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W-F-101J
September 14, 1976
SUPERSEDING
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July 29, 1970
Fed. Spec. W-F-101G
May 14, 1965

FEDERAL SPECIFICATION

FAN, CIRCULATING, BRACKET; FAN, CIRCULATING, DESK; AND FAN, CIRCULATING, MULTIPURPOSE, HIGH VELOCITY

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers fans of the desk, bracket, and multipurpose high velocity types.

1.2 Classification.

1.2.1 Types and sizes. Fans covered by this specification shall be of the following types and sizes as specified (see 6.1).

Type I - Desk bracket, oscillating.
  Size 1 - 10 inch diameter blade assembly.
  Size 2 - 12 inch diameter blade assembly.
  Size 3 - 16 inch diameter blade assembly.

Type II - Bracket, nonoscillating.
  Size 40 - 30 inch diameter blade assembly.

Type III - High velocity multipurpose.
  Size - Size based on performance (see 3.5, table II).

2. APPLICABLE DOCUMENTS

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

Federal Specifications:

J-C-175 - Cable Assembly, Power, Electrical (3-Wire Grounding Type, For Use On 125 Volt Equipment).
QQ-Z-325 - Zinc Coating, Electrodeposited, Requirements For.
CC-M-1807 - Motors, Alternating Current, Fractional And Integral Horsepower (500 HP and Smaller).

Federal Standards:

Fed. Std. No. 123 - Marking For Shipment (Civil Agencies).
Fed. Test Method Std. No. 141 - Paint, Varnish, Lacquer, and Related Materials: Methods of Inspection, Sampling, and Testing.
Fed. Test Method Std. No. 151 - Metals, Test Methods.

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

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(Single copies of this specification and other Federal Specifications required by activities outside the Federal Government for bidding purposes are available without charge from Business Service Centers at the General Services Administration Regional Offices in Boston, New York, Washington, DC, Atlanta, Chicago, Kansas City, MO, Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, WA.

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Specification:

MIL-E-16298 - Electric Machines Having Rotating Parts and Associated Repair Parts: Packaging Of.

Military Standards:

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129 - Marking for Shipment and Storage.
MIL-STD-461 - Electromagnetic Interference Characteristics Requirements for Equipment.
MIL-STD-462 - Electromagnetic Interference Characteristics, Measurement of.
MIL-STD-463 - Definitions and System of Units, Electromagnetic Interference Technology.

(Copies of Military Specifications and Standards required by suppliers in connection with specific procurement functions should be obtained from the procuring 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. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

National Motor Freight Traffic Association, Inc., Agent:

National Motor Freight Classification.

(Application for copies should be addressed to the American Trucking Associations, Inc., Tariff Order Section, 1616 P Street, N.W., Washington, DC 20036.)

Uniform Classification Committee, Agent:

Uniform Freight Classification.

(Application for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza., Chicago, IL 60606.)

Underwriters' Laboratories, Inc., UL Standards:

Standard No. 507 - Standard for Electric Fans.
UL Subject 746 - Document "E" Guide to Requirements for Polymeric Materials Used as Electrical Insulation.

(Application for copies should be addressed to the Underwriters' Laboratories, Inc., 207 East Ohio Street, Chicago, Illinois 60611; 1285 Walt Whitman Road, Melville, L.I., New York 11746; or 1655 Scott Blvd., Santa Clara, CA 95050.)

National Electrical Manufacturers Association (NEMA) Publication:

Pub. No. MG 1 - Motors and Generators.

(Application for copies should be addressed to National Electrical Manufacturers Association, 155 East 44th Street, New York, N.Y. 10017.)

American Society For Testing and Materials (ASTM) Standards:

B499 - Measurement of Coating Thickness by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals.
D1730-67 - Preparation of Aluminum-Alloy Surfaces for Painting.

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

American National Standards Institute Inc., (ANSI) Standard:

ANSI-S1.4 - General Purpose Sound Level Meters.

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

3. REQUIREMENTS

3.1 Preproduction samples.

3.1.1 Preproduction sample. Unless otherwise specified (see 6.1), before production is commenced, a complete fan covered by this specification shall be submitted or made available to the contracting officer or his authorized representative for approval in accordance with 4.2.2.1, 4.2.2.2, 4.2.3 and 4.3. Approval of the preproduction sample authorizes the commencement of production but does not relieve the supplier of responsibility for compliance with all applicable provisions of this specification. The preproduction sample shall be manufactured in the same facilities to be used for the manufacture of the production items.

3.1.2 Waiver of preproduction sample tests. Preproduction sample tests described in 4.3 may be waived provided the contracting officer finds that the model offered by the contractor is equal to or superior in quality and performance and meets all the requirements of this specification. This determination may be made by visual examination or by comparison of component parts, bills of materials, or drawings of a model previously found acceptable on a Government contract, provided the contractor furnishes copies of certified test data covering previous tests of this model to the contracting officer. Test data must indicate compliance with the specified test conditions and must have been obtained as a result of tests conducted within the past 4 years on an identical type and size fan furnished on a Government contract. In addition to test data, a certified statement to the effect that the fans being furnished are identical with those previously tested will be required.

3.2 Fire and casualty hazards. Each contractor shall submit proof that the fans he proposes to supply under this specification conform to the requirements of UL Standard No. 507. Listing by Underwriters' Laboratories will be accepted as evidence that the product conforms to this requirement. In lieu of the Underwriters' Listing, the contractor may submit independent proof satisfactory to the contracting agency that the fans conform to applicable requirements of the published standard, including method of tests of UL Standard No. 507. Compliance with the above preliminary requirements in regard to fire, safety and casualty hazards does not absolve the contractor from complete compliance with the other requirements of this specification in order to secure acceptance of his material or equipment.

