

MIL-R-81367(WP)

4 April 1966

MILITARY SPECIFICATION

RAIN REMOVAL SYSTEM, AIRCRAFT WINDSHIELD, JET AIR BLAST

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

1. SCOPE

1.1 This specification covers jet air blast rain removal systems for use on the windshields of manned aircraft.

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

Military

MIL-A-8806	Acoustical Noise Level in Aircraft, General Specification for
MIL-B-81365	Bleed Air Systems, General Specification for

STANDARDS

Military

MIL-STD-210	Climatic Extremes for Military Equipment
MS33574	Dimensions, Basic, Cockpit, Stick-Controlled, Fixed Wing Aircraft

FSC 1680

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STANDARDS

Military(continued)

MS33576

Dimensions, Basic, Cockpit, Wheel
Controlled, Fixed Wing Aircraft

(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 component inspection - The jet air blast rain removal system furnished under this specification shall be a product which has been inspected and has passed the prototype component inspection specified herein.

3.2 General - The requirements of MIL-B-81365 shall apply as requirements of this specification with the exceptions and additions noted herein. When the two specifications conflict this specification shall govern.

3.3 Design and construction -

3.3.1 Controls - The system shall be operated by an on-off control. Any necessary regulation within the system shall be automatic. The on-off control shall be suitably protected to prevent inadvertent operation.

3.3.2 Overheat caution - An overheat caution system shall be provided to indicate overheat of the windshield, adjacent structure, or accessories. Overheat condition shall be indicated by a caution light.

3.3.3 Acoustical noise level - Operation of the rain removal system shall not raise the acoustical noise level in any part of the aircraft intended for occupancy by the crew or other personnel above the short duration requirements of MIL-A-8806 during takeoff, or above the normal requirements during cruise, approach, landing, and taxiing.

3.3.4 Safety - All components of the system shall be failsafe.

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3.3.5 Functional range - The system shall be capable of operation in light to heavy rain (See Table I) with no overstressing or overheating of the windshield during all flight conditions (takeoff, cruise, approach, landing, and taxiing) throughout the following atmospheric conditions.

- (a) Altitude - sea level to the operational ceiling of the aircraft
- (b) Ambient temperature - as specified in MIL-STD-210 for hot and cold atmospheres

3.4 Performance - The jet air blast rain removal system and components shall meet the performance requirements specified in MIL-B-81365. and the following:

3.4.1 Visibility - The jet air blast rain removal system shall ensure that minimum visibility (see 4.6.6) is maintained through the required clear area of the windshield (see 4.6.6.3 and Figure 1) during all aircraft flight conditions in light, moderate, and heavy rain (see Table I) without overheating or overstressing the windshield or adjacent structure.

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 commercial laboratory acceptable to 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 Classification of inspection - The inspection of the jet air blast rain removal system shall be classified as follows:

- (a) Prototype component inspection
- (b) Quality conformance inspection

4.3 Prototype component inspection - Prototype component inspection on the rain removal system shall consist of the following and in the order listed:

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Sample 1

- (a) Proof pressure (4.6.2)
- (b) Endurance (4.6.3)
- (c) Flow resonance (4.6.4)
- (d) Burst pressure (4.6.5)

Sample 2

- (a) Visibility (4.6.6)
- (b) Vibration (4.6.7)

4.3.1 Sampling for prototype component inspection - Unless otherwise specified, as soon as practicable after award of a contract or order, the contractor shall furnish prototype samples for inspection to determine conformance with this specification. Prototype samples shall consist of two complete rain removal systems on contract or order. The samples shall be identified with the manufacturer's part number and contract number and shall be inspected as specified herein and in accordance with the contract or order (see 6.2).

4.3.1.1 A sample shall consist of all components necessary to assemble a complete system.

4.4 Quality conformance inspection - The quality conformance inspection shall consist of individual inspection.

4.4.1 Individual inspection - Each jet air blast rain removal system on contract or order shall be subjected to the following inspection. Any system component containing a defect shall be rejected and replaced. After replacement of the component, the system shall be completely reinspected.

- (a) Examination (4.6.1)

4.5 Test conditions - Specific environmental conditions for each test shall be as described under inspection methods where required.

4.6 Inspection methods -

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

4.6.2 Proof pressure - The jet air blast rain removal system shall be subjected to and shall pass the proof pressure test specified in MIL-B-81365.

4.6.3 Endurance - The jet air blast rain removal system shall be subjected to and shall pass the endurance test specified in MIL-B-81365.

4.6.4 Flow resonance - The jet air blast rain removal system shall be subjected to and shall pass the flow resonance test specified in MIL-B-81365.

4.6.5 Burst pressure - The jet air blast rain removal system shall be subjected to and shall pass the burst pressure test specified in MIL-B-81365.

