

MIL-R-81589 (AS)

27 August 1968

MILITARY SPECIFICATION

RAIN REPELLENT FLUID APPLICATION SYSTEM
AIRCRAFT WINDSHIELD

This Specification has been approved by the Naval
Air Systems Command, Department of the Navy,
Washington, D.C.

1. SCOPE

1.1 This Specification covers a system for the application of rain repellent fluid conforming to Specification MIL-R-81261(WP) to the windshields of manned aircraft.

2. APPLICABLE DOCUMENTS

The following documents, of the issue in effect on the date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONSMilitary

MIL-D-1000	Drawings, Engineering and Associated Lists
MIL-W-5088	Wiring, Aircraft, Installation of
MIL-E-5272	Environmental Testing, Aeronautical and Associated Equipment, General Specification for
MIL-S-8805/3A	Switches and Switch Assemblies, Sensitive and Push. (Snap Action) General Specification for
MIL-R-81261	Rain Repellent, Glass Window and Windshield for In-Flight Application
MIL-T-81587	Timer-Rain Repellent Application System Enclosure (1)

STANDARDSMilitary

MIL-STD-143	Specifications and Standards, Order of Precedence for the Selection of
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STANDARDS (Cont'd.)

Military (Cont'd.)

MS-29527 Valve, Solenoid

MS-33574 Dimensions, Basic, Cockpit, Stick Controlled
Fixed Wing Aircraft

MS-33576 Dimensions, Basic, Cockpit, Wheel Controlled
Fixed Wing Aircraft

Drawings

C10-12833 Container - Rain Repellent Fluid (Naval Air
Development Center)

(When requesting applicable documents, refer to both title and number. Copies of unclassified documents may be obtained from the Commanding Officer, Naval Supply Depot (Code 1051) 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120. Requests for copies of classified documents should be addressed to the Naval Supply Depot, Via the Cognizant Government Inspector).

3. REQUIREMENTS

3.1 Prototype Inspection - The rain repellent fluid application system furnished under this specification shall be a product which has been inspected and has passed the prototype inspection specified herein.

3.2 Materials - Materials and processes used in the manufacture of component parts shall be of high quality, suitable for the intended purpose and shall conform to the applicable drawings and specifications.

3.2.1 Selection of specifications and standards - Specifications and standards for necessary commodities and services not specified herein shall be selected in accordance with Standard MIL-STD-143, except as provided in 3.2.2.

3.2.1.1 Commercial parts having suitable properties may be used where, on the date of invitation for bids there are no suitable standard parts.

3.2.2 Electrical wiring shall conform to the requirements of Specification MIL-W-5088.

3.3 Design and Construction - The Rain Repellent System shall be comprised of the following components:

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3.3.1 Fluid Container - The fluid container shall conform to Naval Air Development Center Drawing C10-12833. It shall be mounted on a bracket suitable for attaching to the aircraft structure. The bracket shall include a saddle and clamp to provide support for the container. The bracket shall be installed in the aircraft in a readily accessible location to facilitate the removal and replacement of the fluid container.

3.3.2 Container Adapter Block Assembly - The container adapter block assembly shall conform to Figure 1, in either the left hand or the right hand configuration, whichever will result in the most desirable installation. The adapter block assembly shall consist of the detail parts shown on Figures 2, 3 and 4.

3.3.3 Solenoid Valve - The solenoid valve shall conform to Military Standard MS-29527-1. The solenoid valve shall be installed as close to the dispensing nozzle or nozzles as structural considerations will permit. (The repellent fluid hydrolyzes and would clog a long lead between valve and nozzle).

3.3.4 Dispensing Nozzle - One or more dispensing nozzles shall be provided. The nozzle may be either in the form of a block with one or more orifices or a hollow bar or tube with several orifices. If more than one block type nozzle is used, the design shall provide for the required flow of fluid to each nozzle. If hollow bar or tube type nozzle is used, fluid shall be fed into the bar or tube at both ends.

3.3.5 Interval Timer - The interval timer shall conform to Specification MIL-T-81587.

3.3.6 Momentary Contact Switch - The momentary contact switch shall conform to Specification MIL-S-8805/3A. The switch shall be located in the upper forward left corner of the cockpit on the underside of or below the glareshield.

3.4 Performance -

3.4.1 Operation - The system shall be operated by a momentary contact switch. Rain repellent fluid shall be dispensed during a time interval determined by the setting of the interval timer (3.3.5). The volume of fluid dispensed, as established by the timer setting and the number and size of the nozzle orifices, shall be the minimum volume required to provide the visibility specified in 3.4.2.

3.4.2 Visibility - The rain repellent system shall insure that the minimum visibility as established by the visibility index is maintained through the required clear area of the windshield (see Figure 5)

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during all aircraft flight conditions in rainfall ranging from the design point of the jet blast or wiper system up to four inches per hour. (See Table I).

