type airplanes shall be provided with adequate heat for warning cameras and defogging camera lenses and camera windows. The minimum allowable temperature for photographic equipment shall be +40°F.

3.10.5 Heater Compartments - Provision shall be made to ventilate adequately and continously the compartment in which combustion type heaters are installed in order to prevent the accumulation of fuel vapors in the event of fuel leakage. Maximum concentration of fuel vapor in heater compartments shall not exceed the. limits specified in paragraph 3.6,

3.10.6 Electrical Equipment - Ventilation shall be provided in any compartment in which electrical or other types of heat generating equipment are installed in order to prevent the development of temperatures exceeding +160°F for periods of 1/2 hour, or 130°F continuous under any condition of flight. Battery compartments shall be heated in order to prevent the temperature of the compartment from falling below +30°F.

3.11 Ground Preheat - Provision shall be made for supplying sufficient heat, either from an outside source or from the cabin heating system to maintain the engine and its auxiliary section at a temperature not exceeding 0°F; transmissions and gear boxes in rotary wing aircraft at 0°F; and batteries, bombsights, automatic flight control equipment, and the pilot's compartment at a temperature not less than +30°F with the outside air temperature at -65°F. These provisions shall be dependent upon the use of ground equipment and shall not depend upon the operation of the airplane engine or batteries.

3.12 Noise control

3.12.1 Heater Noise - In flight, the noise produced by the heating system shall not increase, at any frequency within the audible airplane sound spectrum, the total sound level within the enclosed and heated spaces by more than 2 decibels.

3.12.2 Ventilation Noise - The design and location of ventilator shall be such that in flight the total sound level in the enclosed spaces is not increased more than 3 decibels when the ventilator are opened.

3.12.3 Vibrators - Any units, the operation of which is of such nature that noise or vibrations would be transmitted to the airplane structure, shall be mounted on vibration damping supports of an approved type.

3.23 Weight - The weight of the heating and ventilating equipment shall be as low as practicable, consistent with good manufacturing practices for this type of airplane equipment. The combustion heaters or heat exchange and as much of the duct work as practical shall be readily removable from the airplane so that the weight of the heating system may be reduced as much as possible on those airplanes operating in theatres where heating is not required.

3.l4 Controls

3.14.1 Temperature - The cabin or cockpit temperature control may be manual or automatic. The controls for starting the system in operation shall be as simple as possible and the shut off control on the heating system shall, if possible, consist of a single control for shutting off . all the component parts of the Type I heating system or if a Type II system is installed, stopping all flow of heated air into the occupied spaces. If a Type III system is installed a single

control shall vary the inlet duct air temperature and completey shut off the flow of bleed air to the heating system.

3.14.2 Partial Output - Means shall be provided for operating the heating system at partial output. A suitable nameplate conforming to specificatin MIL-P-6906 and showing clearly and visibly visibly the "off", "intermediate" and "high" positions shall be installed with the controls. Suitable, concise, clear instruction for the operation of the heating system shall also incorporated in this nameplate or mounted adjacent to the heating system controls. ventilating system controls are combined with the heating controls suitable instructions for the operation of this system also shall be into incorporated.

3.14.3 Leakage - The conrols for the ventilating systsm shall be of such design and construction that a minimum of leakage results when the system is closed.

3 14.4 Fuel - In addition to the controls and safety features specified in Specification MIL-H-5484, the heating system shall incorporate suitable automatic control located in the fuel line as near the fuel take-off from the main fuel system as possible to stop the flow of fuel if the pressure in the fuel line downstream of this point is reduced by leakage or by being broken. In carrier type airplanes it is permissible to incorporate a limit switch in the landing gear ,mechanism in such manner as to cut off the flow of fuel when the landing gear is lowered as an alternate method of fuel control to that required in Specification MIL-H-5484.

3.14.5 Heated Air - Either a device for lighting a warning light on the pilot's instrument panel or a system shut-off control as described in paragraph 3.14.1 shall be provided to operate automatically whenever the emperature of the heated ventilating air exceeds 350 degrees. Fahrenheit.

