

MIL-B-23071C  
~~17 June 1983~~  
 SUPERSEDING  
 MIL-B-23071B  
 29 September 1972

**MILITARY SPECIFICATION**  
**BLOWERS, MINIATURE, FOR COOLING ELECTRONIC EQUIPMENT**  
**GENERAL SPECIFICATION FOR**

This specification is approved for use by all Departments and Agencies of the Department of Defense.

**1. SCOPE.**

**1.1 Scope.** This specification covers alternating current (ac) fractional horsepower miniature blowers having specific environmental characteristics required for cooling communication, special military equipment, and other electronic equipment. The blowers described herein shall be capable of withstanding extreme service and environmental conditions such as shock, high temperature, low temperature, vibration, humidity and fungus.

**1.2 Classification.**

**1.2.1 Military part number.** The military part-number shall consist of the letter "M", the basic number of the specification sheet, and an assigned dash number as shown in the following example (see 3.1).



**2. APPLICABLE DOCUMENTS**

**2.1 Government specifications and standards.** Unless otherwise specified, the following specifications and standards, of the issue listed in that issue of the Department of Defense Index of Specifications and Standards specified in the solicitation, form a part of this specification to the extent specified herein.

**SPECIFICATIONS**

**FEDERAL**

J-W-1177	-	Wire, Magnet, Electrical.
PPP-B-576	-	Boxes, Wood, Cleated, Veneer, Paper Overlaid.
PPP-B-601	-	Boxes, Wood, Cleated, Plywood.
PPP-B-636	-	Boxes, Shipping, Fiberboard.
PPP-T-60	-	Tape: Packaging, Waterproof.
PPP-T-76	-	Tape, Packaging, Paper (for Carton Sealing).

**MILITARY**

MIL-P-116	-	Preservation, Methods Of.
MIL-B-131	-	Barrier Materials, Watervaporproof, Flexible, Heat-Sealable.
MIL-D-3464	-	Desiccants, Activated, Bagged, Packaging Use and Static Dehumidification.
MIL-C-5015	-	Connectors, Electrical, Circular Threaded, AN Type.
MIL-M-13231	-	Marking of Electronic Items.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Naval Electronic Systems Command, ATTN: ELEX 8111, Department of the Navy, Washington, DC 20363, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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- MIL-E-16298 - Electric Machines Having Rotating Parts and Associated Repair Parts, Packaging of.  
 MIL-W-16878 - Wire, Electrical, Insulated.  
 MIL-C-26482 - Connectors, Electrical (Circular, Miniature, Quick Disconnect, Environment Resisting), Receptacles and Plugs.

(See Supplement 1 for applicable specification sheets).

## STANDARDS

## FEDERAL

- FED-STD-H28 - Screw-Thread Standards for Federal Services.

## MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection By Attributes.  
 MIL-STD-129 - Marking for Shipment and Storage.  
 MIL-STD-130 - Identification Marking of US Military Property.  
 MIL-STD-147 - Palletized Unit Loads.  
 MIL-STD-195 - Marking of Connections for Electrical Assemblies.  
 MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.  
 MIL-STD-454 - Standard General Requirements for Electronic Equipment.  
 MIL-STD-461 - Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference.  
 MIL-STD-462 - Electromagnetic Interference Characteristics, Measurement of.  
 MIL-STD-794 - Parts and Equipment, Procedures for Packaging of.  
 MIL-STD-45662 - Calibration Systems Requirements.  
 MS3102 - Connector, Receptacle, Electric, Box Mounting, Solder Contacts, AN Type.  
 MS3112 - Connectors, Receptacle, Electric, Series 1, Box Mounting, Flange, Bayonet Coupling, Solder Contact.  
 MS3116 - Connectors, Plug, Electric, Series 1, Solder Type, Straight, Bayonet Coupling.

(Copies of 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.)

2.2 Other publications. The following documents 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.

## AIR MOVEMENT AND CONTROL ASSOCIATION, INC.

Standard Test Code for Air Moving Devices, Bulletins 210-74 and 300-67

(Application for copies should be addressed to the Air Movement and Control Association, Inc., 30 W. University Drive, Arlington Heights, Chicago, Illinois 60004).

## AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Application Part II of Fluid Meters Sixth Edition 1971 (Interim Supplement 19.5 on Instruments and Apparatus) PTC 19.5-71

(Application for copies should be addressed to the American Society of Mechanical Engineers, United Engineering Center, 345 E. 47th Street, New York, New York 10017).

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI S1.2 - Method for Physical Measurements of Sound.

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(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, New York, 10018).

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

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

### 3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern.

3.2 Qualification. Blowers furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.5 and 6.3).

3.3 Material. The material used in the construction of blowers shall be as specified herein. However, when a definite material is not specified, a material shall be used which will insure the blowers meet the performance requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guarantee of the acceptance of the finished product.

3.3.1 Flammable and explosive material. When specified in the contract or purchase order (see 6.2), blowers shall contain the smallest possible amount of flammable and explosive material consistent with good design practice.

3.3.2 Corrosive material. Corrosive material used in any of the processes in the manufacture of blowers shall be neutralized to minimize corrosion in the completed blower.

3.3.3 Fungus and moisture resistant materials. Fungus inert materials in accordance with Requirement 4 of MIL-STD-454 and moisture resistant materials shall be used.

#### 3.3.4 Wire.

3.3.4.1 Magnet. Magnet wire shall be in accordance with J-W-1177.

3.3.4.2 Leads. Wire leads shall be in accordance with MIL-W-16878. Unless otherwise specified (see 3.1), color coding shall be in accordance with MIL-STD-195. Soldering shall meet Requirement 5 of MIL-STD-454.

#### 3.4 Design and construction.

3.4.1 Motor frame and housing. Unless otherwise specified (see 3.1), the motor frame and housing shall be constructed of aluminum alloy and shall be finished with sufficient protective coating to pass the environmental tests (see 4.7.16 through 4.7.20 and 4.6.2).

3.4.1.1 Blower housing. The blower housing shall be smoothly finished in order to minimize audible noise caused by the airflow and shall be securely attached to the motor. The blade housing, when used as the normal means of support for the item, shall have strength to withstand the vibration and shock tests of MIL-STD-202, (see 4.7.17 and 4.7.18). Unless otherwise specified (see 3.1), the blade housing finish shall be black.

