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29 March 1985
SUPERSEDING
MIL-T-5842A
13 July 1953

MILITARY SPECIFICATION

TRANSPARENT AREAS ON AIRCRAFT SURFACES (WINDSHIELDS AND CANOPIES), RAIN REMOVING AND WASHING SYSTEMS FOR, DE-FROSTING, DE-ICING, DEFOGGING, GENERAL SPECIFICATION FOR

This specification is approved for use by the Naval Air Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE.

1.1 Scope. This specification establishes the requirements for systems which keep transparent areas, on aircraft surfaces (windshields and canopies), clear of ice, frost, fog, rain , salt, snow, insects, dust, gun gas residue and grease. These systems are inherent to the aircraft, but can be ground applied.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extend specified herein

SPECIFICATIONS

FEDERAL

QQ-C-320	Chromium Plating (Eletrodeposited)
QQ-P-416	Plating, Cadmium (Eletrodeposited)

Beneficial comments, (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Naval Air Engineering Center, Systems Engineering and Standardization Department, (Code 93), Lakehurst, NJ 08733-5100, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

SPECIFICATION (Continued)

MILITARY

MIL-S-5002	Surface Treatments and Inorganic Coatings for Metal Surfaces of Weapons Systems
MIL-T-6396	Tank, Fuel Oil, Water-Alcohol, Coolant Fluid, Aircraft, Non-Self-Sealing, Removable, Internal
MIL-W-6882	Water Repellent Kit, Window and Windshield, Glass and Plastic
MIL-E-7080	Electric Equipment, Aircraft, Selection and Installation of
MIL-P-7105	Pipe Threads, Taper, Aeronautical National Form, Symbol ANPT, General Requirements for
MIL-F-7179	Finishes and Coatings, Protection of Aerospace Weapons Systems, Structures and Parts, General Specification for
MIL-S-7742	Screw Threads, Standards, Optimum Selected Series, General Specification for
MIL-I-8500	Interchangeability and Replaceability of Component Parts for Aircraft and Missiles
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-T-18606	Test Procedures for Aircraft Environmental Systems
MIL-T-18607	Thermal Anti-Icing Equipment, Wing and Empennage
MIL-E-18927	Environmental Systems, Pressurized Aircraft, General Requirements for
MIL-C-38999	Connector, Electrical, Circular, Miniature, High Density, Quick Disconnect (Bayonet, Threaded, and Breech Coupling) Environmental Resistant, Removable Crimp and Hermetic Solder Contacts, General Specification for
MIL-R-81367	Rain Removal System, Aircraft Windshield, Jet Air Blast

SPECIFICATIONS (Continued)

Military (Continued)

MIL-R-81589	Rain Repellent Fluid Application System, Aircraft Windshield

STANDARDS

Military

MIL-STD-143	Standards and Specifications, Order of Precedence for the Selection of
MIL-STD-203	Aircrew Station Controls and Displays, Assignment, Location and Actuation of, For Fixed Wing Aircraft
MIL-STD-210	Climatic Extremes for Military Equipment
MIL-STD-250	Aircrew Station Controls and Displays for Rotary Wing Aircraft
MIL-STD-470	Maintainability Program Requirements (for Systems and Equipment)
MIL-STD-704	Aircraft Electric Power Characteristics
MIL-STD-785	Reliability Program for Systems and Equipment Development and Production
MIL-STD-810	Environmental Test Methods
MIL-STD-850	Aircrew Station Vision Requirements for Military Aircraft
MIL-STD-882	System Safety Program for Systems and Associated Subsystems and Equipment; Requirements for
MIL-STD-889	Dissimilar Metals
MIL-STD-1472	Human Engineering Design Criteria for Military Systems, Equipments and Facilities
MIL-STD-2072	Survivability, Aircraft; Establishment and Conduct of Programs for
MS21344	Fittings, Installation of Flared Tube, Straight Threaded Connectors, Design Standard for

MS33649 Boss, Fluid connection - Internal Straight Thread

MS33656 Fitting End, Standard Dimensions for Flared Tube Connection and Gasket Seal

NAVAL AIR SYSTEMS COMMAND

MIL BULL 544 List of Specifications and Standards (Book Form)

(Copies of military specifications, standards, handbooks, drawings and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.1.2 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARDS:

ASTM B 633 Electrodeposited Coatings of Zinc on Iron and Steel

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

3. REQUIREMENTS

3.1 Systems component. The transparent area protective systems shall be complete with all necessary components such as instruments, controls, valves, ducting, heaters, heat exchangers, pumps, electrical circuits and such other equipment that is necessary to provide the required visibility for all operating conditions of the aircraft.