TABLE I

Rain Definitions					
Rain Condition	Precipitation Intensity		Droplets Dia. (mm)	Milligrams of Liquid Water/per cu Meter of Air	Grains of Liquid Water Per Cu Ft of Air
	mm/hr	in/hr			
Light	1.00	0.04	0.45	138.9	0.06
Moderate	4.00	0.16	1.0	277.8	0.12
Heavy	15.00	0.59	1.5	833.3	0.365
Excessive	40.00	1.6	2.1	1851.9	0.81
Cloudburst	100.00	4.0	3.0	4000.0	1.75

(Air density as at 0°C and 740 mm Hg pressure)

3.4.2.1 Required Clear Area - The limits of the required clear area on the external surface of the windshield panel(s) shall be determined with respect to the pilot's (co-pilot's) eye position defined by MS 33574 or MS 33576. The minimum upper limit of the clear area shall be defined by the external intersection of the windshield panel(s) and a horizontal plane passing through the pilot's (co-pilot's) eye position with the aircraft at maximum expected nose-down attitude during approach and landing. The minimum transverse extent of the clear area shall be defined by the external intersection of the windshield panel(s) and two vertical planes passing through and measured from the pilot's (co-pilot's) eye position, one 13 degrees horizontally to the left and one 13 degrees horizontally to the right. The lower limit of the clear area shall be defined by the lower extent of the windshield panel(s) or the upper limit of intervening structure as viewed from the pilot's (co-pilot's) eye position.

3.4.2.2 Visibility Index - The visibility index for the required clear area shall be defined as the area weighted average of the local visibility factors. It shall be computed as given below and as illustrated in Figure 5.

$$\text{Visibility index} = \frac{(\text{Local visibility factor} \times \text{local area})}{(\text{Local areas comprising required clear area})}$$

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3.4.2.1 Local Visibility Factors - Local visibility factors shall be determined from the description in Table II.

TABLE II

Observed Physical Conditions

Windshield Condition	Visibility Thru Windshield	Local Visibility Factor
Droplets hit, shatter and are blown away	Good	9
	Fair	7
	Poor	4
Droplets hit and roll away	Good	8
	Fair	6
	Poor	3
Droplets adhere and grow in size before being blown away	Good	6
	(See Note 1) Fair	4
	(See Note 2) Poor	2
	(See Note 3) Very Poor	1
Droplets form water trails	Good	7
	(See Note 1) Fair	5
	(See Note 2) Poor	3
	(See Note 3) Very Poor	1

NOTES: 1. Droplets or water trails obscure less than 25% of the required clear area.

2. Droplets or water trails obscure from 25 to 50% of the required clear area.

3. Droplets obscure more than 50% of the required clear Area.

3.4.3 Vibration - The assembly consisting of the container, the supporting bracket, clamp, and the container adapter block, shall withstand the vibration test specified in 4.6.5.

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4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection - Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities 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 conformed to prescribed requirements.

4.2 Classification of inspection - The inspection of the rain repellent application system shall be classified as follows:

- a. Prototype Inspection
- b. Quality Conformance Inspection

4.3 Prototype Inspection - Prototype inspection on the rain repellent system shall consist of the following tests in the order listed:

Sample 1

- a. Endurance (4.6.2.)
- b. Pressure Test (4.6.3.)

Sample 2

- a. Visibility (4.6.4.)
- b. Vibration (4.6.5.)

4.3.1 Sampling for prototype inspection - Unless otherwise specified, as soon as practicable after award of a contract or order, the contractor shall furnish two prototype samples for inspection to determine conformance with this specification. A prototype sample shall consist of all the components necessary to assemble a complete rain repellent system. The sample shall be identified with the manufacturer's part number and contract number and shall be inspected as specified herein.

4.4 Quality Conformance Inspection - Each rain repellent system shall be subjected to the examination specified in 4.6.1. Any system component containing a defect shall be rejected and replaced. After replacement of the component, the system shall be completely reinspected.

4.5 Test Conditions - Specific environmental conditions for each test are described under inspection methods (4.6).

4.6 Inspection Methods

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4.6.1 Examination - The system shall be thoroughly examined to determine conformance with this specification and applicable drawings with respect to all requirements not covered by tests.

4.6.2 Endurance - A completely assembled rain repellent system shall be subject to an endurance test consisting of 2000 cycles of operation at a rate of 6 ± 1 cycle, per minute. One-thousand (1000) cycles shall be accomplished with the interval timer set to provide a $1.5 \pm .02$ second pulse to the solenoid valve and 1000 cycles with the timer set to provide a $4.5 \pm .02$ second pulse. A 28 V.D.C. pulse of $.5 \pm .05$ seconds to the interval timer shall initiate each cycle. In event of a malfunction of any component in the system, the component shall be replaced and the test re-run.

4.6.3 Pressure Test - The rain repellent system shall be subjected to an internal pressure of 200 ± 5 p.s.i. for one hour. A gage of suitable range shall be substituted for the fluid supply gage (Figure 4) for this test. There shall be no evidence of leakage or failure of any of the component parts.