3.3 Material. All material used in the manufacture of fan component parts shall be new. Additionally, material shall be free of defects that affect the fan's appearance, serviceability, or safety.

3.3.1 Plastic. Each type of plastic used in the fans construction shall be identified by the supplier. Plastic components other than slow burning or self extinguishing shall not be used in the fan's construction. When plastic is used as an enclosure for live electrical parts or to support same, it shall be of a self extinguishing type. Testing to determine plastic type shall be in accordance with 4.3.8.

3.4 Component parts.

3.4.1 General. The fan shall consist of a motor, base, blade, guard, electric cord, speed control device, and other parts necessary to constitute a complete functional product. Additionally, type I size 3 fans and type II and III fans shall have a handle designed for ease of carrying. Type I, sizes 1 and 2 fans shall have handles if specified (see 6.1).

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3.4.2 Motor. Unless otherwise specified (see 6.1), the fan motor shall be of a single phase, induction, squirrel cage, guarded machine design of the permanent-split capacitor, two-value capacitor, or shaded pole type meeting the requirements specified in Federal Specification CC-M-1807 for Type I, Class 1, Style A, Kind 2 (Group C or D) or Kind 3, Enclosure 1, Design D motors. Motor shall have torque sufficient to start and operate fan at any specified speed control setting. Additionally, motor shall be capable of operating continuously under maximum load without exceeding the temperature rise specified in UL Standard No. 507. See 4.3.3.

3.4.2.1 Voltage and frequency. Unless otherwise specified (see 6.1), motors shall be designed for a rated voltage and frequency of 115 volts, 60 HZ, or 120 volts, 60 HZ, alternating current and shall be capable of operating within the range of 115 volts ± 10 percent, 60 HZ ± 5 percent, or 120 volts ± 10 percent, 60 HZ. ± 5 percent.

3.4.2.2 Insulation. Insulation shall be class A or B in accordance with NEMA Publication No. MG-1.

3.4.2.3 Bearings. Bearings shall be ball, sleeve, or spherical design and shall be of the maintenance free permanent lubrication type.

3.4.2.4 Duty. Motor shall be designed for continuous operation when employed as the drive source for the type fans described herein.

3.4.2.5 Electromagnetic interference suppression. When specified in the invitation for bids (see 6.1), motors shall be designed for suppression of electromagnetic interference in accordance with requirements of MIL-STD-461 Notice 4. Testing shall be in accordance with 4.3.4.

3.4.3 Base.

3.4.3.1 Types I and II. The base shall not crack, break, or become distorted to such degree that its safety or effectiveness as a base is impaired when tested as specified in 4.3.5.1. Additionally, the bottom of type I fan base shall have replaceable protective material or at least four protective feet for vibration isolation and prevention of surface marring. The protective material or feet shall be installed in such manner as to preclude marring of finished surfaces when base of fan is dragged across such surfaces with fan vertical axis inclined 30° or more with respect to horizontal. Type I and II base shall be provided with mounting facilities suitable for fixed mounting of fan on vertical or horizontal surfaces.

3.4.3.2 Type III. The base shall be constructed of at least 5/16 inch steel rod (1/4 inch support rods are acceptable) or 3/4 inch steel tubing and shall be formed so that it will not show permanent distortion when tested as specified in 4.3.5.1. Additionally, the base shall be such as to effect stable operation of fan under all normal operating conditions. Suitable means shall be provided for fixed mounting of fan on a vertical surface. Also, the bottom of fan base shall be provided with a suitable protective material to preclude marring of finished surfaces.

3.4.4 Guard.

3.4.4.1 Types I and II. The guard shall enclose the entire face, perimeter and reverse side of fan blades and associated moving parts. All guard openings shall be of a size that precludes entrance of a 1/2 inch diameter sphere when the sphere is thrust into any opening(s) with a force of one pound (see 4.3.5.2). The guard shall consist of a front section and a rear section, designed so that when assembled to form a complete guard the sections are secured in equally spaced positions around their interface. Additionally, the sections must be readily separable, without the use of special purpose tools, so as to permit access to the blades and associated moving parts. The assembled guard shall be securely fastened to the motor housing. The guard shall be designed to preclude vibration noise, particularly noise caused by any portion of the guard coming in contact with any other portion of the guard or fan. The guard shall clear the base adjusting and locking device when operated in any specified tilt position (see 3.4.9). The guard shall neither contact the blade assembly or other rotating components nor show permanent distortion when tested in accordance with 4.3.5.2.

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3.4.4.2 Type III. The guard or protective housing shall enclose the entire face, perimeter and reverse side of fan blades and associated moving parts. All openings in guard or housing shall be of a size that precludes a 1/2 inch diameter sphere when the sphere is thrust with a force of one pound (see 4.3.5.2). Additonally, the guard or protective housing shall be designed to permit ready access, without the use of special purpose tools, to the blade assembly and associated components for maintenance and cleaning. Also, the guard or housing shall be designed to preclude vibration noise, particularly noise caused by any portion of the guard or housing coming in contact with any other portion of the guard housing or fan. The guard shall neither contact the blade assembly or other rotating components nor show permanent distortion when tested in accordance with 4.3.5.2.

3.4.5 Blade assembly. The blade assembly shall consist of a complete air screw having at least three blades together with a hub or central support. Additionally, the fan shall be designed so that blade assembly will not contact the fan guard or motor housing should the blade assembly become loose on the motor shaft. Also the blade assembly shall not chip, crack, break, or show sign of distortion when operated at a speed of 150 percent of the maximum fan speed, in accordance with 4.3.6.1. The diameter of the Type 1 fan blade assemblies shall be 10, 12, and 16 inches, respectively, for the size 1, 2 and 3 fans and the diameter of the type II fan blade assembly shall be 30 inches, all diameter tolerances being ± 1/2 inch (see 1.2.1). The diameter of the type III fan blade assembly shall be as necessary to meet performance requirements provided maximum dimensions specified in 3.7 are not exceeded.