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**3.4.2 Threaded parts.** All threaded parts shall be in accordance with FED-STD-H28 and shall be of such design and construction as to remain mechanically and electrically (where applicable) secure for the entire life of the blower and under conditions of the environmental requirements specified herein (see 4.7.16 through 4.7.20). Dissimilar metals shall not be used unless suitably protected against electrolytic corrosion. Where practical, the Unified National Coarse (UNC) thread series shall be used.

**3.4.3 Locking of screw-thread assemblies.** All screw-thread assemblies shall be rendered resistant to loosening under vibration.

**3.4.4 Electrical connections.** Unless otherwise specified (see 6.2), electrical connections shall be made with the use of connectors conforming to MIL-C-26482, type MS-3112E-B-4P. The mating connector is MS-3116E-B-4S. For motors having wire size AWG 12, or larger, the connector shall conform to MIL-C-5015, type MS-3102R-18-11P.

**3.4.5 Weight.** The maximum weight of the blower shall not exceed the value specified (see 3.1).

**3.4.6 Mounting.** Unless otherwise specified (see 3.1), blowers shall be capable of being mounted in any orientation. Blowers having identical mountings and silhouette dimensions will have the same specification sheet number but different dash numbers (where applicable).

**3.5 Performance requirements.** Unless otherwise specified (see 3.1), blower performance tests including maximum power, current and temperature rise shall be conducted at 0 inches water column (see 6.4) static pressure and at the rated voltage and frequency as specified (see 3.1). Prior to testing, all blowers shall be subjected to a warm-up period. The run-in period for continuous duty blower shall be a minimum of 1 hour. For intermittent duty blowers, the run-in period shall consist of sufficient normal operating cycles so that the sum of the on periods is not less than 1 hour. Warm-up period between each of the tests is not required provided the time lapse between the preceding and succeeding tests does not exceed three hours.

**3.5.1 Wire lead stress.** All connections shall be mechanically secure and electrically continuous prior to soldering and shall be tested as specified in 4.7.2.

**3.5.2 Input current.** When measured as specified in 4.7.3, the input current (running and lock rotor) shall not exceed the value specified (see 3.1).

**3.5.3 Input power.** When measured as specified in 4.7.4, the input power shall not exceed the value specified (see 3.1).

**3.5.4 Speed.** Blower impeller speed shall be measured as specified in 4.7.5.

**3.5.4.1 Speed (reference).** The reference speed (or initial value) shall be recorded for future reference. The nominal speed indicated on the applicable specification sheet (see 3.1) shall approximate the reference speed.

**3.5.4.2 Speed (subsequent).** All subsequent speeds measured after the reference speed shall be not less than 95 percent of the reference speed of 3.5.4.1.

**3.5.5 Burn-in.** Burn-in shall be performed as specified in 4.7.6. At the end of the burn-in test, the speed test in accordance with 3.5.4 shall be performed to determine failure. A failure occurs when speed drops 5 percent below the initial speed test.

**3.5.6 Generated vibration.** When measured as specified in 4.2.7, the generated vibration of the blower shall not exceed the root-mean-square (rms) force pounds specified (see 3.1). After the life test, the value shall not increase by more than 25 percent from the initial value.

**3.5.7 Line voltage and frequency.** When tested as specified in 4.7.8, the change in blower speed shall be as specified (see 3.1).

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3.5.8 Transient voltage test. The blowers shall be capable of withstanding voltage pulses of plus 20 percent of steady state voltage as specified in 4.7.9. Pulse duration shall be  $2 \pm 0.05$  seconds. After testing as specified in 4.7.9, blower performance shall be as specified in 3.5.4.2 and 3.5.6.

3.5.9 Dielectric withstanding voltage. When measured as specified in 4.7.10, there shall be no insulation breakdown or arcing.

3.5.10 Insulation resistance. When tested as specified in 4.7.11, the insulation resistance shall be greater than 12 megohms.

3.5.11 Airflow performance. When tested as specified in 4.7.12, the blowers airflow performance at two required static pressures shall be equal to or greater than that specified (see 3.1 and 6.4).

3.5.12 Dynamic balance (when applicable see 3.1). When tested as specified in 4.7.13, the blowers shall meet the limit specified.

3.5.13 Acoustic noise (when applicable see 3.1). When tested as specified in 4.7.14, the noise level in decibels (sound pressure level) at 3 feet shall not exceed the limit specified.

3.5.14 Electromagnetic compatibility. When specified, the blowers shall meet the limit requirements of MIL-STD-461 for Class A4 equipment tests CE01, CE03, RE01, RE02, RS02 and RS03 (see 4.7.15 and 6.2).

3.5.14.1 Electromagnetic pulse (EMP). The blowers shall withstand the EMP resulting from an exo-atmospheric nuclear explosion. No damage shall be sustained by interface pins subjected to the following maximum common mode current or voltage transients:

$$I_{pin}(t) = \pm I_p(f_0) e^{-\pi f_0 t/Q} \times \sin(2\pi f_0 t), \text{ and}$$

$$V_{pin}(t) = \pm V_p(f_0) e^{-\pi f_0 t/Q} \times \sin(2\pi f_0 t), \text{ where}$$

$f_0$  = resonant frequency in Hertz

$t$  = time in seconds

$Q$  = decay factor =  $16 \pm 4$  and

$I_p(f_0)$  and  $V_p(f_0)$  are given as a function of the resonant frequency in Figure 1.

3.5.15 Cold start. Unless otherwise specified (see 6.2), after exposure as specified in 4.7.16, the blowers shall meet the requirements specified in 3.5.2 and 3.5.3 and at least 80 percent of the referenced speed as measured in 3.5.4.1.

3.5.16 Vibration. When tested as specified in 4.7.17, the blowers shall be visually and mechanically inspected and shall meet the requirements specified in 3.5.2, 3.5.4.2 and 3.5.6.

3.5.17 Shock. When tested as specified in 4.7.18, the blowers shall be visually and mechanically inspected and shall meet the requirements specified in 3.5.2, 3.5.4.2 and 3.5.6.

3.5.18 Humidity. When tested as specified 4.7.19, the blowers shall be visually and mechanically inspected and shall meet the requirements of 3.5.2, 3.5.4.2, 3.5.9, and 3.5.10.