3.14.6 Fresh Air - Controllable fresh air intakes shall be provided to admit under the conditions of flight specified in paragraph 4.2.2.7 of Specification MIL-T-18606(Aer) no less than two and one fourth (2-1/4) pounds of fresh air per minute per occupant. The ventilating system shall be constructed so as to deliver the proper amount of such ventilating air to each of thet Crew stations.

3.14.7 Individual stations - The ventilators shall be manually operated by controled convenient to the cabin occupants and need be water tight in the closed position only. Provision shall be made at the outlet at each crew station for individual control of the volume of air delivered at this point and the outlets shall be positioned so as to avoid delivering a blast of sir directly on to the occupant.

3.14.8 Mock-up Inspection - The design and location of the controls and indicators shall be subject to airplane mock-up inspection and approval.

3.15 Electrical System

3.15.1 Electrical Installation - The installation shall conform to Specifications MIL-E-2030, MIL-W-5088 and MIL-I-6051. Where equipment is subject to removal for inspection and servicing, All connectors in conformance with Specification MIL-C-5015 shall be used.

3.15.2 Input Power Requirements - The equipment shall meet applicable requirements of Specification MIL-E-7894 and shall give specified performance from the following power sources with characteristics as defined in MIL-E-7894 having limits as specified herein. The power required shall not exceed the specified amounts. Unspecified values shall be approved by the procuring agency.

AC Power (Single Phase) 115 Volt

Operating Voltage Limits	108 to 121 volts
Operating Frequency Limits	380 to 420 cps
Reduced Performance Voltage Limits	102 to 108 and 121 to 124 volts
Reduced Performance Frequency Limits	_____ cps
Power (1 Ø)	_____ v.a.

AC Power (Three Phase) 115/200 Volt	
Operating Voltage Limits	108 to 121 volts
Operating Frequency Limits	380 to 420 cps
Reduced Performance Voltage Limits	102 to 108 and 121 to 124 volts
Reduced Performance Frequency Limits	_____ cps
Power (3Ø)	_____ v.a.
DC Power 28 Volts	
Operating Voltage Limits	25 to 29 volts
Reduced Performance Voltage Limits	20 to 25 and 29 to 31 volts
Power	_____ amps

3.15.3 Electric Motors - All motors shall meet the requirements of specification MIL-H-8609 and if located in any space other than the combustion space in the heating system, shall be explosion proof. All motors shall be self-ventilated.

3.l5.4 Electrice Leads - The electrical cables installed in the airplane shall not be run inside the heating or ventilating ducts and shall not be in contact with the heating or ventilating ducts to prevent damage to the cable insulation by high temperatures.

3.15.5 Magnetic Interference - The installation of the heating system shall meet the requirements of Specification MIL-S-7762 with regard to the effect of the electrical system on any compass located within the airplane.

3.16 Ventilating System - The ventilating system may be combined with the heating system so that the set of air scoops and ducts are used for both, if this design proves advantageous. However, irrespective of the system employed, the ventilating equipment shall meet all the requirements specified herein.

3.17 Temperature

3.17.1 Surface Temperature Limits - The design and construction of the heating system shall be such that the temperature of these portions of the outside surface of the case, flue, or any other portion of the heater installation or ducts within reach of operating personnel shall not be in excess of 180°F measured in an ambient temperature of 70°F.

3.17.2 Heated Air Limits - The design and construction of the heating system shall be such that the temperature of the air delivered from the heat exchanger or combustion heater under any condition of flight shall not exceed 350°F measured at a point in the ventilating air duct 18 inches downstream of the heat exchanger or combustion heater.

3.17.3 Structural Member Limits - The installation of the heating system shall be such that the structure member of the airplane is raised above a maximum temperature of 250°F under any conditions of operation of the heating system.

3.18 Heating Requirement - Type I (Combustion)

3.18.1 Airframe Requirements - The combustion heaters shall be approved heaters meeting all the requirements of Specification MIL-H-5484 for the type of airplane in which installed.

3.18.2 Starting - The Type I heating system shall be designed constructed so that it will ignite and operate continuously under any conditions of flight from sea level to the service coiling of the airplane. The temperature of the exhaust gases from the heater shall not exceed 1000°F measured under any condition of operation of the heating system.