3.4.5.1 Fan blades. The fan blades shall be constructed of metal or plastic and shall be of such design that normal cleaning and dusting shall not cause bending out of alignment. Non integral metal blades shall be secured to the hub or central support with not less than two rivets per blade or other means of equal strength and rigidity. Other blade designs, if not integral parts of blade assembly shall be secured to hub or central support in a manner that provides strength and rigidity equivalent to that specified above for metal blades. Type I and III fan blades shall show no distortion or fracture and shall show no displacement with respect to the hub assembly upon application of 20 pound-feet of torque in the manner specified in 4.3.5.3. Also, Type II fan blades shall show no distortion or fracture and shall show no displacement upon application of 40 pound-feet of torque in the manner specified.

3.4.5.2 Hub or central support. The hub or central support shall be readily replaceable on the motor shaft, forming a snug fit on the motor shaft and secured in a manner that precludes turning. Additionally, the hub or central support of type I and III fan blades shall show no distortion or fracture and shall not separate from fan blades when subjected to an axial pull force of 25 pounds as described in 4.3.5.3. Also, the hub or central support of type II fans shall show no distortion or fracture and shall not separate from fan blades when subjected to an axial pull force of 30 pounds as described in 4.3.5.3.

3.4.5.3 Blade assembly balance (applicable to type III fans only). The blade assembly on the type III fan shall be balanced to an accuracy of at least 3 gram-centimeters.

3.4.6 Speed regulating device.

3.4.6.1 The speed regulating device shall have not less than the number of speed positions indicated in table I and these positions shall be marked.

3.4.6.2 The speed regulating devices shall be such that the low speed positions provide the percentage range of maximum speeds indicated in table I, when operating at rated voltage and frequency.

TABLE I.

Type	Size	Minimum number of positions	Percent of maximum fan speed with switch on lowest speed position
I	1	1	----
I	2	2	60 to 85 percent
I	3	3	60 to 85 percent
II	30	2	Not over 80 percent
III		2	Not over 80 percent

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3.4.6.3 No damage to fan or speed regulating device shall occur if speed regulating device is left continuously in any speed position.

3.4.6.4 The speed regulating device shall be nonflammable and designed to permit continuous operation at any speed setting.

3.4.6.5 The fan shall be capable of starting at any speed setting at a voltage 10 percent lower than rated voltage.

3.4.6.6 With the exception of type I, size 1 fans, type I and II fan speed regulating device mechanisms (except control means) and associated wiring shall be completely enclosed within the fan base with access provided via detachable base plate cover, preferably underneath the base. Additionally, the speed regulating control shall be positioned in such location on the fan base so as to be easily accessible when fan is used in either desk or bracket positions. All components of the type III speed regulating device shall be enclosed except the control means (handle, button, or knob).

3.4.6.7 Types I and II fans shall have a clearance of not less than 1-1/2 inches between the speed regulating device control means and fan guard for all positions of the fan. Also, all fan types shall have a clearance of not less than 2 inches between the control means and fan blade for all positions of the fan.

3.4.7 Electric cord and plug. Unless otherwise specified (see 6.1) the cable assembly shall be any class and grade specified in Fed. Spec. J-C-175. The cable assembly shall be at least 10 feet from plug connector to the point of entrance into the fan. If cable assembly is to be of a specific color, such color shall be specified (see 6.1), otherwise color shall be compatible with color of fan. On type I and II fans the cable assembly shall enter fan base and be concealed.

3.4.7.1 Oscillator cord (type I fans only). The oscillator cord shall be of flexible stranding and shall be no greater than 3/8 inch in overall diameter. Additionally, the cord shall not enter the motor through the motor end adjacent to blade assembly. Also cord shall have sufficient length between motor and stationary base to insure freedom of oscillatory movement.

3.4.8 Oscillatory mechanisms (type I fans only). The angle of oscillation shall not be less than 55 degrees for the type I, size 1 fan, and not less than 75 degrees for the type I sizes 2 and 3 fans. Oscillating gears and drive train shall be designed to provide a smooth uninterrupted movement of the main fan blade assembly during each oscillatory cycle. Metal oscillating gears shall be lubricated and contained within a sealed gear box to prevent loss of lubricant and collection of abrasive matter. Oscillating gears of the self lubricating type (nylon, delrin, etc.) shall be enclosed to preclude dust and other abrasive matter. Oscillatory mechanisn shall be of a design that can be disengaged in any position within above specified oscillation limits, whereupon the fan shall remain stationary in the position of disengagement.

3.4.9 Tilt adjustment and locking devices. Tilt adjustment and locking devices shall be of sturdy construction, remaining secure when tested in accordance with 4.3.5.4. Additionally adjustment and locking devices shall be designed to permit adjustment and locking in any specified tilt position without the use of tools. If a wing nut is used to secure the locking device, it shall have a smooth contoured surface and shall be at least 1-inch in diameter across the "wings". If a knob is used, it shall also be at least 1-inch in diameter. Also, should the locking device be of a design that would permit the fan to become accidentally disassembled, upon loss of securing lock (wing nut, knob, etc.), a safety stop shall be provided to preclude accidental disassembly. Tilt adjusting devices shall be designed so that tilt adjustments can be accomplished with ease without necessity of physically supporting the total weight of the portion of the fan being adjusted, without binding, and without marring fan protective finishes. Additionally, type I fans shall be designed so that assembly shall not be required in order to utilize in either desk or bracket positions. Tilt adjustment on type I fans shall permit operation within the range of at least 10 degrees below horizontal to at least 10 degrees above horizontal when used as a desk fan, and from horizontal to at least 25 degrees below horizontal when used in the bracket position. Tilt adjustment on type II fans shall permit operation within the range from horizontal to at least 25 degrees below horizontal. Tilt adjustment on type III fans shall permit operation through a range of 180 degrees, from straight up to straight down. The above tilt angles shall be construed as angles formed by motor shaft axis and the horizontal plane.