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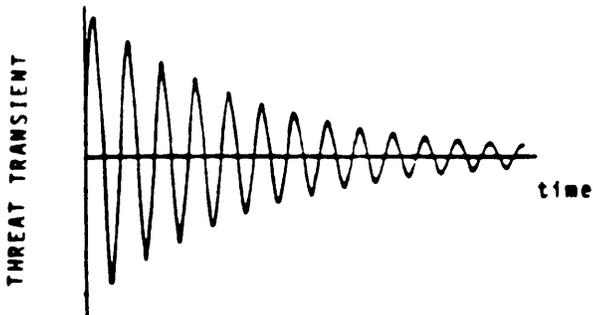
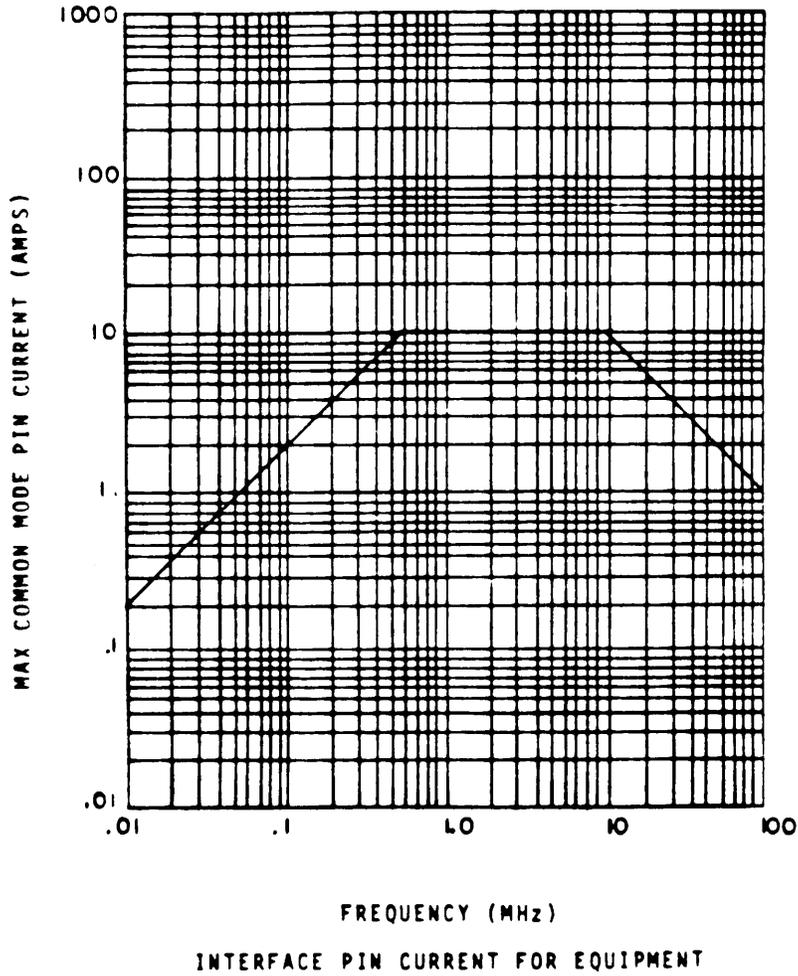


FIGURE 1. Electrical requirements for equipment.

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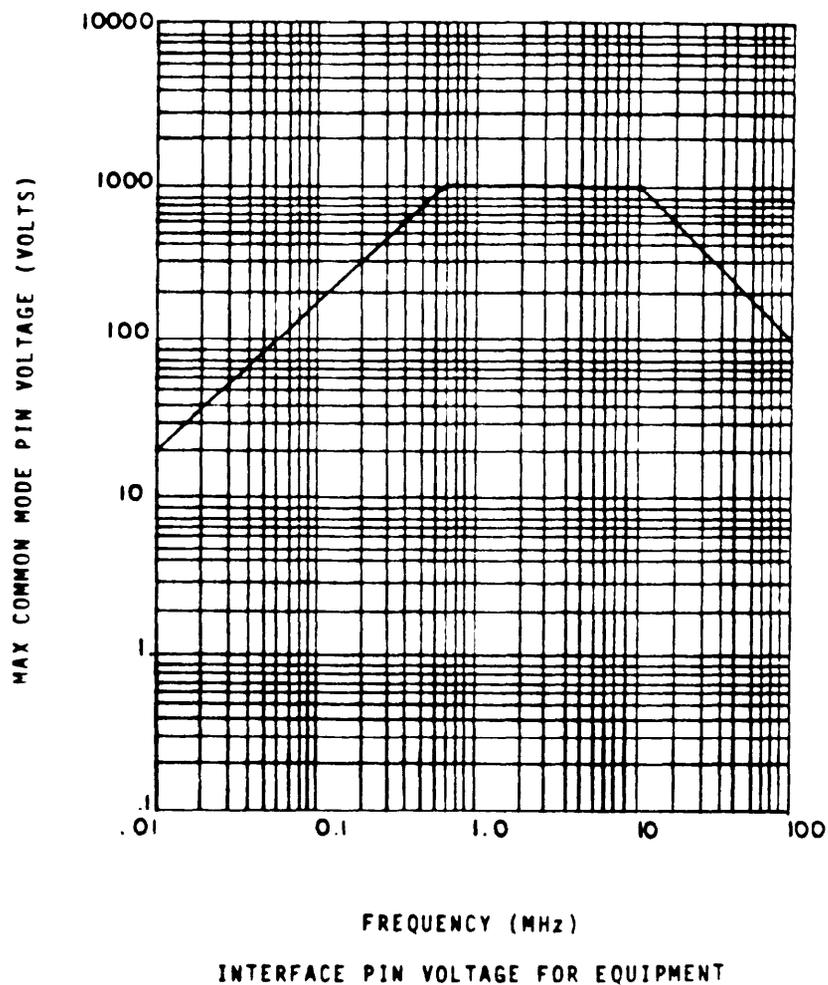


FIGURE 1. Electrical requirements for equipment - Continued.

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3.5.19 Salt spray. When tested as specified in 4.7.20, there shall be no evidence of significant corrosion on any part of the blower. The blowers shall be visually and mechanically inspected and shall meet the requirements of 3.5.2, 3.5.4.2, 3.5.9, and 3.5.10.

3.5.20 Temperature rise. When tested as specified in 4.7.21, the winding temperature rise shall not exceed the value specified (see 3.1).

3.5.21 Extended life. Unless otherwise specified (see 3.1), the life of the blower tested shall be greater than 1000 hours when tested as specified in 4.7.22. The life of the blower shall be considered terminated when it fails to meet the speed requirement of 3.5.4. Input current, subsequent speed and generated vibration shall be measured as specified in 3.5.2, 3.5.4.2 and 3.5.6.

