INCH-POUND

MIL-F-24751(SH)
1 November 1990

MILITARY SPECIFICATION

FANS, VANEAXIAL GAS TURBINE ENCLOSURE COOLING NAVAL SHIPBOARD

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

1. SCOPE

1.1 Scope. This specification covers high pressure and hi-shock, type TA vaneaxial fan for use in cooling the gas turbine enclosures of ship propulsion/generator systems.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

FF-B-171	Bearings, Ball, Annular (General Purpose)
FF-S-85	Screw, Cap, Slotted and Hexagon Head

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 55Z3, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 4140

FF-S-86	Screw, Cap Socket-Head
FF-S-92	Screw, Machine: Slotted, Cross-Recessed or Hexagon Head
FF-S-200	Setscrews: Hexagon Socket and Spline Socket, Headless
FF-W-84	Washers, Lock (Spring)
FF-W-92	Washer, Flat (Plain)
PPP-F-320	Fiberboard; Corrugated and Solid, Sheet Stock (Container Grade), and Cut Shapes

MILITARY

MIL-S-901	Shock Tests, HI (High-Impact); Shipboard Machinery, Equipment and Systems, Requirements for
MIL-E-917	Electric Power Equipment, Basic Requirements (Naval Shipboard Use)
MIL-S-1222	Studs, Bolts, Hex Cap Screws, Socket Head Cap Screws and Nuts
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-E-16298	Electric Machines Having Rotating Parts, Accessories and Associated Support Items: Packaging of
MIL-M-17060	Motors, 60-Hertz, Alternating Current, Integral-Horsepower, Shipboard Use
MIL-L-19140	Lumber and Plywood, Fire-Retardant Treated
MIL-P-24441	Paint, Epoxy – Polyamide, General Specification For
DOD-G-24508	Grease, High Performance, Multipurpose (Metric)
MIL-C-81751	Coating, Metallic – Ceramic

STANDARDS

MILITARY

MIL-STD-108	Definitions and Basic Requirements for Enclosures for Electric and Electronic Equipment
MIL-STD-167-1	Mechanical Vibrations of Shipboard Equipment (Type I – Environmental and Type II – Internally Excited)
MIL-STD-278	Welding and Casting Standard

MIL-STD-740-2	Structureborne Vibratory Acceleration Measurements and Acceptance Criteria of Shipboard Equipment
MIL-STD-1399, Section 300	Interface Standard for Shipboard Systems, Electric Power, Alternating Current (Metric)

(Unless otherwise indicated, copies of federal and military specifications and standards are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.1.2 **Other Government drawings and publications.** The following other Government drawings and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

DRAWINGS

NAVAL SEA SYSTEMS COMMAND (NAVSEA)

804-6397382	Fan, Vaneaxial Gas Turbine Enclosure Cooling

PUBLICATIONS

NAVSEA

NAVSHIPS 0900-LP-003-8000	Metals Surface Inspection Acceptance Standards

NAVAL SHIPS TECHNICAL MANUAL (NSTM)

S9086-CH-STM-010 CH-074, VI	Welding and Allied Processes

(Application for copies should be addressed to the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 **Non-Government publications.** The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A 153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; (DOD adopted)

B 26 Standard Specification for Aluminum-Alloy Sand Castings; (DOD adopted)

B 209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; (DOD adopted)

B 211 Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire; (DOD adopted)

B 633 Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; (DOD adopted)

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

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

210 Test Code for Air Moving Devices

300 Test Code for Sound Rating

(Application for copies should be addressed to the Air Movement and Control Association, 30 West University Drive, Arlington Heights, IL 60004.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.5) in accordance with 4.3.

3.2 Material.

3.2.1 General. It is the intent of this specification that commercial materials be permitted for fan parts. When not identified by Government specifications, steel and aluminum materials, other than castings, shall be identified by American Iron and Steel Institute number or range of numbers (for example, AISI 1008-1020) or by Aluminum Association number (for example, 5052). Chemical or mechanical analysis is required only for castings.