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3.5 Fan performance. Unless otherwise indicated, fan performance, listed in table II, shall be determined at rated voltage and frequency at normal operating temperature of the motor in the high speed position. Type III fans shall be provided with vanes, louvers, or other means as necessary to impart an essentially linear jet stream character to the air movement. Thrust per watt ratios shall be obtained by dividing measured thrust (in pounds) by the measured fan motor power input (in watts) required to produce the particular measured thrust. Performance tests are specified in 4.3.6.

TABLE II. Fan performance requirements

Type	Size	Maximum power input (watts)	Minimum thrust/watt ratio (lbs./watt)	Minimum thrust (lbs.)	Minimum CFM air delivery 9 ft. in front of blade	Maximum A weighted noise level (decibels)
I	1		.0038	.20		49
	2		.0061	.35		51
	3		.0128	.83		57
II	4		.0114	4.2		75
III		145			2500	60

3.5.1 Vibration limits (applicable to type I and II fans only). When tested in accordance with 4.3.6.6, the rotating components of the type I fan shall be balanced to the extent that total vibration shall not exceed 0.003 times the distance in inches between an upward extension of a vertical line running through the approximate center of the motor support and point of measurement. The distance is to be measured parallel to the motor axis with motor housing adjusted for zero degrees tilt. The rotating components of the type II fan shall be balanced to the extent that total vibration, when measured as outlined above, shall not exceed 0.009 times the distance in inches between an upward extension of a vertical line running through the approximate center at the motor support and point of measurement.

3.6 Finish. Unless otherwise specified (see 6.1), the finish shall be the manufacturer's standard practice provided that the color of the fan is not predominately black or gray and provided that the finish is suitable for business and home use. When specified (see 6.1), finish shall be as follows:

3.6.1 Aluminum alloy parts. Aluminum parts shall be protected for corrosion resistance by either anodizing, or covering with enamel or lacquer coating.

3.6.2 Ferrous parts. Ferrous parts shall be protected for corrosion resistance by either chromium or zinc plating or covering with enamel, or lacquer coating. No rust shall appear, except as noted, when tested in accordance with 4.3.7.3.

3.6.3 Coatings.

3.6.3.1 Enamel and lacquer coatings. Prior to coating, ferrous parts shall be treated in accordance with manufacturer's corrosion inhibitive methods. Aluminum parts shall be pretreated in accordance with one of the methods outlined in ASTM D1730. The dry film thickness shall be between .7 and 1 mil. and shall have a dry film contrast ratio of not less than 0.98. Coatings when applied at the above thickness shall ribbon or curl without flaking or otherwise loosening from the primer or base metal. Coating flexibility shall be such that no cracking or crazing occurs when tested in accordance with 4.3.7.1.

3.6.3.2 Chromium or zinc plating. Chromium plated finishes shall have a polished appearance. Minimum thickness of the total plating shall be 0.0004 (0.4 mils) when tested in accordance with 4.3.7.2. Zinc plated finishes shall have a polished appearance and shall be type I, class 2, in accordance with QQ-Z-325 (see 4.3.7.2).

3.7 Maximum dimensions, type III fan. The dimensions of type III fan, shall not exceed 19 inches high, 18 inches wide, and 11 inches deep.

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3.8 Workmanship and design. The finished fans shall be clean and conform to the quality and grade of the products established by this specification. All burrs, rough and sharp edges shall be removed. All exposed welds or seams shall be ground smooth. There shall be no flaking, peeling or chipping of paint or any exposure of bare metal. All bolt and rivet holes shall be accurately and cleanly punched or drilled and rivet heads neatly finished. In general, fan shall be free from any workmanship or design defects that affect appearance and serviceability and any workmanship or design defects that may cause injury to the user.

3.9 Marking for identification.

3.9.1 The fans shall be marked with contract number and date of manufacture.

3.10 Manuals. The contractor shall pack with each end item his standard commercial repair instructions, which shall include a complete list of all replaceable parts.

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 in the contract or order, the supplier 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 that supplies and services conform to prescribed requirements.

4.2 Sampling for inspection and acceptance. Sampling for inspection and acceptance shall be made in accordance with the provisions set forth in MIL-STD-105, except where otherwise indicated.

4.2.1 Inspection of components and materials. In accordance with 4.1, the contractor is responsible for insuring that components and materials used were manufactured, tested and inspected in accordance with the specified requirements of referenced subsidiary specifications and standards, or if none, in accordance with this specification.

4.2.2 End product inspection. All fans of the same type and size offered for acceptance at one time shall be considered a lot for the purpose of inspection. The sample unit for these inspections shall be one completely fabricated fan.

4.2.2.1 Visual examination. The completely assembled end item shall be examined for defects in finish, construction, workmanship, and marking. Defects shall be classified as follows. The inspection level shall be II with an acceptable quality level (AQL) of 2.5 for major defects and 6.5 for total defects, expressed in terms of defects per hundred units.

Examine	Defect	Major	Minor
Finish	Not finished as required.	X	
Design	Any characteristic not in accordance with the specified requirements.	X	
Construction and workmanship general (applicable to all components and assemblies)	Fractured, split, bowed, malformed, or otherwise impaired.	X	
	Sharp burrs, slivers, or splinters that may be injurious to personnel.	X	
Assembly	Not properly assembled or secured.		X
Marking identification	Missing, incomplete, not legible, not as specified.		X

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4.2.2.2 Dimensional examination. Examination shall be made of the end item to determine compliance with dimensional requirements. Any noncompliance with specified requirement shall constitute a defect. The inspection level shall be S-2 and the AQL shall be 6.5, expressed in terms of defects per hundred units.