3.6 Marking. Blowers shall be marked in accordance with MIL-STD-130 with military part number, manufacturer's name or symbol, capacitor value, terminal identification, wiring diagram, voltage, frequency, phase and current, air delivery (cubic feet per minute (CFM)) at zero static pressure (see 6.4), revolution per minute of motor, and maximum operating temperature. Markings shall be applied by acid or electric etching, permanent marking ink, or engraving applied directly to the housing or identification label. The markings shall be as permanent as the normal life expectancy of the blower on which it is applied and shall withstand the same environmental tests required of the blower (see 4.7.16 through 4.7.20). Metal decals conforming to MIL-M-13231 shall be used.

3.7 Workmanship. The blowers shall be smoothly finished. Burrs and sharp edges shall be removed to minimize damage to personnel and to inhibit audible noise.

#### 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.

4.1.1 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality and quantity to permit performance of the required inspection shall be established and maintained by the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-STD-45662.

4.2 Classification of inspections. The inspections specified herein are classified as follows:

- Materials inspection (see 4.3).
- Qualification inspection (see 4.5).
- Quality conformance inspections (see 4.6).

4.3 Materials inspection. Materials inspection shall consist of certification supported by verifying data that the materials used in fabricating the blowers are in accordance with the applicable referenced specifications or requirements prior to such fabrication.

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**4.4 Inspection conditions.** Unless otherwise specified herein, all measurements and tests shall be made at an ambient temperature of 25°C ±5°C, atmospheric pressure of 30 ±2 inches of mercury, and a relative humidity no greater than 55 percent. The room ambient temperature change shall not exceed a rate of 2°C per hour. For environmental tests (see 4.7.16 through 4.7.20), temperature rate of change shall be approximately 0.5°C per minute or 30°C per hour.

**4.5 Qualification inspection.** Qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.3) on sample units produced with equipment and procedures normally used in production.

**4.5.1 Sample size.** Six blowers shall be subjected to qualification inspection.

**4.5.2 Inspection routine.** The sample shall be subjected to the inspections specified in table I, in the order shown. All sample units shall be subjected to the inspection of group I. The sample shall then be divided as specified in table I for groups II and III.

**4.5.3 Failures.** One or more failures shall be cause for refusal to grant qualification approval.

**4.5.4 Retention of qualification.** To retain qualification, the contractor shall forward a report at 24-month intervals to the qualifying activity. The qualifying activity shall establish the initial reporting date. The report shall consist of:

- a. A summary of the results of the tests performed for inspection of product for delivery (group A and B), indicating as a minimum the number of lots that have passed and the number that have failed. The results of tests of all reworked lots shall be identified and accounted for.
- b. A summary of the results of tests performed for periodic inspection (group C), indicating as a minimum the number of lots that have passed and the number that have failed (including subgroups failed). The summary shall include results of all periodic inspection tests performed and completed during the 24-month period. If the summary of the test results indicates nonconformance with specification requirements, and corrective action acceptable to the qualifying activity has not been taken, action may be taken to remove the failing product from the qualified products list.

Failure to submit the report within 30 days after the end of each 24-month period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the contractor shall immediately notify the qualifying activity at any time during the 24-month period that the inspection data indicates failure of the qualified product to meet the requirements of this specification.

In the event that no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the item. If during two consecutive reporting periods there has been no production, the manufacturer may be required, at the discretion of the qualifying activity, to submit the products, (a representative product of each type, grade, class, etc) to testing in accordance with the qualification inspection requirements.

**4.6 Quality conformance inspection.**

**4.6.1 Inspection of product for delivery.** Inspection of product for delivery shall consist of groups A and B inspection.

**4.6.1.1 Inspection lot.** An inspection lot shall consist of all blowers of the same part number produced under essentially the same conditions, and offered for inspection at one time.

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TABLE I. Qualification inspection.

Inspections	Requirement paragraph	Test method paragraph
<u>Group I (six samples)</u>		
Visual and mechanical inspection	3.1, 3.3, 3.4, 3.6, 3.7	4.7.1
Wire lead stress	3.5.1	4.7.2
Input current	3.5.2	4.7.3
Input power	3.5.3	4.7.4
Speed	3.5.4	4.7.5
Burn-in	3.5.5	4.7.6
Speed	3.5.4	4.7.5
Generated vibration	3.5.6	4.7.7
Line voltage and frequency	3.5.7	4.7.8
Transient voltage	3.5.8	4.7.9
Speed (subsequent)	3.5.4.2	4.7.5
Generated vibration	3.5.6	4.7.7
Dielectric withstanding voltage	3.5.9	4.7.10
Insulation resistance	3.5.10	4.7.11
<u>Group II (two samples)</u>		
Airflow performance	3.5.11	4.7.12
Dynamic balance	3.5.12	4.7.13
Acoustic noise	3.5.13	4.7.14
Electromagnetic compatability	3.5.14	4.7.15
Cold start	3.5.15	4.7.16
Input current	3.5.2	4.7.3
Speed (subsequent)	3.5.4.2	4.7.5
Input power	3.5.3	4.7.4
Generated vibration	3.5.6	4.7.7
Vibration	3.5.16	4.7.17
Visual and mechanical inspection	3.1, 3.3, 3.4, 3.6, 3.7	4.7.1
Input current	3.5.2	4.7.3
Speed (subsequent)	3.5.4.2	4.7.5
Generated vibration	3.5.6	4.7.7
Shock	3.5.17	4.7.18
Visual and mechanical inspection	3.1, 3.3, 3.4, 3.6, 3.7	4.7.1
Input current	3.5.2	4.7.3
Speed (subsequent)	3.5.4.2	4.7.5
Generated vibration	3.5.6	4.7.7
Humidity	3.5.18	4.7.19
Visual and mechanical inspection	3.1, 3.3, 3.4, 3.6, 3.7	4.7.1
Input current	3.5.2	4.7.3
Speed (subsequent)	3.5.4.2	4.7.5
Dielectric withstanding voltage	3.5.9	4.7.10
Insulation resistance	3.5.10	4.7.11
Salt spray	3.5.19	4.7.20
Visual and mechanical inspection	3.1, 3.3, 3.4, 3.6, 3.7	4.7.1
Input current	3.5.2	4.7.3
Speed (subsequent)	3.5.4.2	4.7.5
Dielectric withstanding voltage	3.5.9	4.7.10
Insulation resistance	3.5.10	4.7.11
<u>Group III (four samples)</u>		
Temperature rise	3.5.20	4.7.21
Continuous duty motors	3.5.20	4.7.21.1
Intermittent duty motors	3.5.20	4.7.21.2
Extended life	3.5.21	4.7.22
Speed (reference and subsequent)	3.5.4	4.7.5
Input current	3.5.2	4.7.3
Generated vibration	3.5.6	4.7.7

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4.6.1.2 Group A inspection. Group A inspection shall consist of the inspections specified in table II, in the order shown.