4.6.6 Visibility

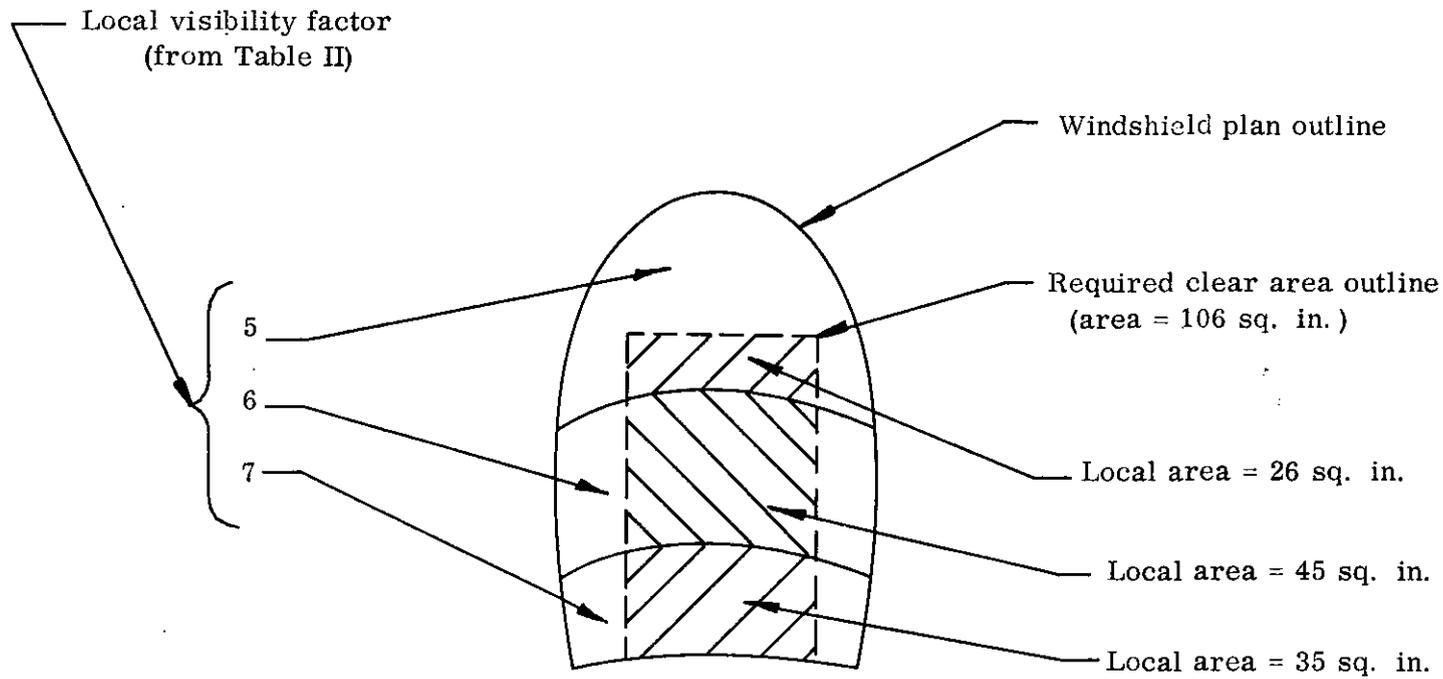
4.6.6.1 The jet air blast rain removal system shall be installed in a functional mock-up of the forward fuselage including the windshield panels and adjacent structures. The mock-up shall be instrumented to monitor critical windshield and structural temperatures and jet air blast flow rates. The mock-up shall be operated to ensure that:

- (a) Simulated flight velocity range is equal to that of the aircraft.
- (b) Jet air blast patterns cover the required clear area (see Figure 1).
- (c) Rain droplet size and intensity can be controlled to the values specified in Table I.

TABLE I

Rain Definitions					
Rain Condition	Precipitation Intensity		Droplet Diam. mm.	Milligrams of Liquid Water per cu. meter of air	Grains of Liquid Water per cu. ft. of air
	mm. per hour	inches per hour			
Light Rain	1.00	0.04	0.45	138.9	0.06
Moderate Rain	4.00	0.16	1.0	277.8	0.12
Heavy Rain	15.00	0.59	1.5	833.3	0.365

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



$$\text{Visibility index} = \frac{5 \times 26 + 6 \times 45 + 7 \times 35}{26 + 45 + 35} = \frac{645}{106} = 6.1$$

Figure 1. Sample Visibility Index Computation

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4.6.6.2 Local visibility factors - Local visibility factors shall be determined from the description in Table II.

TABLE II.