3.18.3 Cabin Pressurization. - When installed in aircraft with cabin pressurization, the ventilating air passages only of the heater shall be subjected to the increased pressures developed by the pressurizing system. The space within the heat exchanger shall be subjected to the increased pressures developed by the pressurizing system. The space within the heater combustion chamber and controls as well as the ignition and fuel systems shall not be subjected to the pressures developed by the cabin pressurizing system.

3.18.4 Vapor Prevention - Provision shall be made to ventilate adequately and continuously the compartments in which combustion-type heaters are installed in order to prevent the accumulation of fuel vapors in the event of fuel leakage. Ventilation rate shall exceed 5 pounds of air per minute per 100,000 BTU per hour rated thermal capacity of the heater.

3.18.5 Fuel Pump - The heater fuel pump shall conform to Specification MIL-P-6992 (Aer).

3.19 Heating Equipment - Type II (Engine Exhaust)

3.19.1 Air Supply - Suitable means shall be provided to permit the flow of sufficient air through the heat interchanger at all times to prevent premature failure due to overheating. The valves used to control the flow of heated air shall be of such construction and ruggedness as to preclude warpage or leakage for any reason during the life of the heating system.

3.19.2 Secondary Exchange - If a secondary air-to-air exchanger is used, means shall be provided for regulating the flow of the air being heated in the secondary exchanger. The design and construction of primary exhaust-to-air heat exchanger shall be sucha that vibration or expansion and contraction due to rapid heating and cooling shall not cause cracking of the heat exchanger of the exhaust stack.

3.20 Heating Equipment - Type III (Engine Bleed Air)

3.20.1 Type III Heating Equipment shall be of either the bleed air convection or ram air convection type.

3.20.2 Temperature regulation of cabin inlet air shall be l emhd by a suitable air-to-air heat exchanger and by-pass system.

3.21 Heating Equipment - Type IV(Electric)

3.21.1 Type IV Electric Heating Equipment shall conform to the requirements of Specification MIL-E-7080.

3.22 De-ice and Anti-ice - When the heating system used for de-icing the wings and tail surfaces is combiined with the cabin heating system, that part pertaining to the thermal de-icing and anti-icing shall conform to the requirements of SpecificatiOn MIL-T-18607 (Aer).

33.23 Ducting - All flexible air ducting Shall conform to the requirements of Specification MIL-H-8796 (ASG)

3.24 Marking - Fuel Lines to the heater shall be marked in accordance with AN standard Drawing and 10375.

3.25 Drawings and Data - Complete drawings and data on the entire installation shall be submitted. The drawings shall include a schematic layout of the system as installed in the airplane, showing the size and type of heating units and heat exchangers, the size and location of all ducting, the complete heating, ventilating, defogging, defrosting and anti-icing systems and fuel and/or electrical schematic diagram if applicable. The data should include calculations of the heat required, expected temperature gradients, principles of operation, method and location of controls, wiring, diagrams, wieght analysis, estimated fuel consumbtion and electric power consumption.

4. QUALITY ASSURANCE PROVISIONS

4.1 Classification - The inspection and testing of heating and ventilating systems shall be considered as falling within the following classifications:

(a) Tests and Inspections to be conducted during trials.
(b) Tests and Inspections to be conducted during production.

4.2 Tests and Inspections to be Conducted during Trials. These tests include all the test of this specification. The first airplane of each contract and the first airplane in which any major change in the heating or ventilating system is incorporated shall be flight tested as specified in Specification MIL-T-18606(Aer) to detemine conformance with the requirements of this specification.

4.3 General Inspection.-The materials used in the construction of the heating and/or ventilating system shall have been inspected at source of procurement by Navy Inspectors in accordance with established procedures. The heating system shall be thoroughly inspected and tested for conformance to the requirements of this specification with regard to design, quality of construction, suitability of materials used, finish, markings, dimensions and weight.

4.4 Carbon Monoxide and Leakage - Tests for carbon monoxide and leakage of the heating and ventilating system shall be conducted in accordance with Section 3.

4.5 Noise Control - Measurements of the increase in sound level in the enclosed spaces caused by the operation of the heating or ventilating system shall be conducted at the same time as the other sound Ievel measurements are conducted during the trials and the results shall not exceed the values specified in paragraphs 3.12.1 and 3.12.2.