4.2.2.3 Testing of the end product. The contractor shall perform tests in accordance with 4.3.2 using inspection level S-2 with an AQL of 4.0 defects, expressed in terms of defects per hundred units. Certified test data indicating compliance will be acceptable in lieu of performing tests specified in 4.3.3, 4.3.4 and 4.3.8.

4.2.3 Code and standards compliance. The contractor shall provide the Government representative with proof of compliance with the Underwriters' Laboratories requirements of 3.2.

4.3 Tests.

4.3.1 Preproduction sample tests. The preproduction sample tests shall consist of all tests specified or described under 4.3. Evidence acceptable to the Government and indicating specification compliance may be offered in lieu of fan manufacturer performance of 4.3.3, 4.3.4, and 4.3.8 tests. Except as noted for 4.3.3, 4.3.4 and 4.3.8, all tests are to be conducted on the same fan sample at manufacturer's expense.

4.3.1.1 Place of preproduction sample tests. Preproduction sample tests shall be conducted at a Government laboratory designated by the Mechanical and Electrical Division, Federal Supply Service, General Services Administration, or upon approval by Mechanical and Electrical Division, Federal Supply Service, tests may be conducted at a commercial laboratory, or at the manufacturer's plant.

4.3.2 Lot acceptance tests. Unless otherwise specified, the contractor shall furnish all samples and shall be responsible for accomplishing the required tests. Testing, if conducted at the contractors plant shall be under the supervision of the Government inspector. Contractors not having laboratory test facilities satisfactory to the Government shall engage the services of a commercial laboratory acceptable to the Government. Except as indicated, each fan selected for lot acceptance testing shall be subjected to all tests cited below. Lot acceptance tests shall consist of all tests cited in 4.3.3, 4.3.4 (when required), 4.3.5, 4.3.6, 4.3.7 (when required), and 4.3.8; however, evidence acceptable to the Government and indicating specification compliance may be offered in lieu of fan manufacturer performance of 4.3.3, 4.3.4 and 4.3.8 tests.

4.3.3 Motor. With exception of temperature rise test, motor tests shall be conducted in accordance with requirements of Federal Specification CC-M-1807. Temperature rise test shall be in accordance with UL Standard No. 507. Proof of Compliance with UL Standard No. 507 and certificate of compliance from motor manufacturer indicating that motor complies with all applicable requirements of Federal Specification CC-M-1807 will be accepted in lieu of test performance. Failure of above tests or lack of compliance as cited above shall be cause for rejection of product. Refer to 3.4.2 for motor requirements.

4.3.4 Electromagnetic interference test. When specified (see 3.4.2.5 and 6.1), electromagnetic interference suppression tests shall be conducted in accordance with MIL-STD-461, Notice 4, and MIL-STD-462. Refer to MIL-STD-463, as necessary, for definitions and systems of units used in electromagnetic interference technology. The test sample shall be one complete fan, testing shall be accomplished by a test laboratory acceptable to the Government. Failure shall be cause for rejection of products. Refer to 3.4.2.5 for interference suppression requirements. The supplier shall furnish the contracting officer a test plan and a test report as required by MIL-STD-461. Disapproval of the test report shall constitute failure of this test.

4.3.5 Structural tests.

4.3.5.1 Base. Type I and II fans shall be dropped free fall from a height of 15 inches onto a concrete or rigid metal surface so as to strike on one edge of base. Subsequently base shall be examined to determine compliance with 3.4.3.1. Non compliance with 3.4.3.1 shall be construed as test failure and shall be cause for rejection. Damage to other parts of fan shall not be considered. The type III fan shall be placed in normal operating position and subjected to a vertical force of 50 pounds for a period of ten minutes. Subsequently, fan shall be examined to determine if permanent distortion of base has occured (see 3.4.3.2). Evidence of permanent base distortion shall be construed as test failure and shall be cause for rejection.

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4.3.5.2 Guard tests. To determine compliance with 3.4.4.1 and 3.4.4.2 the following tests shall be performed. A 1/2 inch diameter sphere shall be thrust into any selected guard opening(s) with a force of one pound from a direction and in a manner most apt, to favor penetration of the guard. Sphere penetration of the guard shall constitute test failure and be cause for rejection of fan. Subsequent to sphere penetration test fans shall be subjected to the applicable guard test described below. Type I and II fan motor housings with blade assembly and guard shall be held securely in a position such that the plane of blade rotation is horizontal with the guard facing upward. The fan guard when in correct test position shall be supported only by means of attachment to motor housing incorporated in fan design. No supports shall be placed underneath guard during test. The type III fan shall be adjusted for a tilt position such that airflow, if in operation, would be straight up (tilt position of 90 degrees above horizontal) with plane of blade rotation horizontal. After positioning as appropriate for the specific fan type, a round steel shaft 4 inches in diameter and weighing 50 pounds shall be placed so that the shaft exerts a force of 50 pounds over randomly selected areas of the fan guard face one of which is to be the center portion of fan face. With each placement of the shaft, the fan blade assembly shall be rotated by hand whereupon guard shall not contact fan blades or other rotating components. For type III fans repeat the above procedure with fan tilt adjusted so that air flow, if in operation, would be straight down (a tilt position of 90 degrees below horizontal) with plane of blade rotation horizontal. When in position, the 50 pound shaft is to be placed over randomly selected areas at rear of fan guard and blade assembly rotated by hand. Blade assembly contact, other rotating component contact, or permanent guard distortion any time during testing of either type I, II, or III fan shall be construed as test failure and shall be cause for rejection. Refer to 3.4.4 for requirements.