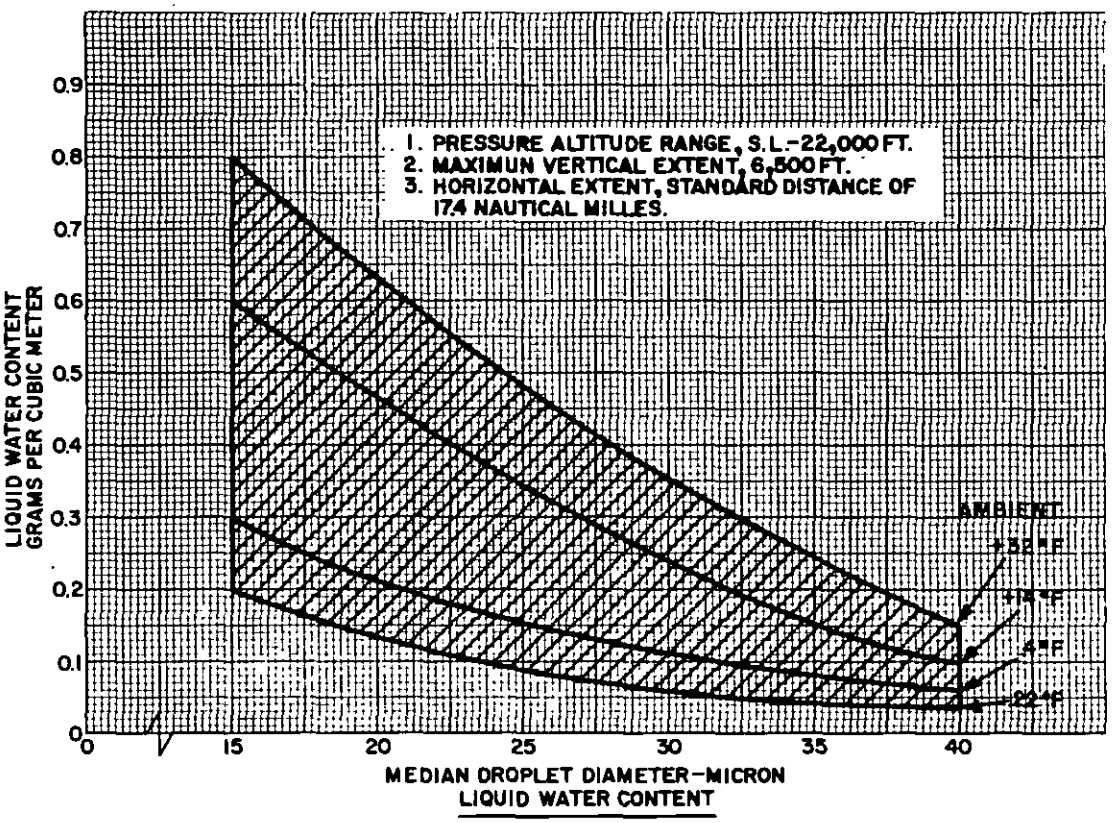
3.2 Design conditions.

3.2.1 Design ambient conditions.

3.2.1.1 Operations. The design ambient conditions of the atmosphere under which equipment shall remain operational shall be in accordance with the operations criteria of MIL-STD-210, Ground and World-Wide Air Environments.

3.2.1.2 Performance. Unless otherwise specified herein, the design ambient conditions of the atmosphere for meeting the performance requirements of this specification, shall be in accordance with the 10% risk criteria of MIL-STD-210, Ground and World-Wide Air Environments. If a 10% risk criteria is not available for a given parameter, the highest risk factor provided shall be used.

3.2.1.3 Icing conditions. The atmospheric conditions for icing occurence are defined by figures 1 and 2.



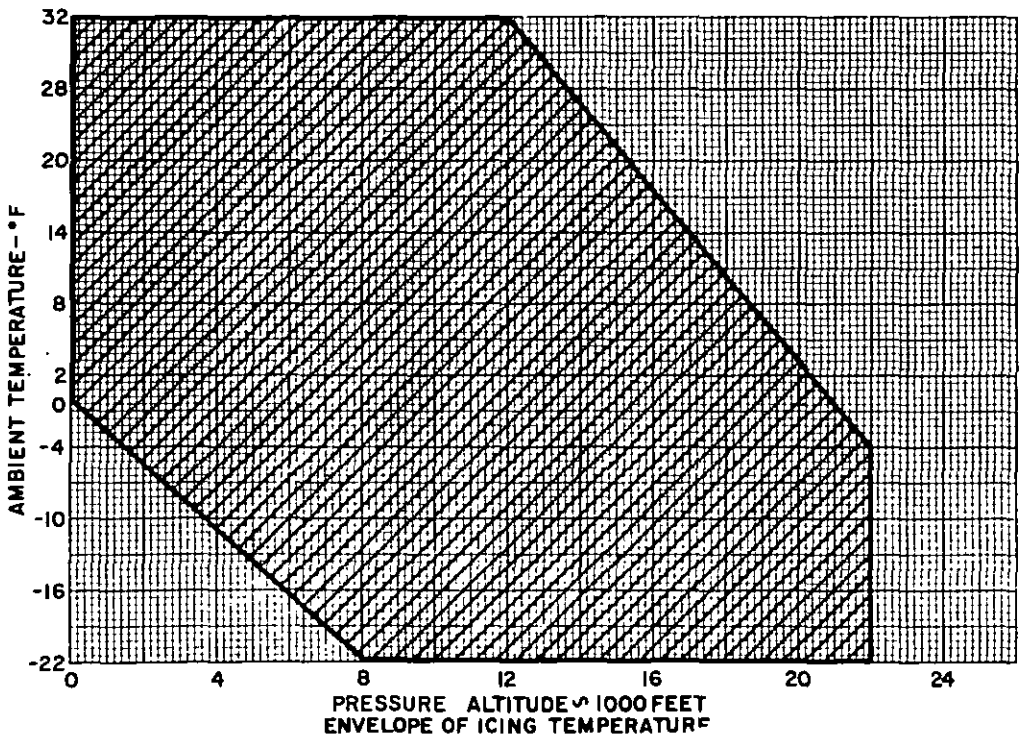
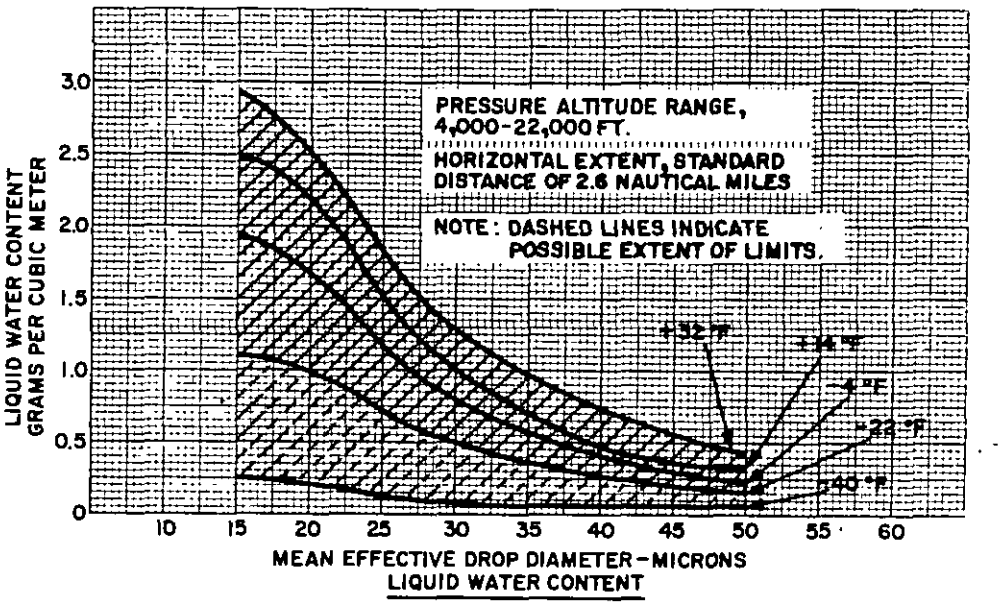