4.6 Ventilating Equipment -The airplane shall be operated under the flight conditions specified in Section 3, the amount of ventilating air delivered at each outlet shall be measured with all outlets open full and the amount of air delivered per occupant determined by measurement with a calibrated orifice or venturimeter shall not be less than the amount specified in Section 3. The controls shall then be adjusted to shut off the system and a test of each outlet made to demonstrate that no appreciable leakage results.

4.7 Heating Equipment.

4.7.1 Temperature Limits - In addition to the tests necessary to determine compliance with this specificaton the following additional temperatures shall be determined while the airplane is in flight at minimum cruising speed at an altitude of 1000 feet and these temperatures shall not exceed the following values. The temperature rise of the ventilating air shall not exceed 275 degrees farenheit measured at a point 18 inches downstream of the heater, the maximum temperature of the exterior of the heater and ducts witin reach of operating personnel shall not exceed the value specified in Section 3, and the temperature of the exhaust gases (combustion heater only) shall not exceed the value specified in Section 3.

4.7.2 Automatic Temperature Control - The hot air outlets shall then be . partially blocked in such manner that the flow of air is reduced and the temperature thereby increased at a rate of temperature change not in excess of 30 degrees Fahrenheit per minute. If a Type I heater is installed, when the temperature of the ventilating air reaches 350 degrees Fahrenheit plus or minus 10 degrees, the temperature control shall operate either to reduce the temperature of the ventilating air or shut the heater off entirely. If a Type II or Type III heating system is installed, the light on the pilot's instrument panel shall light or, if an automatically operating shut-off valve is installed, this valve shall operate to shut off completely the flow of bested air.

4.7.3 Automatic Shutoff Controls -The heating system shall be allowed to remain on while the airplane is landed and if a combustion heater without a blower is installed, the heater shall cease operation when the ram air pressure falls below the required minimum and the device for stopping the flow of fuel and turning off the igniter shall operate. If a blower is incorporated in the combustion heating system, the device for starting the blower shall operate when the ram pressure falls below the required minimum. If an exhaust type heating system is installed, the temperature rise of the ventilating air delivered from the heat interchanger shall not exceed 275 degrees Fahrenheit during taxiing or while the motors are idling after landing.

4.7.4 Electrical Power Consumption.-If a Type I heating system is installed, the electrical power consumption shall be determined for starting for continuous operation and for the blower, if included in the system, and the consumption shal1 not exceed the values specified in Specification MIL-H-5484.

4.7.5 Magnetic Interference - The magnetic interference of the heating system shall be determined during starting, continuous operation and with blower operation and the effect on any compass located in the airplane shall not exceed the value specified in paragraph 3.15.5.

4.8 Test and Inspections to be Conducted During Production.These tests and inspections are to be made on the heating systems incorporated in airplanes submitted under contract. The following tests and inspections shall be made at the manufacturer's plant by the cognizant naval inspector or in his presence, unless otherwise authorized by the Bureau of Aeronautics.

4.8.l General Inspection - Shall be in accordance with 4.3.

4.8.2 Flight Test. -During the acceptance flight of each airplane the heating system shall be placed in operation and it shall be noted whether or not It apparently operates satisfactorily. If it does not, such further tests as are deemed necessary by the inspector shall be performed to establish definitely the satisfactory performance or the repairs necessary to secure satisfactory operation, which repairs are to be made by the contractor before acceptance of the airplane.

5. PREPARATION FOR DELIVERY

(Not applicable)

6. NOTES

6.1 Intended Use - The equipment outlined in this specification is intended for use in naval aircraft.

6.2 Sizes - Heaters shall be of such size as to provide for the fulfillment of the requirements of this specification for the type airplane in which installed. Tests to determine conformance to these requirements shall be conducted in accordance with Specification MIL-T-18606(Aer), Test Procedures for Aircraft Cabin Pressurizing and Air Conditioning Systems. If of Type I, the heater shall be selected of the proper type for the airplane and in one of the standard sizes specifed in Specification MIL-H-5484, Heater, Aircraft, combustion Type.

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