4.3.5.3 Blade torque and hub axial pull force tests. To determine compliance with blade torque requirements of 3.4.5.1 each blade of the blade assembly shall be subjected to a torque of 20-pound-feet or 40 pound-feet, as applicable dependent upon fan type applied in such manner that the force causing the torque is directed in the plane of blade rotation. Torque shall be applied for one minute where-upon blades shall be examined for displacement from the hub assembly. To determine compliance with axial pull force requirements of 3.4.5.2, the blades of the complete blade assembly shall be held in a fixed position whereupon an axial pull force of 25 pounds or 50 pounds, as applicable dependent upon fan types shall be applied to the hub or central support for one minute alternately in both axial directions. After force application the hub or central support shall be examined for evidence of displacement distortion or fracture. Evidence of displacement, distortion or fracture after performance of either of the above tests shall be construed as test failure and shall be cause for rejection.

4.3.5.4 Adjustment and locking devices. Prior to test, adjust type I and III fans for a tilt setting of 10 degrees above horizontal and type II fan for a horizontal tilt setting and lock in position. Subsequently, the complete fan shall be raised 6 inches above a rigid horizontal surface and allowed to drop free fall. Prior to release, the bottom of the fan base shall be positioned so that it is parallel to the rigid impact surface. Repeat the drop two additional times, then examine for compliance with 3.4.9. Tilt settings after completion of three drops shall not vary by more than 2 degrees from the settings established prior to test. Evidence of variation shall be construed as test failure and shall be cause for rejection.

4.3.6 Performance tests. Except as noted, tests specified or described under 4.3.6 shall be conducted at rated voltage and frequency at high speed setting, and after fan has been in operation for at least one hour.

4.3.6.1 Overspeed. The blade assembly shall be removed from the motor shaft and secured to the shaft of a variable-speed motor having a high speed rating of at least 175 percent of the fan high speed rating. The blade assembly shall then be run at a speed of 150 $\pm$ 3 percent of the maximum speed of the fan for one hour. Upon completetion of the test, the blade assembly shall be examined for cracks, breaks, chipping, and tightness of blades to hub or central support. The speed of rotation shall be measured stroboscopically or with a counter that imposes neglible load on the motor. Cracks, breaks, chipping or signs of distortion shall be construed as test failure and shall be cause for rejection. Refer to 3.4.5 for requirements.

4.3.6.1.1 Speed. To determine compliance with 3.4.6.2, the fan shall be operated at both low and maximum speed settings and speed (r.p.m.) shall be measured stroboscopically or with a counter that imposes no appreciable load on fan motor. The sensitivity and accuracy of the test apparatus shall be such that differences of 20 r.p.m. may be detected. Inability to meet requirements of 3.4.6.2 shall be construed as test failure and shall be cause for rejection.

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4.3.6.2 Measurement of thrust. Refer to paragraph 3.5 and table II for thrust requirements. Inability to meet thrust requirements shall be construed as test failure and shall be cause for rejection.

4.3.6.2.1 Sensitivity of apparatus. The thrust shall be measured by means of an apparatus having a sensitivity such that a change in thrust of 0.01 pounds causes a motion of the pointer or indicating device of at least 1/8 inch.

4.3.6.2.2 Description of apparatus. The apparatus shall be calibrated by means of standard weights. In case of controversy, the apparatus developed at the National Bureau of Standards shall be used. This apparatus is based on the principle of a pendulum, counterbalanced to give adequate sensitivity. A platform is suspended by four rods of equal length, the connection of the rods to the platform and to the supporting framework being through ball bearings. The platform is thus free to move back parallel to a horizontal plane. The weight of the platform and a part of the weight of any fan placed on the platform are counterbalanced by two counter-weights placed above the plane of the four upper supporting bearings. In practice, the overhead weights are adjusted to give an overbalanced condition with no fan; and the desired stability and sensitivity are obtained by adding weights to the platform. The current for the fan motor is brought in through the frame and through an insulated line carried through insulated brush contacts. A scale graduated in terms of the tangent of the deflection angle is attached to the platform.

4.3.6.2.3 Calibration of apparatus. The scale is calibrated and the sensitivity measured by applying known horizontal forces by means of a light thread running over a ball bearing pulley to standard weights.

4.3.6.2.4 Alternate method for determining thrust. In lieu of determining thrust by the above method, the following alternate method may be used. Using the apparatus described in 4.3.6.2.2, with exception of graduated scale pointer device, place the fan on the platform with the motor axis in a horizontal plane and mark the platform's initial position with a stationary marker. After marking position of the platform, attach a light thread to center of the fan guard. Run thread over a pulley and down to a position below the platform. At this point, attach a bucket containing lead weights to the thread. Turn fan on and set to highest speed position. Change weight in bucket until platform is returned to the initial position as marked above. Detach bucket and weigh on a scale or balance having an accuracy of at least 0.001 pounds. The weight of the bucket and lead weights, so obtained, gives the direct measurement of fan thrust.

4.3.6.3 Power input. The sensitivity and accuracy of the apparatus for measuring power input to determine compliance with power requirements of paragraph 3.5 and table II shall be such that differences of one watt may be detected. Inability to meet power requirements shall be construed as test failure and shall be cause for rejection.

4.3.6.4 Noise test. Refer to paragraph 3.5 and table II for noise requirements. Inability to meet requirements shall be construed as test failure and shall be cause for rejection.

4.3.6.4.1 Noise measurement. Noise measurement shall be made with a general purpose type 2 sound level meter conforming to ANSI Standard S1.4-1971 or latest revision thereof. The sound level meter shall conform to response curve A of the above ANSI S1.4 Standard.

4.3.6.4.2 The fan shall be mounted in its normal operating position centrally in the test room, and the motor axis of rotation shall be horizontal and at least 3 feet above the floor.