FIGURE 1. Continuous maximum atmospheric icing conditions.



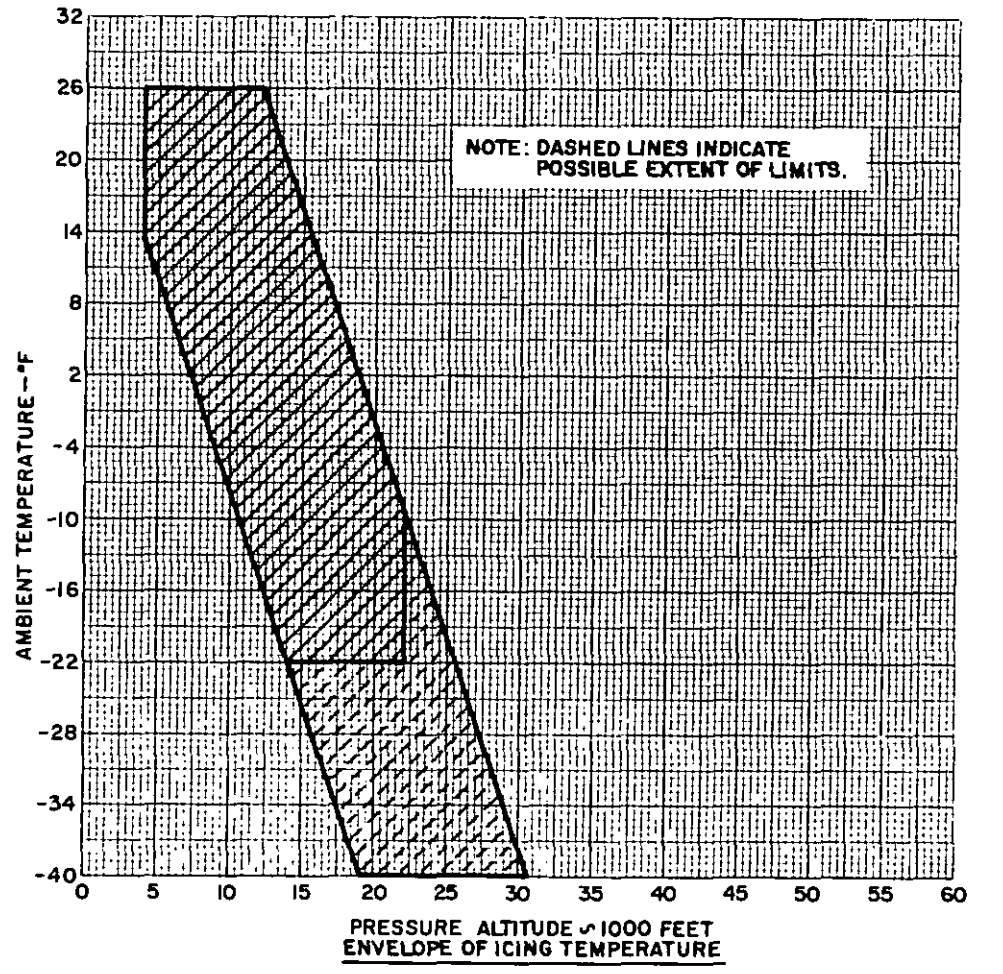


FIGURE 2. Intermittent maximum atmospheric icing conditions.

3.2.1.4 Ground operation humidity. For joint occurrence of high temperature and high humidity on the ground, the 1% curve of figure 3 shall be used in conjunction with 3.2.1.1 and 10% curve of figure 3 shall be used in conjunction with 3.2.1.2.

3.2.1.5 Occupant load. A moisture output of 0.5 pounds/hour per pilot and crew and 0.3 pounds/hour per passenger shall be included in the humidity levels within occupied compartments.

3.2.2 Visibility.

3.2.2.1 General. The vision and optical qualities of transparent areas shall be as specified in MIL-STD-850.

3.2.2.2.1 Aircrew stations. The critical viewing areas for aircrew stations shall conform to the minimum criteria as specified in MIL-STD-850.

3.2.2.2.2 Other transparent ares. The critical viewing areas for other transparent areas such as sensor windows and camera windows shall be the minimum clear area required to perform the mission of the aircraft.

3.3 Selection of materials, parts and processes. The materials, parts and processes used shall be selected primarily to accomplish the designated performance requirements. Specifications and standards for all materials, parts and processes which are not specifically designated herein, shall be selected in accordance with MIL-STD-143 and Military Bulletin 544 and shall require activity approval prior to use. Variations from designated items and the use of newly developed advanced materials shall require acquiring activity approval.