4.6.1.2.1 Sampling plan. Group A inspections shall be performed on 100 percent of the production blowers. The acceptable quality level (AQL) shall be as specified in table II. Major and minor defects shall be as defined in MIL-STD-105.

4.6.1.2.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

TABLE II. Group A inspection.

Inspection	Requirement paragraph	Test method paragraph	AQL (percent defective)	
			Major	Minor
Visual and mechanical inspection	3.1, 3.3, 3.4, 3.6, 3.7	4.7.1	1.0	4
Input current	3.5.2	4.7.3		
Speed (reference)	3.5.4.1	4.7.5		
Dynamic balance	3.5.12	4.7.13		
Dielectric withstanding voltage	3.5.9	4.7.10	1.0	
Insulation resistance	3.5.10	4.7.11		
Burn-in	3.5.5	4.7.6		

4.6.1.3 Group B inspection. Group B inspection shall consist of the inspections specified in table III, in the order shown, and shall be made on sample units which have been subjected to and have passed the group A inspection. Prior to testing, all blowers shall be subjected to a warm-up period as specified in 3.5.

4.6.1.3.1 Sampling plan. The sampling plan shall be in accordance with table IV. The sample size shall be based on the inspection lot size from which the sample was selected for group A inspection.

4.6.1.3.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

TABLE III. Group B inspection.

Inspection	Requirement paragraph	Test method paragraph
Airflow performance	3.5.11	4.7.12
Line voltage and frequency	3.5.7	4.7.8
Temperature rise	3.5.20	4.7.21
Wire lead stress	3.5.1	4.7.2
Cold start	3.5.15	4.7.16
Input current	3.5.2	4.7.3
Speed (subsequent)	3.5.4.2	4.7.5
Input power	3.5.3	4.7.4

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4.6.1.3.3 Disposition of sample units. Sample units which have passed all the group B inspection may be delivered on the contract, if the lot is accepted and the sample units are still within specified electrical tolerances.

TABLE IV. Sampling for group B inspections.

Number of blowers in lot	Number of blowers in sample	Acceptance number (defectives)	Rejection number (defectives)
40 or less	2	0	1
41 to 110	3	0	1
111 to 300	4	0	1
301 to 500	6	0	1
501 to 800	10	1	2
801 to 3200	15	1	2
3201 and greater	25	2	3

4.6.2 Periodic inspection. Periodic inspection shall consist of group C. Except where the results of these inspections shown noncompliance with the applicable requirements (see 4.6.2.1.4), delivery of products which have passed groups A and B inspections shall not be delayed pending the results of these periodic inspections.

4.6.2.1 Group C inspection. Group C inspection shall consist of the inspections specified in table V.

4.6.2.1.1 Sampling plan. A minimum of two blowers which have not been subjected to the group B tests shall be selected from the blowers which have passed the group A tests at a frequency of once every 2 years for groups I and II and once every 6 months for group III. The manufacturer is afforded the option of submitting three blowers, one to be subjected to the group I tests, one to the group II tests, and one to the group III tests. Consequently, if only two blowers are selected, one shall be subjected to the group I and group II tests, and the other blower to the group III tests.

4.6.2.1.2 Failures. If one or more sample units fail to pass group C inspection, the sample shall be considered to have failed.

4.6.2.1.3 Disposition of sample units. Sample units which have been subjected to group C inspection shall not be delivered on the contract.

4.6.2.1.4 Noncompliance. If a sample fails to pass group C inspection, the manufacturer shall notify the qualifying activity and the cognizant inspection activity of such failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which are manufactured under essentially the same materials and processes, and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action, acceptable to the qualifying activity has been taken. After the corrective action has been taken group C inspection shall be repeated on additional sample units (all inspections or the inspection which the original sample failed, at the option of the qualifying activity). Groups A and B inspections may be reinstated; however, final acceptance and shipment shall be withheld until the group C inspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure shall be furnished to the cognizant inspection activity and the qualifying activity.

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TABLE V. Group C inspection.

Inspection	Requirement paragraph	Test method paragraph
<u>Group I (2 yrs.)</u>		
Vibration	3.5.16	4.7.17
Shock	3.5.17	4.7.18
<u>Group II (2 yrs.)</u>		
Humidity	3.5.18	4.7.19
Salt spray	3.5.19	4.7.20
<u>Group III (6 mos.)</u>		
Extended life test	3.5.21	4.7.22
Speed	3.5.4	4.7.5
Input current	3.5.2	4.7.3
Generated vibration	3.5.6	4.7.7

4.6.3 Inspection of packaging. Except when industrial packaging is specified, the sampling and inspection of the preservation and interior package marking shall be in accordance with group A and B quality conformance inspection requirements of MIL-P-116. The sampling and inspection of the packing and marking for shipment and storage shall be in accordance with the quality assurance provisions of the applicable container specification and the marking requirements of MIL-STD-129. The inspection of industrial packaging shall be as specified in the contract (see 6.2).

#### 4.7 Methods of inspection.

4.7.1 Visual and mechanical inspection. The blowers shall be visually and mechanically inspected to insure conformance with the specification (see 3.1, 3.3, 3.4, 3.6, 3.7).

4.7.2 Wire lead stress (see 3.5.1). Each wire shall be tested in accordance with MIL-STD-202, method 211, test condition C. Unless otherwise specified (see 3.1), weight of load shall be 5 pounds. Any indication of the lead pulling loose, wire strands breaking, or a permanent deformation of the insulation shall be cause for rejection.

4.7.3 Input current (see 3.5.2). The input current shall be measured by means of an ammeter.

4.7.4 Input power (see 3.5.3). The input power shall be measured by means of a wattmeter.

4.7.5 Speed (see 3.5.4). Impeller speed shall be measured using a stroboscope. The accuracy of the equipment used for measuring blower speed shall be with  $\pm 2$  percent of the measured value.