4.3.6.4.3 Resilient means shall be interposed between the fan and its support so that the transmission of vibration to the support and the reaction of the fan are both negligible.

4.3.6.4.4 Seven measurements shall be taken at stations in one horizontal plane which includes the motor axis of rotation. These stations shall all be on a circle having a 3-foot radius, measured from the center of the hub of the blade assembly, and shall be spaced equidistant at 45 degrees positions on this circle, including one position on the fan axis of rotation at the back of the blades and omitting the position on the fan axis of rotation at the front of the blades.

4.3.6.4.5 The fan speed at the beginning of the noise test shall be kept constant during the test.

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4.3.6.4.6 The average of the readings shall be taken at the noise level of the fan at the test speed. If the range of the sound level measurement is less than 10 decibels, their average can be obtained by an arithmetical average of the decibel readings. However, the average of a number of sound level readings is defined as 10 times the logarithm to the base 10 of the average of the antilogarithms of 1/10 of the separate decibel values; this value to be used where differences in reading between positions exceed 10 decibels. The following example will illustrate the method of obtaining the average:

Microphone position	Sound level	Antilogarithm to the base 10 of 1/10 of the decibel sound level
	Decibels	
A	60	1,000,000
B	50	100,000
C	40	10,000
		Total.....1,110,000
		Average.....370,000
Log10 370,000 = 5.57	10 Log10 370,000 = 55.7 or the average decibel value	

4.3.6.4.7 If the noise level of the room when the fan is not in operation is less than 10 decibels lower than any reading taken with the fan in operation, the reading shall be corrected in accordance with the following:

Difference in decibels between room level and fan level reading	Subtract this decibel correction from fan level reading
6	1.3
7	1.0
8	0.8
9	0.6
10	0.4

4.3.6.4.8 Test room. The test room for measuring the noise shall be so constructed that the noise reflected from the walls, floor and ceiling will have a negligible effect on the measurements taken. The size of the test room shall be such that recirculating air currents will not affect the motor speed or the power input. The noise level of the test room when the fan is not in operation shall be at least 6 decibels lower than the lowest reading which is obtained during the operation of the fan.

4.3.6.5 Air delivery test (applies to type III fans only). Inability to meet air delivery requirement as specified in paragraph 3.5 and table II shall be construed as test failure and shall be cause for rejection. Air delivery is to be measured in cubic feet per minute.

4.3.6.5.1 Air flow measuring instrument. The air flow shall be measured with an anemometer(s) of the commercial biram or paddlewheel type having a minimum diameter of 2-1/2 to 3 inches and an air-speed range of 50 to 1500 feet per minute.

4.3.6.5.2 Air flow test room. The test room for measuring the air flow shall be so constructed that all wall openings, including doors and windows, can be tightly closed. The test room shall be large enough to prevent disturbance of the normal air stream pattern during the test. The minimum size of the unobstructed test space within the test room shall be 15 feet wide, 30 feet long and 9 feet high.

4.3.6.5.3 Anemometer stand. The stand that supports the anemometer shall offer minimum resistance to the flow of air. It shall be so constructed that it will support the anemometer in any one of the stations required for any complete air delivery test. The anemometer clamp shall present minimum obstructions to the normal air flow. The operator shall be able to change the position of the anemometer without disturbing the normal air stream pattern.

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4.3.6.5.4 Air delivery measurement. The fan shall be mounted so that its axis of rotation is horizontal, parallel to the long side of the test room, 4 feet above the floor and centered in the unobstructed width of the test space. The plane of rotation of the fan blades shall be 5 feet from the back wall. The anemometer shall be rigidly supported in the air stream with its axis of rotation parallel to the axis of rotation of the fan. The anemometer stand shall be so located that the center of the anemometer, in all stations, will be in a single vertical plane which is parallel to and 9 feet in front of the plane of rotation of the fan blades. Test readings shall be taken at 2 inch intervals over a four foot span, both vertical and horizontal lines at a distance of 9 feet in front of the plane of rotation of the fan blades. The center of the four foot span referenced above shall be on a line coincident with the axis of rotation of the fan blades. A total of 49 test readings shall be taken. Each test reading shall be taken over an operating period of not less than two (2) minutes. All readings shall be taken at maximum fan speed. The air delivery in cubic feet per minute shall be the average of all test readings in feet per minute multiplied by the area of a 4 foot diameter circle (12.56 square feet).

4.3.6.6 Vibration test (type I and II fans only). Vibration shall be measured in a plane perpendicular to the motor shaft axis at the rear of the fan motor housing or cover. Measurements shall be taken at each specified speed setting (see table I) with fan operating at rated voltage and frequency. Refer to 3.5.1 for requirements. Test procedure is as follows:

(a) Place assembled fan in a normal upright position and set tilt to 0 degrees. Oscillating fans shall be locked in a stationary (non-oscillating) position at center of oscillatory swing.
(b) Using a prick punch, make a pin point indentation (point of measurement) in the approximate center of rear motor housing/cover.
(c) Using a microscopic device mounted on an independent stable base and having a reticulated eyepiece, focus on the above indentation. Calibrate eyepiece so that each minor division is in the range of .001 - .005 inches as applicable. When focusing insure that sufficient light is available.
(d) Place fan in operation and observe that the indentation, when viewed through the microscopic device, appears to inscribe a straight line. Measure and record the length of the inscribed line. This length will be the total vibration movement and shall not exceed the limit specified in 3.5.1. Vibration in excess of specified limit shall be construed as test failure and shall be cause for rejection.

Note: Alternate methods of vibration measurement may be used in lieu of above procedure provided that these methods give equivalent results and are acceptable to the Government.