3.3.1 Non-specification material. The contractor shall be required to develop specifications for materials for which no federal, military or industry specifications exist. The specifications shall cover technical requirements, test methods and acceptance criteria for review and acceptance by the acquiring activity.

3.3.2 Metals. All metals used in the construction of the system shall be of a corrosion-resistant type or shall be suitably protected in accordance with 3.3.1.1. The use of dissimilar metals, as defined by MIL-STD-889, shall be avoided wherever practicable.

3.3.2.1 Corrosion-protection. Metals which do not inherently possess adequate corrosion-resistant characteristics shall be suitably protected to resist corrosion which may result from such conditions as dissimilar metal combinations, moisture, salt spray, high temperature

deterioration, galvanic corrosion, as applicable. Treatments that tend to promote stress corrosion in surfaces that contain residue tensile stresses shall be avoided.

3.3.2.2 Magnesium. Magnesium and magnesium alloys shall not be used.

3.3.2.3 Insulation materials. Materials used for thermal insulation in the system established by this specification shall be of minimum weight, flameproof, corrosion resistant, impervious to flammable liquids, resistant to deleterious effects of natural and induced environments peculiar to military operations and free from odor and smoke at all times. System design disclosure will clearly indicate where insulation is required (see 3.11).

3.3.2.4 Corrosion resistant steel. 19-9DL corrosion resistant steel shall not be used.

3.3.2.5 Fluids. Any fluid used in a system established by this specification shall be compatible with the transparency surface it is used on and with any other material it may contact. The fluid shall be noncorrosive, nontoxic and nonflammable. Detergents shall not be used.

3.3.3 Parts.

3.3.3.1 Standard parts. Standard parts (MS, AN or JAN) shall be used whenever they are suitable for the purpose, and shall be identified on the drawings by their part numbers. In the event there is no suitable corresponding military standard part in effect on date of invitation for bids, commercial parts may be used provided they conform to all requirements of this specification.

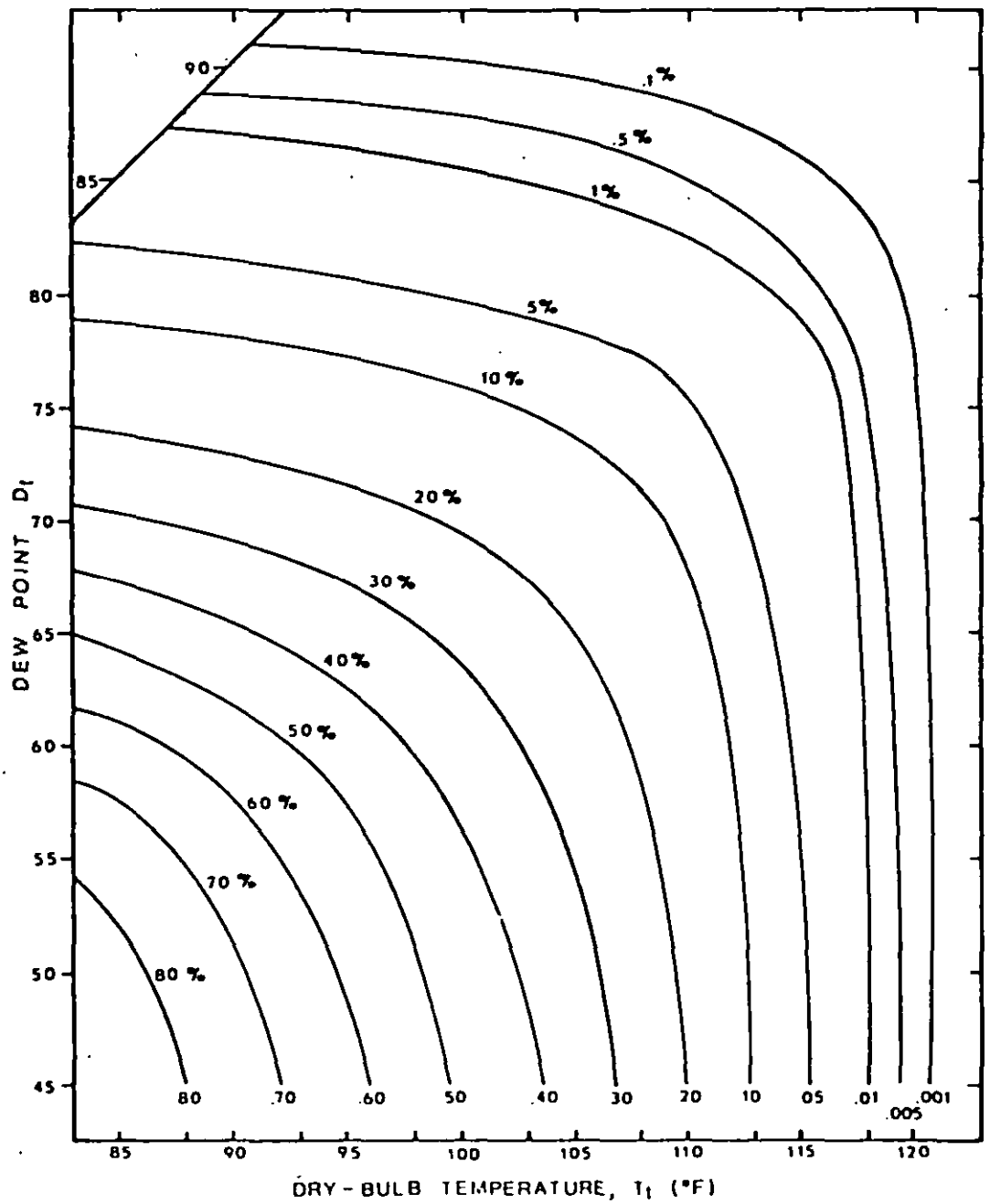
3.3.3.2 Interchangeability. All parts having the same part number shall be functionally and dimensionally interchangeable as specified in MIL-I-8500.