4.7.6 Burn-in (see 3.5.5). The blowers shall be placed in an oven at the high test temperature specified for 48 hours with nominal voltage and frequency specified (see 3.1).

4.7.7 Generated vibration (see 3.5.6).

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4.7.7.1 Blower mounting. The blower shall be positioned with the shaft horizontal and elastically supported to allow vibration in all axes. The elastic members of the mounting shall be either tension or compression types and shall be directly attached to the blower motor. Cradles and other mounting devices shall not be used. The weight of the suspended blower, accelerometer, and accelerometer adapting block, if used, shall cause the elastic support to compress or stretch at least the amount given by the following formula:

$$d = \frac{880,000}{N^2}$$

where: d = minimum compression or stretch, inches

N = blower motor speed, revolution per minute (rpm)

4.7.7.2 Accelerometer mounting. The accelerometer shall be attached directly to the motor frame between the bearings (see applicable specification sheets) with its sensing axis perpendicular to the motor shaft. An intermediate adapting block may be used to match mating surfaces. Accelerometer and adapting block, if used, shall be attached by stud mounting, Eastman 910 cement, or other equally rigid adhesives. With blowers operating at speeds greater than 6000 rpm only stud mounting or Eastman 910 cement, or equal, shall be used. The combined weight of the accelerometer, mounting stud, and adapter block shall not exceed 1.60 ounces.

4.7.7.3 Instrumentation. A calibrated accelerometer system output shall be fed directly into a rms voltmeter having an input impedance of at least 1.0 megohm and a time constant of 6 to 10 seconds (see 6.4). Conditioning of the accelerometer output by filtering or any other means is not permitted.

4.7.7.4 Root mean measure (rms) force calculation. The blowers shall be operating at least 15 minutes prior to testing. The mean steady state rms acceleration in g's shall be recorded. The blower weight in pounds shall be determined and recorded. The weight in pounds of the accelerometer, mounting stud, and adapting block, if used, shall be determined and recorded. The blower rms force output from the following formula shall be determined and recorded.

$$F_{rms} = wa$$

where: w = combined weight of blower, mounting stud, and adapter block, pounds  
a = measured acceleration, g-rms.

4.7.7.5 Production testing. The generated vibration measurement required in the group C, quality conformance tests of 4.6.2.1 accomplished by any method the contractor desires if it can be suitably demonstrated to the satisfaction of the command or agency concerned that the method will not allow a blower to exceed the rms force obtained by the method in 4.7.7.4.

4.7.8 Line voltage and frequency (see 3.5.7). The blowers shall be operated at the extreme limits of the steady state band in combinations of voltage and frequency shown in table VI. Speed measurements shall be taken at each limit.

TABLE VI. Steady state voltage and frequency.

Condition	Lower limit (-10%)	Voltage rated	Upper limit (+10%)	Lower limit (-5%)	Frequency rated	Upper limit (+5%)
A (reference condition)		X			X	
B	X			X		
C			X			X
D			X	X		

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4.7.9 Transient voltage (see 3.5.8). With the blower operating at conditions B and D (table VI), five voltage pulses, at 10 second intervals, shall be superimposed on the steady state nominal voltage.

4.7.10 Dielectric withstanding voltage (see 3.5.9). A test potential of  $980 \pm 0$ , -30 volts rms, 60 hertz shall be applied from each winding to frame and between windings. The test potential shall be raised slowly (minimum time 3 seconds) to the specified value and maintained for one minute, then reduced slowly (minimum time 3 seconds) to zero. A failure shall be indicated by a leakage current in excess of one milliamperere peak or the indication of internal arcing or corona discharge. The leakage current limit of one milliamperere peak shall not include the current drawn by the equipment capacitance, or the capacitance of the windings under test. Subsequent dielectric tests will be at  $880 \pm 0$ , -30 volts rms.

4.7.11 Insulation resistance (see 3.5.10). Unless otherwise specified (see 3.1), the blower shall be tested in accordance with MIL-STD-202, method 302, condition B: The test voltage shall be applied between ground (frame) and each winding which is not permanently grounded, with all other windings grounded. Windings which are normally connected together shall be considered as one winding for this test.

4.7.12 Airflow performance (see 3.5.11). Blowers intended for application at approximately sea level atmospheric pressure conditions shall be measured in terms of CFM with any apparatus applying the principle of nozzles generally described in the ASME Power Test Codes, part 5, Chapter 4, Bulletin PTC 19.5: 4- 1959 or the AMCA Standard for Air Moving Devices, Bulletin 210-74. Other air volume rate monitoring instrumentation such as Laminar Flow elements, etc, may be used only upon written approval from the activity responsible for qualification (see 6.3).

4.7.13 Dynamic balance (see 3.5.12).

4.7.13.1 Mounting. The blowers shall be elastically mounted to allow vibration in all axes. A cradle may be used to support the blower in the elastic mounting providing its weight is not greater than 15 percent of the sum of the weight of the accelerometer, mounting block, if used, and blower. The elastic members may be in tension or compression but must deflect under the weight of the blower and its cradle, if used, an amount at least equal to the amount given in the following formula:

$$d = \frac{880,000}{N^2}$$

where: d = minimum stretch or compression,  
inches  
N = blower speed, rpm

The deflection should not be so great that the elastic members is exceeded or that the limit of deflection is reached (that is, elastic members must not "bottom out").

4.7.13.2 Instrumentation. A calibrated accelerometer system output shall be fed through a suitable filter which is tuned to read the vibration at the running speed of the blower. Since vibration frequencies below the running speed are not expected, a low-pass filter can be used. The output of the filter shall not attenuate or amplify the input signal from the accelerometer system, or, if it does, an appropriate correction factor must be determined for the frequency being measured and applied to the voltmeter reading. The output signal from the filter shall then be fed to an rms voltmeter, preferably one with sufficient damping (no greater than 10 seconds) to eliminate sporadic momentary deflections of the voltmeter readings, and with an input impedance of at least 1.0 megohm.