4.3.7 Finish tests (when required, see 3.6 and 6.1). Inability to meet finish requirements when tested as specified below shall be construed as test failure and shall be cause for rejection.

4.3.7.1 Enamel and lacquer. Dry film thickness and contrast ratio shall be determined in accordance with test methods 6183 and 4122.1 respectively of Fed. Test Method Standard 141. Ability to ribbon or curl without flaking or losening shall be determined in accordance with Method 6304.1 of Fed. Test Method Standard No. 141. Compliance with the flexibility of 3.6.3.1 shall be determined by rapidly doubling a coated tinplate test panel over a 1/8-inch steel rod mandrel in accordance with Method 6221 of Fed. Test Method Standard No. 141. Prior to doubling, the panel shall be: (1) allowed to air dry for 2 hours at a temperature of 23° ± 1.1°C. (73.4° ± 2°F.) and a relative humidity of 50 ± 4 percent; (2) baked for 3 hours at a temperature of 105°C.; and (3) conditioned for at least 1/2 hour at a temperature of 23° ± 1.1°C. (73.4° ± 2°F.) and a relative humidity of 50 ± 4 percent. Refer to 3.6.3.1 for enamel and lacquer coating requirement.

4.3.7.2 Thickness of Chromium and zinc finishes. Determine total thickness of chromium plated surfaces, and zinc plated surfaces by either the magnetic test of ASTM B499 or the electronic test, method 520.1 of Fed. Test Method Std. No. 151 (see 3.6.3.2).

4.3.7.3 Resistance to rust test. All grease is removed from the parts to be tested by immersion in 1,1,1-trichloroethane for 10 minutes. The parts are then immersed for 10 minutes in a 10 percent solution of ammonium chloride in water at a temperature of 20 ± 5°C. Without drying, but after shaking off any drops, the parts are placed for 10 minutes in a box containing air saturated with moisture at a temperature of 20 ± 5°C. After the parts have been dried for 10 minutes in a heating cabinet at a temperature of 100 ± 5°C, their surfaces shall show no signs of rust. Traces of rust on sharp edges and any yellowish film removable by rubbing shall be ignored. See 3.6.2.

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4.3.8 Buring rate/self extinguishing test (plastic parts). Testing to determine plastic type, either slow burning or self extinguishing shall be in accordance with Underwriters' Laboratories, Inc., "Burning Test For Polymeric Materials Classed As Slow Burning", and "Burning Test For Polymeric Materials Classed As Self-Extinguishing", reference pages E3, E4, and E5 of UL subject 746 of March 1, 1967. Refer to 3.3.1 for requirements. Failure to meet requirements of paragraph 3.3.1, as determined per this test shall be cause for rejection of product. Certificate of compliance from plastic supplier indicating that requirements of paragraph 3.3.1 are satisfied will be accepted in lieu of performance of above test by fan supplier.

4.3.9 Inspection of preparation for delivery. The preservation, packaging, packing, and marking of the fans shall be examined and tested to determine compliance with MIL-E-16298 and section 5 of this specification

5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging.

5.1.1 Level A. Each fan shall be preserved and packaged in accordance with the level A requirements of MIL-E-16298.

5.1.2 Level C. Each fan shall be preserved and packaged in accordance with the supplier's standard practice.

5.2 Packing.

5.2.1 Level A. Each fan shall be packed in accordance with level A requirements of MIL-E-16298.

5.2.2 Level B. Each fan shall be packed in accordance with level B requirements of MIL-E-16298. In addition, the box shall be equipped with a corrugated fiberboard liner covering sides and ends and a pad in the bottom of the same material as the box. The fan shall be braced in a way that only the base will be in contact with the inside of the box.

5.2.3 Level C. Each fan shall be packed in accordance with National Motor Freight Classification item 61920 or with Uniform Freight Classification item 34690 as applicable.

5.3 Marking.

5.3.1 Civil agencies. In addition to special marking required by contract or order, interior packages and shipping containers shall be marked in accordance with Fed. Std. No. 123.

5.3.2 Military agencies. Packages and shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Ordering data. Purchasers should select the preferred options permitted herein, and include the following information in procurement documents:

(a) Title, number, and date of this specification.
(b) Type and size required (see 1.2.1).
(c) If preproduction sample not required (see 3.1.2).
(d) Handles for type I, size 1 or 2 fan, if required (see 3.4.1).
(e) Motor characteristics, if other than specified (see 3.4.2).
(f) Operating voltage and frequency, if other than specified (see 3.4.2.1).
(g) If suppression of electromagnetic interference is required (see 3.4.2.5).
(h) Cable assembly, if other than specified and color of cable assembly, if other than specified (see 3.4.7).
(i) Finish if other than manufacturer's standard practice or if the finish specified in 3.6 is desired (see 3.6).
(j) Inspection responsibility, if other than specified (see 4.1).
(k) Levels of preservation, packaging, and packing (see 5.1 and 5.2).
1) Special marking, if required (see 5.3).

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6.2 Additional details for the thrust measurement apparatus discussed in 4.3.6.2, with description and working drawings may be obtained from the National Bureau of Standards, Washington, D.C.

6.3 When applicable (see 3.4.2.5), the contracting officer shall arrange with the appropriate Military Agency (USA Electronics Command for Army) to have the contractors electromagnetic interference suppression test plan and test report reviewed for technical adequacy and compliance.

6.4 Other fan designs. Refer to latest revision of Fed. Spec. W-F-95 for coverage of radial discharge (hassock) fans and to latest revision of Fed. Spec. W-F-97 for coverage of column (pedestal) fans.

MILITARY INTERESTS:

Custodians:

Army - ME
Air Force - 82

Review interest:

Defense General Supply GS

Coordinating activity:

Army - ME

Preparing activity:

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CIVIL AGENCY COORDINATING ACTIVITIES:

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