3.3.4 Protective treatment.

3.3.4.1 Painting. Exposed corrosion and heat resistant steel parts need not be painted. Finishes and coatings for all other exposed metal surfaces shall be type I in accordance with MIL-F-7179.

3.3.4.2 Aluminum. All aluminum and aluminum alloy parts shall be anodized in accordance with MIL-A-8625, type II. Parts which cannot be anodized shall receive chemical conversion treatment in accordance with MIL-S-5002.

3.3.4.3 Plating. Unless other surface treatments are approved by the acquiring activity, all steel parts shall be plated. The parts which reach a temperature detrimental to plating shall not require plating.



Joint values of high temperature (to 120°F) and high humidity which are equalled or exceeded 0.1, 0.5, 1, 5, 10, 20, 30, 40, 50, 60, 70 and 80 percent of the time (hours) of the most severe month in the world's severest joint high temperature, high humidity environment.

FIGURE 3. Joint values of high temperature and high humidity.

3.3.4.4 Chromium plating. Chromium plating shall be in accordance with QQ-C-320. Plating shall be applied directly on steel, and at a rate not to exceed 0.0005 inches per hour.

3.3.4.5 Zinc plating. Zinc plating shall be in accordance with ASTM B633. Zinc plating shall not be used on parts where the temperature may exceed 600°F (315°C) in service.

3.3.4.6 Cadmium plating. Cadmium plating shall be electrodeposited in accordance with QQ-P-416, type II, class 2, except cadmium plating shall not be used on parts where the temperature exceeds 450°F (232°C) in service.

3.3.4.7 Corrosion resistant steel parts. Corrosion resistant steel parts shall not be plated unless required for dissimilar metal interface or functional reasons. They shall be passivated in accordance with MIL-S-5002.

3.3.4.8 Threads. Machine screw threads shall conform to MIL-S-7742. Pipe threads shall conform to MIL-P-7105.

3.4 Performance requirements.

3.4.1 Ice protection. In an icing environment defined by 3.2.1.3, the exterior surfaces of all critical viewing areas (3.2.2.2) shall be kept free of ice, during all steady-state and transient operations.

3.4.2 Fog and frost protection. Interior surfaces of critical viewing areas (3.2.2.2) shall be maintained free of fog and frost for all steady-state ground and flight operating conditions. Critical viewing areas shall also be maintained free of fog and frost during maximum rate descent from the operational ceiling of the aircraft in the ambient environment defined by figure 4. Preheating of the critical viewing areas, by increasing occupied compartment air temperature above normal limits, prior to descent, shall not be required in order to maintain fog free surfaces. The normal fog and frost protection provisions shall not be disabled by closure of an air conditioning package shutoff valve.

3.4.3 Rain removal system. The rain removal system for windshields shall meet the clearing requirements of MIL-R-81589 regardless of the rain removal system selected. Rain removal for other transparent areas shall clear critical viewing areas (3.2.2.2) as required to meet mission requirements of the aircraft.

3.4.4 Snow removal. Snow removal shall be removed from critical viewing areas (3.2.2.2) during ground and flight conditions.

3.4.5 Transparency cleaning system. A cleaning system shall be provided which shall remove salt, dust, insects, gun gas residue