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**4.7.13.3 Measurements.** The accelerometer readings are to be taken on the bearing housings in a plane perpendicular to the blower's rotational axis or, if the bearing housings are not accessible, the vibration shall be measured at the extremities of the blower in a plane perpendicular to the blower's rotational axis. The accelerometer may be mounted permanently to the blower or its cradle or, if the blower speed is less than 24,000 rpm, it can be equipped with a pointed rod or screw and held with fingers pointed end against the blower. Convert the voltmeter reading using the accelerometer system sensitivity given as millivolts rms per G rms to G's rms and, using the following formula, calculate the velocity reading in inches per second rms.

$$V_{\text{rms}} = \frac{3690 \text{ G rms}}{\text{Blower rpm}}$$

**4.7.14 Acoustic Noise.** Acoustic noise measurements are to be made in accordance with ANSI S1.2. The blower shall be resiliently supported as specified in 4.7.13.1 for measuring dynamic balance. The noise test is to be performed with the blower running at 0 inches water column static pressure.

**4.7.15 Electromagnetic compatibility (see 3.5.14).** Tests to determine conformance to the requirements of 3.5.14 shall be performed in accordance with MIL-STD-462.

**4.7.16 Cold start (see 3.5.15).** The nonenergized blower shall be subjected to the minimum ambient temperature as specified (see 3.1) for a minimum of 16 hours. The blower, while at the low temperature, shall then be continuously energized at rated excitation for a period of 8 hours. Five minutes after initial excitation is applied, the blower speed shall be measured as described in 4.7.5. The blower shall then be deenergized and the above cycle repeated one more time.

**4.7.17 Vibration (see 3.5.16).** Unless otherwise specified (see 3.1), sample units shall be rigidly mounted on the vibration equipment utilizing the normal blower mounting surface and subjected to the vibration requirements of MIL-STD-202, method 201.

**4.7.18 Shock (see 3.5.17).** Unless otherwise specified (see 3.1), the nonenergized sample units shall be securely mounted to the shock mounting fixture utilizing the normal blower mounting surface and subjected to the requirements of MIL-STD-202, method 213, figure 213-1, test condition A.

**4.7.19 Humidity (see 3.5.18).**

**4.7.19.1 Nonoperating humidity cycling.** The nonenergized blowers shall be subjected to five 24-hour temperature variations consisting of approximately 16 hours at 60°C ±3°C and 8 hours at 30°C ±3°C. The relative humidity shall be maintained above a minimum of 95 percent during the steady state conditions. The transitions between temperatures shall be accomplished within the 8-hour period so that the time at the high temperature is 16 hours. Two hours after temperature stabilization and during the high and low temperature portions of the first or second cycle, a sample of the atmosphere in the chamber shall be made to determine the conditions of temperature and relative humidity throughout the chamber.

**4.7.19.2 Operating humidity cycling.** After remaining inoperative for not less than 12 hours or more than 24 hours at a temperature of 25°C ±3°C and 50 percent minimum relative humidity, the blower shall be operated continuously at rated voltage and frequency in an ambient temperature of 50°C ±3°C for a period of 8 hours. The relative humidity shall be increased to 95 percent minimum during the first 2 hours and maintained at 95 ±5 percent for 4 hours, then reduced to the conditions of 4.4 during the final 2 hours.

**4.7.20 Salt spray.** The blowers shall be tested in accordance with MIL-STD-202, method 101, condition B and with 5 percent salt solution. The blower shaft shall be horizontal when the blower is placed in the test chamber.

**4.7.21 Temperature rise (see 3.5.20).**

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4.7.21.1 Continuous duty blowers. The temperature rise of the windings shall be determined by resistance measurements made in a draft-free area. The blower shall be mounted by its normal means on a surface of low thermal conductivity. A thermocouple shall be securely attached to the motor frame at a convenient location between bearings on the motor frame surface. Frame temperature, room ambient temperature, and motor winding resistance shall be measured and recorded. The blower shall then be energized for a 3-hour minimum period with nominal voltage and frequency until the frame temperature has reached the point of stability. The blower shall be considered to be thermally stable when five successive frame temperature readings at one-minute intervals are equal. This temperature shall be recorded for informational purposes. To determine R, the resistance of the main winding shall be measured five times at intervals of approximately 30 seconds, commencing immediately after the motor is deenergized. After the fifth measurement is completed, the resistance shall then be extrapolated back to the resistance at the time of shutdown. The temperature rise of the winding shall be computed from the following formula:

$$T = \frac{R - r}{r} \times (t' + 234.5) - (T_A - t')$$

where

- T = temperature rise in degrees centigrade of the winding over the ambient temperature.
- t' = initial ambient temperature in degrees centigrade - room temperature.
- R = resistance of the winding in ohms at the time of shutdown.
- r = resistance of the winding in ohms at temperature (t').
- T<sub>A</sub> = ambient temperature at the time of shutdown.

4.7.21.2 Intermittent duty blowers. The temperature rise test shall be performed in the same manner as for continuous duty blowers, except that the specified duty cycle shall be employed. The temperature of the motor frame shall be considered stabilized when the temperature peaks caused by the "on" portions of the cycle reach a maximum which is repeated for at least six consecutive cycles.

4.7.22 Extended life test (see 3.5.21). With the exception that an intermittent duty blower will be operated at a specified duty cycle, the blower will be continuously energized at rated excitation for 1000 hours and at a maximum temperature specified (see 3.1).

4.7.22.1 Mounting. The blowers shall be placed in a chamber in such a position that no obstruction shall be within one impeller diameter of the blower outlet or inlet.

4.7.22.2 Operation. With the blower continuously operated at rated excitation and output load conditions of 100 percent of maximum CFM volume rate, the chamber temperature shall be increased to that specified (see 3.1). This temperature shall be maintained within a  $\pm 5^\circ\text{C}$  tolerance until specimen failure or until the specimen has met the 1000-hour requirement specified (see 3.1). At the conclusion of the test the blower shall be cooled to room temperature before taking the subsequent measurements.

## 5. Packaging.

5.1 Preservation. Preservation shall be level A or C, as specified (see 6.2).

### 5.1.1 Level A.

5.1.1.1 Cleaning. Cleaning shall be in accordance with process C-1 of MIL-P-116.

5.1.1.2 Drying. Drying shall be in accordance with MIL-P-116.

5.1.1.3 Preservative application. Surface subject to corrosion shall be treated with preservative in accordance with MIL-E-16298.