Local Visibility Factors				
Local Visibility Factor	Observed Windshield Physical Conditions			
	Intensity (See Table I)	Evaporation	Runback	Visibility thru Runback
10	None	---	---	---
9	Light	Immediate	---	---
8	Light	Partial	1 inch	---
8	Moderate	Immediate	---	---
7	Light	Partial	2 inch	---
7	Moderate	Partial	1 inch	---
7	Heavy	Immediate	---	---
6	Light	Partial	Considerable	---
6	Moderate	Partial	2 inch	---
6	Heavy	Partial	1 inch	---
6	Light	Unnoticeable	Continuous	Good
5	Moderate	Partial	Considerable	---
5	Heavy	Partial	2 inch	---
5	Light	Unnoticeable	Continuous	Fair
5	Moderate	Unnoticeable	Continuous	Good
4	Heavy	Partial	Considerable	---
4	Light	Unnoticeable	Continuous	Poor
4	Moderate	Unnoticeable	Continuous	Fair
4	Heavy	Unnoticeable	Continuous	Good
3	Light	Unnoticeable	Continuous	Very Poor
3	Moderate	Unnoticeable	Continuous	Poor
3	Heavy	Unnoticeable	Continuous	Fair
2	Moderate	Unnoticeable	Continuous	Very Poor
2	Heavy	Unnoticeable	Continuous	Poor
1	Heavy	Unnoticeable	Continuous	Very Poor

4.6.6.3 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

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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.

4.6.6.4 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 illustrated in Figure 1.

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

4.6.6.5 Clearance demonstrations - Clearance conforming to the minimum visibility index shall be demonstrated at velocities, mock-up angles of attack, and jet air blast nozzle configurations corresponding to the following conditions. There shall be no overheating or overstressing of the windshield panels or adjacent structure.

- (a) Power approach at minimum practical landing gross weight and speed of $(V_{\text{power approach minimum}} - 5 \text{ knots})$ for a 90° F day 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 $1.4(V_{\text{stall}})$ landing for a 90° F day with 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 for a 90° F day with light, moderate, and heavy rain. The minimum visibility index shall be 4.4.
- (d) Landing with an idle engine power setting at maximum landing design gross weight and speed of $1.2(V_{\text{stall}})$ landing for a 90° F day with light, moderate, and heavy rain. The minimum visibility index shall be 4.4.

- (e) Power approach configuration at optional gross weight, speed, temperature, and rain conditions selected for the most feasible comparison required by the flight tests (see 4.6.6.7). The minimum visibility index shall be 6.0.

4.6.6.6 Temperature demonstrations - Temperature effects of system operation shall be demonstrated using the mock-up system at velocities, mock-up angles of attack, and jet blast nozzle configurations corresponding to the following conditions. There shall be no overheating or overstressing of the windshield panels or adjacent structure and the minimum visibility index shall be 6.0.

- (a) Takeoff at minimum operational gross weight and speed of $1.2 (V_{stall})$ takeoff for a 90° F day with light rain for 3 minutes.
- (b) Power approach at maximum landing design gross weight and speed of $1.4 (V_{stall})$ landing for a 90° F day until windshield temperature stabilization is reached.
- (c) Ground static conditions and takeoff power for a 103° F day without rain for 30 seconds.

4.6.6.7 Flight test - Flight tests shall be conducted on the jet air blast rain removal system under conditions closely duplicating those of 4.6.6.5 (e) to verify the clearance or to provide an approximate correction factor. The minimum visibility index shall be 6.0.

4.6.7 Vibration - The jet air blast rain removal system shall be subjected to and shall pass the vibration test specified in MIL-B- 81365.

5. PREPARATION FOR DELIVERY (Not applicable)

6. NOTES

6.1 Intended use - The jet air blast rain removal system is intended for use to remove rain from the windshields of manned aircraft.

6.2 Information for contracting officer - Contracts or orders should specify the following:

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- (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 removal 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:

- (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-B-81365.

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 noncompliance 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.

SPECIFICATION ANALYSIS SHEET

Form Approved
Budget Bureau No. 119-R004

INSTRUCTIONS

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof).

SPECIFICATION

MIL-R-81367(WP) RAIN REMOVAL SYSTEM, AIRCRAFT WINDSHIELD, JET AIR BLAST

ORGANIZATION (Of submitter)

CITY AND STATE

CONTRACT NO.

QUANTITY OF ITEMS PROCURED

DOLLAR AMOUNT

\$

MATERIAL PROCURED UNDER A

 DIRECT GOVERNMENT CONTRACT SUBCONTRACT

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?
A. GIVE PARAGRAPH NUMBER AND WORDING.

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THE SPECIFICATION RESTRICTIVE?

 YES NO IF "YES", IN WHAT WAY?

4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)

SUBMITTED BY (Printed or typed name and activity)

DATE

DD FORM 1426
1 APR 63

REPLACES NAVSHIPS FORM 4863, WHICH IS OBSOLETE

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