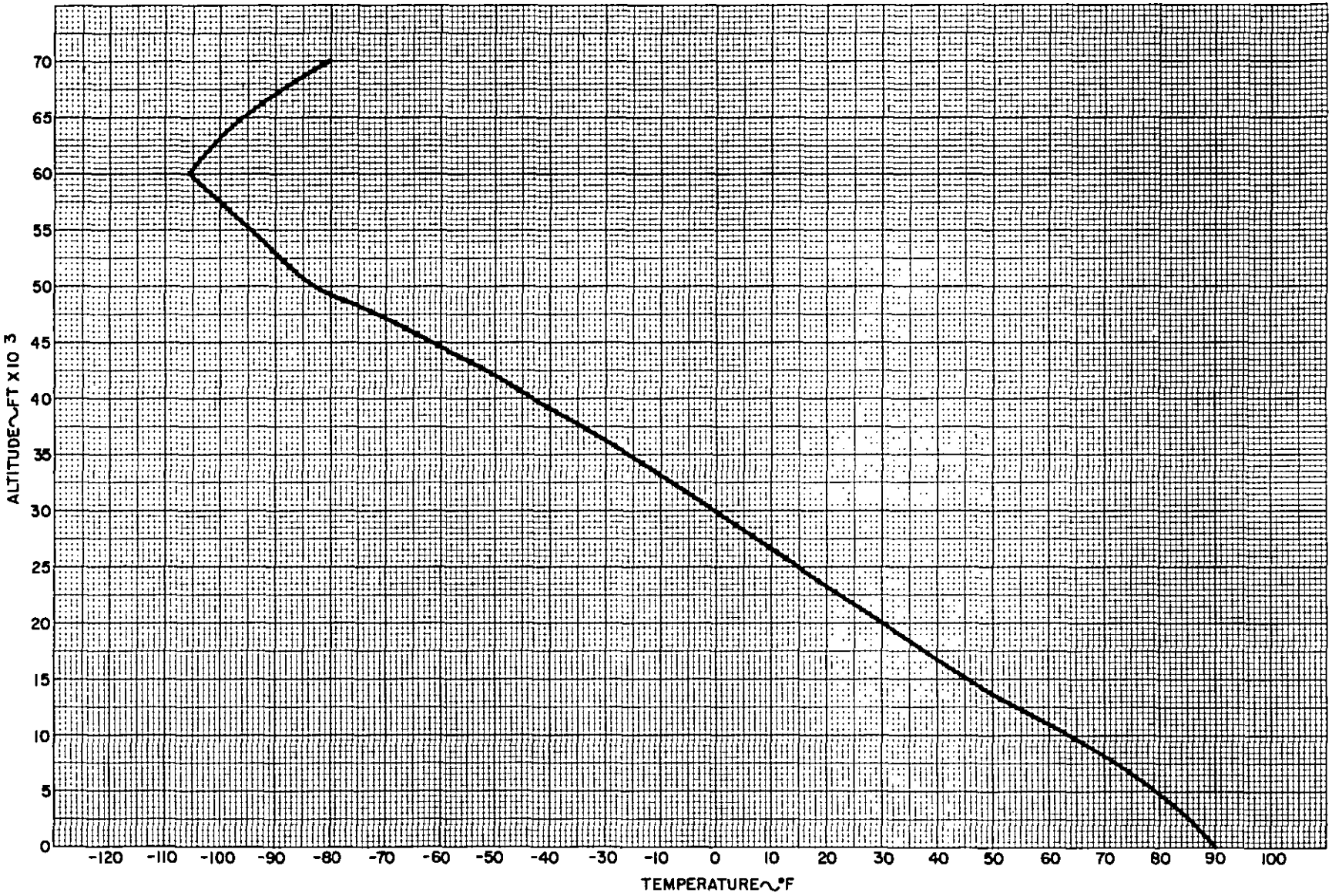


FIGURE 4. Upper air temperature profiles for design of windshield defogging systems.

and grease from reciprocating engines, and any other substance which would reduce visibility of the critical viewing areas (3.2.2.2). The cleaning system shall provide necessary cleaning of the critical viewing areas throughout any single mission.

3.4.6 Emergency vision. A clear vision panel (one which is capable of being opened in flight under conditions of ice, frost, and fog), or a section of transparent areas maintained in a clear condition under conditions of ice, frost, and fog, shall provide vision to the pilot in the event of failure of the normal defroster, defogging, or anti-icing system or systems. The clear vision panel or section of transparent area maintained in a clear condition, shall allow sufficient visibility to safely land the aircraft.

3.5 Design and construction.

3.5.1 General. The transparency clearance systems shall be designed to accomplish the performance requirements specified herein and shall conform to the detail requirements of the applicable specifications designated.

3.5.1.1 Failure concept. Designs shall minimize failures due to thermal expansion, corrosion, decrease in material strength at elevated temperature, vibration or any combination of these causes. The design shall be such that the failure of any single component shall not be hazardous to equipment and personnel. The applicable detail design shall clearly state the failure mode of the clearance system (see 3.11).

3.5.1.2 Water tightness. To the extent possible, entrance of water in the fuselage at system interfaces with the aircraft skin shall be prevented. Any water which enters the fuselage shall be removed with drains to avoid water accumulation. Such drains shall minimize the loss of airflow during system operation. When required, drain valve actuators shall be positioned above the horizontal centerline of the duct in which they are installed.

3.5.1.3 Protection of crew. The use of the system shall not cause physical discomfort to the crew.

3.5.2 Ice protection system. The ice protection system shall be designed to function by means of hot air, electrical conductive coatings, liquid spray, infrared radiation or a suitable method approved by the acquiring activity (see 3.11). Where applicable, the effects of aerodynamic heating may be included in the thermal analysis. The system shall be capable of operation during engine warm-up, taxiing, take-off, touchdown, as well as during normal flight envelope of the aircraft. Redundant systems shall be provided if more than one transparency is protected in the crew station. If redundant systems are required, failure of a single system shall not result in the failure of the remaining ice protection provisions to clear the transparent surfaces (windshields).

3.5.3 Defogging and defrosting systems. Defogging and defrosting systems may consist of hot air jets, double panes with hot air between panes, double pane with dry air insulating gap, electrically conductive coatings, infrared radiation, humidity control of cabin air, or any combination of these methods. Efforts shall be made to reduce the overheating effect in the occupied compartment when the defogging or defrosting system is on. Closing of the air conditioning package shutoff valve shall not prevent use of the defogging and defrosting provisions to enable a safe return and landing.

3.5.3.1 Chemical moisture control. Where chemicals are used for humidity control of cabin or transparent area defogging and defrosting, considerations shall be given to a continuous system in which the reactivation process is contained within the system. If a self-reaction system is not used, the chemicals shall be in a container such that this container shall be readily removed from the system and reactivated or replaced. The minimum allowable period between replacement or reactivation of the chemicals of a non-self-reaction system shall be 10 flights under the maximum condition of moisture removal.

3.5.4 Rain removal systems. Rain removal systems shall consist of either jet air blast, rain repellent, windshield wipers or any combination of these methods. The rain removal system shall not be damaged by flight at the maximum aircraft speed. If more than one method is used, failure of a single method shall not result in the failure of the remaining rain removal methods to clean the transparent surfaces.

3.5.4.1 Jet air blast system. Air blast system shall be in accordance with MIL-R-81367.

3.5.4.2 Rain repellent systems. In-flight applied rain repellent systems shall be in accordance with MIL-R-81589. Repellent systems shall not be used for washing foreign matter from windshields. Ground applied fluid repellent shall be in accordance with MIL-W-6882, as applicable.

3.5.4.3 Windshield wiper systems. Specifications for electric windshield wipers shall be provided by the prime aircraft contractor in accordance with 3.3.1. Hydraulic windshield wipers shall not be installed.

3.5.5 Insect and dust removal systems. Insect removal system performance shall be based on encountering insects of honeybee size (120 milligrams) at a concentration of one per 20,000 cubic feet. Vertical takeoff and landing aircraft shall have a washing system for maintaining the pilot and co-pilot's windshield free of dust based on a dust density of 0.1 grams per cubic foot of commercial 140 mesh silica flour.