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5.1.1.4 Unit packs. Blowers shall be individually packaged in accordance with Method IIb of MIL-P-116, insuring compliance with the General paragraph under Methods of Preservation (Unit Protection) and the Physical Protection paragraph therein and meet the rough handling tests of MIL-P-116. Cushioning and dunnage shall be used to prevent physical or mechanical damage. Particular emphasis shall be placed on protecting exposed impellers from damage during rough handling by use of mounting boards, blocking and bracing, or by use of other equivalent methods of protection. Desiccant shall conform to MIL-D-3464, Type II or III. The cushioned blower shall be placed in a close-fitting fiberboard box conforming to PPP-B-636 and the box shall be closed in accordance with the appendix thereto. The blower container shall then be placed within a close-fitting water-vaporproof barrier bag made of material conforming to MIL-B-131, Class 1. Technical literature shall be packaged in a waterproof, heat sealed bag, minimum 4 mil thick, and shall not be placed within the barrier used to package the blower. The blower and technical literature which constitute one complete equipment shall be packaged in a consolidation package conforming to PPP-B-636, class weather-resistant. Closures and waterproofing shall be accomplished by sealing the center seams, corners, and manufacturer's joint with waterproof tape, 2 inches minimum width, conforming to PPP-T-60, Class 1, or PPP-T-76.

5.1.1.5 Intermediate packs. Intermediate packs are not required.

5.1.2 Level C. The level C preservation for blowers shall conform to the MIL-STD-794 requirements for this level.

5.2 Packing. Packing shall be level A, B, or C, as specified (see 6.2).

5.2.1 Level A. Blowers packaged as specified in 5.1, shall be packed in containers conforming to PPP-B-601, type overseas, style optional. Packing containers shall be closed and strapped in accordance with the appendix to PPP-B-601.

5.2.2 Level B. Blowers packaged as specified in 5.1, shall be packed in containers conforming to PPP-B-601, or PPP-B-576, Class 2.

5.2.3 Level C. The level C packing for blowers shall conform to the MIL-STD-794 requirements for this level.

5.2.4 Unitized loads. Unitized loads, commensurate with the level of packing specified in the contract or purchase order, shall be used whenever total quantities for shipment to one destination equal 40 cubic feet or more. Quantities less than 40 cubic feet need not be unitized. Unitized loads shall be uniform in size and quantities to the greatest extent practicable.

5.2.4.1 Level A. Blowers, packed as specified in 5.2.1, shall be unitized on pallets in conformance with MIL-STD-147, load type 1, with a fiberboard cap (storage aid 4) positioned over the load.

5.2.4.2 Level B. Blowers, packed as specified in 5.2.2, shall be unitized as specified in 5.2.4.1, except that the fiberboard caps shall be class weather-resistant or domestic.

5.2.4.3 Level C. Blowers, packed as specified in 5.2.3, shall be unitized as specified in MIL-STD-794, except that conformance to MIL-STD-147 is not required.

5.3 Marking. In addition to any special or other identification marking required by the contract or purchase order (see 6.2), each unit pack, intermediate and exterior container and unitized load shall be marked in accordance with MIL-STD-129. Marking shall include special marking for method II packs.

5.4 General. Exterior containers (see 5.2.1, 5.2.2, and 5.2.3) shall be of a minimum tare and cube consistent with the protection required and shall contain equal quantities of identical stock numbered items to the greatest extent possible. Loose-fill polystyrene shall not be used for packaging or packing. Adhesives shall not be used in the closure of wraps, bags, or boxes. Special measures shall be taken to ensure that blowers are packaged and packed to prevent damage to impellers.

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6. Notes.6.1 Intended use.

6.1.1 Miniature blower application. The blowers are used for cooling communication, special military equipment, and other electronic equipment.

6.1.2 Application of packaging requirements. The packaging requirements specified herein apply only for direct Government acquisitions. The packaging provisions of the referenced documents listed in section 2 do not apply unless specifically stated in the contract or purchase order. The packaging requirements for blowers acquired by contractors shall be specified in the individual order.

6.2 Ordering data. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Title, number, and date of the applicable specification sheet and the part number.
- c. Use of flammable and explosive material (see 3.3.1).
- d. Aluminum alloy (see 3.4.1).
- e. Type of electrical connector when different from MS-3112E-8-4P (see 3.4.4).
- f. Electromagnetic compatibility (see 3.5.14).
- g. Cold start (see 3.5.15).
- h. Disposition of rejected lots (see 4.6.1.3.3).
- i. Mounting (see 4.7.13.1).
- j. Temperature rise (see 4.7.21).
- k. Levels of preservation and packing, (see 5.1 and 5.2).
- l. If special or other identification marking is required (see 5.3).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in applicable qualified products list whether or not such products have actually been so listed by that date. The attention of the contractors is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the qualified products list is the Naval Electronic Systems Command, ELEX 8111, Department of the Navy, Washington, D.C. 20363; however, information pertaining to qualification of products may be obtained from the Defense Electronics Supply Center (DESC-E), Dayton, Ohio 45444. Application for qualification tests shall be made in accordance with "Provisions Governing Qualification" (see 6.3.1).

6.3.1 Application for qualification. Application for qualification testing shall be made in accordance with "Provisions Governing Qualification (SD-6)" which may be obtained upon application to Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

6.4 Definitions:

- a. Cubic feet per minute (CFM). A unit of measurement for airflow or air volume rate. It represents an air volume change of one cubic foot per minute.
- b. Standard air. Air having a density of 0.075 lb. per cubic foot and an absolute viscosity of  $1.225 \times 10^{-5}$  lb. (mass per foot-second).
- c. Water column. Static pressures are measured in terms of the height or equivalent height of a column of water in a manometer.
- d. Static pressure (SP). In inches, water at standard air density. It should be noted that static pressure is standardized at a density of .075.
- e. Time constant. That interval necessary for the meter to rise to 63 percent of its final value with a steady rms voltage applied to its input.

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6.5 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Custodians:

Army - ME  
Navy - EC  
Air Force - 99

Preparing activity:

Navy - EC

Review activities:

Army - MI  
Navy - AS, SH  
DLA - ES, GS

(Project 4140-0114)

User activities:

Navy - OS, MC  
Air Force - 11, 17

Agent:

DLA - ES

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1. DOCUMENT NUMBER MIL-B-23071C	2. DOCUMENT TITLE Blowers, Miniature, For Cooling Electronic Equipment, General Specification For		
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION (Mark one) <input type="checkbox"/> VENDOR <input type="checkbox"/> USER <input type="checkbox"/> MANUFACTURER <input type="checkbox"/> OTHER (Specify): _____	
3b. ADDRESS (Street, City, State, ZIP Code)			
5. PROBLEM AREAS a. Paragraph Number and Wording:           b. Recommended Wording:           c. Reason/Rationale for Recommendation:			
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