4.6.4 Visibility -

4.6.4.1 The rain repellent system shall be installed in a mock-up of the upper forward fuselage including the windshield panels and adjacent structures. The mock-up shall be instrumented to monitor the volume of fluid dispensed and the dispensing time interval. The mock-up shall be operated to ensure that:

- a. Simulated velocity range is equal to that of the aircraft.
- b. The rain repellent fluid pattern covers the required clear area (See Figure 5).
- c. Rain Droplet size and intensity can be controlled to the values specified in Table I.

4.6.4.2 Clearance Demonstrations - Clearance conforming to the minimum visibility index shall be demonstrated at velocities, mock-up angles of attack, and rainfall rates corresponding to the following conditions:

a. Power approach at minimum practical landing gross weight and speed of (V power approach minimum -5 knots) with light, moderate, and heavy rain. The minimum visibility index shall be 6.0.

b. Power approach at maximum landing design gross weight and speed of 1.4 (V stall) light, moderate, and heavy rain. The minimum visibility index shall be 6.0.

c. Landing with an idle engine power setting at minimum practical landing gross weight and speed of (V stall) landing with light, moderate, and heavy rain. The minimum visibility index shall be 6.0.

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4.6.4.2 (cont.)

d. Landing with an idle engine power setting at maximum landing design gross weight and speed of 1.2 (V stall) landing with light, moderate, and heavy rain. The minimum visibility index shall be 6.0.

e. Power approach configuration at optional gross weight, speed and rain conditions, selected for the most feasible comparison required by the flight tests (See 4.6.4.3); the minimum visibility index shall be 6.0.

4.6.4.3 Flight Test - Flight tests shall be conducted on the rain repellent system under conditions closely duplicating those of 4.6.4.2(e) to verify the results of the clearance demonstrations conducted as specified in 4.6.4.2(a) (b) (c) and (d), or to provide an approximate correction factor. The minimum visibility index shall be 6.0.

4.6.5 Vibration - The assembly consisting of the container, the supporting bracket and clamp, and the container adapter block shall be subjected to the vibration test, procedure XII of MIL-E-5272, without evidence of cracking, permanent deformation, or structural failure.

5. PREPARATION FOR DELIVERY (NOT APPLICABLE)

6. NOTES

6.1 Intended Use - The rain repellent application system is intended for use to repel rain from the windshields of manned aircraft in rainfall exceeding the design points of jet blast and wiper systems.

6.2 Information for Contracting Officer - Contracts or order should specify the following:

a. Title, number, and date of this specification

b. Items of data required (See 6.3)

c. Engineering change procedure in accordance with BUWEPSINST 4275.2A, enclosure (1)

d. Rain repellent systems subjected to tests other than those listed under quality conformance inspection are not to be considered or shipped as part of the contract or order.

6.2.1 Contracts or orders should specify the following provisions for prototype component inspection.

6.2.1.1 Whether prototype component inspection is required. When a contractor is in continuous production of the items from contract to contract, consideration should be given to waive the prototype component inspection. If prototype component inspection is required, indicate:

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a. where the prototype component inspection is to be conducted (at the contractor's plant or Government or commercial laboratory).

b. that the approval of prototype samples or the waiving of the prototype component inspection shall not relieve the contractor of his obligation to fulfill all other requirements of the specification and contract.

6.3 Data - Data information shall be in accordance with MIL-D-1000.

6.3.1 Prototype Data - When prototype samples are submitted (See 6.2) they should be accompanied by one complete set of manufacturer's drawings, the contractor's model specification, a parts list, and a complete test report showing the results of the contractor's tests. The test report should include the following:

a. Report of all tests, graphically presented when possible, together with a detailed statement indicating compliance or extent of non-compliance with all requirements of this specification, referring specifically to paragraph numbers. Whenever a requirement is considered to be not applicable, the report should so state.

b. Summary of visibility tests.

c. Diagrams of test setups.

d. Reproducible outline and description of tests and test conditions. Where tests specified in this specification are not considered applicable, the reasons and the substituted tests should be clearly described.

e. Copies of test log sheets.

f. Photographs when available.

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DEPARTMENT OF THE NAVY

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Washington, D.C. 20360

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DEPARTMENT OF THE NAVY
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SPECIFICATION MIL-R-81589(AS) RAIN REPELLENT FLUID APPLICATION SYSTEM AIRCRAFT WINDSHIELD		
ORGANIZATION (Of submitter)		CITY AND STATE
CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT \$
MATERIAL PROCURED UNDER A <input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT		
1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? A. GIVE PARAGRAPH NUMBER AND WORDING.		
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3. IS THE SPECIFICATION RESTRICTIVE? <input type="checkbox"/> YES <input type="checkbox"/> NO IF "YES", IN WHAT WAY?		
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