3.5.6 Clear vision panels. Clear vision panels shall be so located or provided with deflectors in order not to cause undue discomfort to the crew when the panels are opened.

3.5.7 Heat distribution. Where hot air or electrical conductive coatings are used, the surface temperature at any point in the critical viewing area shall not vary more than 20°F (11°C) from any other point.

3.5.8 Hot air sources. Where hot air is used it shall be supplied in accordance with MIL-E-18927.

3.5.9 Electrical systems. The selection and installation of electrical equipment shall be in accordance with MIL-E-7080. Electrical power characteristics shall be in accordance with MIL-STD-704. All electric motors shall be explosion proof and self-ventilated. Electrical connectors shall be in accordance with MIL-C-38999, Series III or IV.

3.5.10 Tanks. Tanks shall be in accordance with MIL-T-6396. Tanks shall be readily removable for filling or shall be accessible for filling without removing. The tank shall be so located that rupture or leakage of toxic fumes or liquids shall not enter the cockpit, cabin, or other enclosure housing personnel. Instructions shall be provided on either the tank or the aircraft structure, near the filler neck and shall be so located as to be easily readable. The instructions for filling (and pressurizing if applicable), shall be simple and complete, using letters 1/2-inch high and including the following information, as applicable:

FILL WITH:
(Name and Specification number of fluid or fluids)
WHEN CHANGING FLUIDS DRAIN AND FLUSH WITH _____
CAPACITY_____
PRESSURIZE WITH _____ TO _____PSIG

(Additional filling instructions or data considered necessary)

3.5.11 Pressure relief valves and safety discs. The design of the system shall include pressure relief valves or other safety features as required to prevent overpressurizing or excess pressure due to thermal expansion.

3.5.12 Drain. Systems utilized for dual purposes shall provide means for draining and flushing the system at the lowest point.

3.5.12 Threaded fittings. AN and MS straight threaded fittings only shall be used and shall be assembled and connected in accordance with MS33649, MS33656 and MS21344.

3.5.14 Supports. All tubing shall be rigidly supported. Tube supports shall be such as to prevent injury to the tubing. The maximum spacing between supports shall not exceed 24 inches; except that where tubes support fittings, the spacings shall be suitably reduced.

3.5.15 Gauge. A suitable gauge shall be provided for indicating the amount of fluid in tanks exceeding one gallon capacity. The gauge shall be so located in the aircraft as to be plainly visible to operating personnel during flight.

3.5.16 Loss of fluid. The system shall be such that there shall be no loss of fluid during flight maneuvers of the aircraft.

3.5.17 Controls. Controls shall be in accordance with MIL-STD-203 or MIL-STD-250, as applicable.

3.5.17.1 Combustion heaters. When more than one combustion heater is used as a heat source, individual switches shall be provided to permit selection of heaters.

3.5.17.2 Exhaust heaters. On multi-engine aircraft using an exhaust gas heat exchanger as the heat source, the control shall include a multi-position switch to permit selection of hot air from either or both engines, as well as to provide an off position.

3.5.17.3 Conductive coatings. When electrically conductive coatings or infrared sources are used for anti-icing, they shall incorporate an automatic temperature control operated by means of a temperature sensing element in the transparent area. A multiposition switch having not less than an off, low (approximately 1/2 total power), and high position shall be used to operate the control system. When the conductive coatings are used solely for defrosting and defogging purposes, an "ON-OFF" switch may be used to operate the control, in lieu of a multi-position switch. Temperature sensing shall be from two of three identical sensors imbedded in the windshield. Built-in-test, operating in flight, shall be provided to verify normal operation of the temperature controller and for normal operation of the temperature sensors. An indication of any abnormal condition shall be provided to the cockpit.

3.5.17.4 Overheating. Temperature limiting devices, insulation or other methods shall be used, as necessary, to prevent any system or other aircraft component from exceeding any of the following:

a. A surface temperature which would be hazardous to occupants as specified in MIL-STD-1472.

b. Its design temperature limitations.

c. The self ignition temperature of any flammable material (liquid or solid) to which it is exposed (normally or accidentally). Cockpit indication of an overheat condition in the system or any transparency shall be provided.

3.6 Reliability. Reliability shall be a basic consideration in the design of all components used in the system. A reliability program shall be established in accordance with MIL-STD-785. The design goal reliability expressed quantitatively in MTBF for each system operating life shall be furnished as part of Design Approval Report (see 3.11). Each system covered by the specification shall have a minimum operating life of 1000 hours.

3.7 Survivability. The survivability and vulnerability of the system shall be in accordance with MIL-STD-2072.

3.8 Maintainability. The equipment shall be designed in accordance with the qualitative and quantitative maintainability requirements utilizing MIL-STD-470 as a design guide.

3.9 Safety. The transparent area clearance system shall be designed to preclude the incorporation of features which result in critical or catastrophic hazards as specified in MIL-STD-882.

3.10 Human engineering. The design of the system shall conform to the requirements of MIL-STD-1472.

3.11 Design data. Prior to the installation of an ice, frost, fog, rain, salt, insect, dust, gun gas residue, or grease protection system in an airplane, the contractor shall submit to the acquiring activity for approval, a report on the design of the system or systems. The report shall show a schematic drawing of the proposed system and the complete design for compliance with requirements. This data shall be detailed and shall show the methods used in arriving at the necessary capacity of the system or systems, an explanation or description of system operation, the heat distribution and the airflow considering various altitudes, conditions of flight and ground operation and effect on personnel comfort, as specified in this specification.

3.12 Test plan. A report covering the proposed laboratory and flight tests, required to prove the system design, shall be submitted to the acquiring activity for comment and approval prior to the conducting of the final laboratory or flight tests required to prove the system performance. It shall include an outline of the type and location of the instrumentation, conditions of test and methods of test. The instrumentation shall be complete enough to determine heat flows through the area, to determine the dew point at each transparent area, and to insure that the area will not be overheated. In the event that flights cannot be accomplished under the most critical design atmospheric temperatures, the test data shall be recorded at the actual conditions and accurately extrapolated to the design atmospheric conditions of 3.2. The tests shall include those coordinated or combined with the tests required in related system specifications as follows:

a.	Environmental systems	MIL-T-18606
b.	Anti-ice, thermal	MIL-T-18607
c.	Rain removal, jet blast	MIL-R-81367
d.	Rain repellent	MIL-R-81589

3.13 Acceptance tests of components. A report covering the proposed laboratory tests required to prove the component design, shall be submitted to the acquiring activity for comment and approval prior to the conducting of the final laboratory tests required to prove the component performance. It shall include an outline of the type and location of instrumentation, condition of test and method of test. Acceptance tests shall include the following tests:

a. Examination of product.

b. Performance.

c. Proof pressure.

d. Pressure drop.

e. Leakage.

f. Rotational overspeed.

g. Dielectric.

h. Insulation resistance.

i. Burn-in.

3.14 Acceptance tests. Production acceptance (sampling) reliability tests shall be specified by the acquiring activity.

3.15 Qualifiation tests. Qualification (demonstration) reliability tests shall be specified by the acquiring activity.

3.16 Pneumatic components. Qualification of pneumatic components shall be in accordance with MIL-E-18927.

3.17 Workmanship. The workmanship displayed in fabrication and assembly of the system shall be such as to assure, within design limitations, the ability of the system to meet the performance requirements under all applicable environmental conditions specified herein. Unauthorized repair, welding, heavy burrs, or parts assembled by introduction of high stresses not prescribed in the design, are typical signs of inferior

workmanship and shall be cause for rejection. The standards of workmanship exhibited in the approved system, subject to any qualification stated in the Government's Notice of Approval, shall be determinative of the requirements of the contracts relative to workmanship (see 4.2).

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Examination of installation. Each installation shall be inspected to determine compliance with the requirements specified herein. This shall include a visual inspection of the construction and serviceability of the system.

4.3 Demonstration tests. The first installation of each model aircraft or subsequent major changes in the system or aircraft shall be tested to demonstrate compliance with the performance requirements of this specification. Design heat transfer, fluid flow and other conditions shall be flight tested to verify that the quantity computed as part of approved design are met in flight and on the ground. Rain, salt, insect and dust removal systems shall be tested in a wind tunnel facility simulating operational conditions.

4.3.1 Ice protection. With the external surface of the transparency maintained above 35°F (2°C), the ice protection system shall be tested to demonstrate compliance with 3.4.1 without causing overheating or other detrimental effects on the transparency. The heat losses from the inner surface shall not be considered as a part of the basic heat flow which must be conducted to the exterior surface.

4.3.2 Rain removal. Testing of the rain removal system shall be in accordance with MIL-R-81367 and MIL-R-81589 as applicable, except that the clearance demonstration shall be in accordance with MIL-R-81589 regardless of the system used.

4.3.3 Emergency vision test. The emergency vision panel described in 3.4.6 shall be evaluated by making an actual landing in which vision is through the panel and conducted with clear viewing areas.

4.3.4 Ducting tests. When ducting is used in any part of the system or systems, it shall be tested for flow rates, temperature drops, pressure drops, and duct leakage. The methods and instrumentation to be used by the contractor shall be outlined in the approved test plan (see 3.12).

4.4 Environmental tests of components. Components shall be subjected to the environmental tests specified in MIL-STD-810. Failure to pass specified tests shall be cause for rejection.

a. High temperature test, Method 501.1.

b. Low temperature test, Method 502.1.

c. Humidity test, Method 507.1.

d. Altitude test, Method 500.1.

e. Salt spray test, Method 509.1.

f. Vibration test, Method 514.2.

g. Fungus resistance test, Method 508.1.

h. Sand and dust test, Method 510.1.

i. Acceleration test, Method 513.2.

j. Shock test, Method 516.2.

4.5 Final report. A final report shall be prepared to consolidate all test results. This report shall compare detail test requirement to test results. The impact of and action proposed on any failure to meet requirements shall be included in this report. Acquiring activity approval of the final report shall be required as a condition of system(s) acceptance.

5. PREPARATION FOR DELIVERY. Not applicable.

6. NOTES

6.1 Intended use. This specification is intended to outline the basic design, construction, test and inspection of systems for prevention and removal of ice, frost, fog, rain, salt, snow, insects, dust, gun gas residue and grease from transparent areas on military aircraft skin surfaces.

6.2 Data requirements. When this specification is used in an acquisition which incorporates a DD Form 1423, Contract Data Requirements List (CDRL), the data requirements identified below shall be developed as specified by an approved Data Item Description (DD Form

1664) and delivered in accordance with the approved CDRL incorporated into the contract. When the provisions of the DAR 7-104.9(n)(2) are invoked and the DD Form 1423 is not used, the data specified below shall be delivered by the contractor in accordance with the contract or purchase order requirements. Deliverable data required by this specification is cited in the following paragraphs.

Paragraph	Data Requirement	Applicable DID
3.3, 3.3.4.3	Request for acquirement activity approval of deviation, waiver or change	DI-E-3129/C-142
3.3.1	Material specification	DI-E-3131/C-144
3.11	Design approval	UDI-S-23272C
4.5	Test report	UDI-S-23272C
4.1	Report of inspection and tests	UDI-S-23272C
3.12	Test plan	DI-T-5204

(Copies of data item descriptions required by the contractors in connection with specific acquisition functions should be obtained from the Naval Publications and Forms Center or as directed by the contracting officer.)

Preparing Activity
Navy - AS
(DOD Project No. 1650-N116)

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5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
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