3.2.2 Carbon steel. Parts fabricated of steel plate, including castings, shall be of carbon steel having a surface smoothness suitable for electroplating.

3.2.3 Aluminum alloy. Aluminum alloy shall conform to the requirements in table I.

TABLE I. *Aluminum alloy materials.*

Material	Alloy	Requirement
Plate and sheet	5086, quarter hard[1] 5052, quarter hard 6061, T4 or T6	ASTM B209, H32 ASTM B209, H32 ASTM B209, T4 or T6
Bars, shapes, rod, and wire	5052, quarter hard	ASTM B211, H32 ASTM B211, alloy 5052, H32
Sand castings		ASTM B26, alloys 356-T6, 710.0, 712.0, T1, or 713.0

[1]Preferred for welded assemblies.

3.2.4 **Cast iron.** Cast iron shall not be used in any part of the fans. Cast iron shall not be used in motors.

3.2.5 **Hardware.** Hardware shall conform to commercial standards. The following specifications are listed for guidance: capscrews, FF-S-85 or FF-S-86, as applicable; slotted-head machine screws, FF-S-92; hexagon-socket, headless setscrews, FF-S-200; bolts MIL-S-1222; nuts, FF-N-836; lockwashers, FF-W-84; and plain washers, FF-W-92. Fittings shall be of carbon steel, electroplated with zinc to a minimum thickness of 0.0002 inch in accordance with ASTM B 633, class FE/ZN25. High strength, above grade 5, fittings shall not be permitted.

3.2.6 **Dissimilar metals.**

3.2.6.1 **Fittings.** Copper or brass fittings shall be insulated from aluminum or aluminum alloys. Asbestos paper or similar absorbent material shall not be used in contact with aluminum or aluminum alloys.

3.2.6.2 **Faying surfaces.** Faying surfaces of aluminum or aluminum alloy with like or dissimilar metals shall be painted with one coat of epoxy primer, MIL-P-24441, formula 150 and a top coat of MIL-P-24441, formula 151 before assembly. Total minimum dry film thickness for each coating shall be 2 mils.

3.2.6.3 **Tapped holes.** Tapped holes in aluminum shall be avoided. When there is no practical alternative, the thread shall be fitted with a corrosion-resistant steel insert. The thread of the screw shall be coated upon assembly with ceramic metallic coating in accordance with MIL-C-81751. Any departures and non-use of corrosion-resistant threaded inserts shall be approved on a case basis.

3.3 **Welding and allied processes.** All welding and allied processes shall conform to MIL-STD-278, class M.

3.3.1 Weld defects. Weld defects that exceed the parameters established by NAVSHIPS 0900-LP-003-8000 shall be corrected through:

a. *Weld rework* – a procedure that will bring the part into total compliance with the drawing and specification requirements and does not diminish the thickness of the parent metal by more than 10 percent and does not affect the parent metal surface by more than 1/32 inch for 15 percent of the weld length or 12 inches whichever is the least. Rework actions may be completed at the discretion of the manufacturer.

b. *Weld repair* – repairs, in accordance with a Government approved procedure, are required any time any defects exceed the rework limits above. A repair action, if successfully completed, will create a serviceable yet not fully conforming unit. Cracks shall be repaired in accordance with 4.5.2. Weld repairs shall be inspected in accordance with MIL-STD-278.

3.4 Plating of carbon steel parts. After all welding, drilling, and machining operations have been completed, steel assemblies which are not corrosion-resistant shall be plated by one of the following methods:

Process	Plating specification	Class
Zinc electroplating	ASTM B 633	FE/ZN25
Zinc hot-dip	ASTM A 153	B

Parts which can be disassembled shall be plated separately. Machining of the plating will be permitted only as necessary for proper mating of parts; and when the plating is removed from an area, that area shall be coated in accordance with ASTM B 633, class FE/ZN25.

3.5 Surface cleaning and painting.

3.5.1 Cleaning. Whenever practicable, cleaning shall be accomplished prior to assembly of parts.

3.5.2 Painting. All exposed surfaces of fan wheels, interior surfaces of fan casings, exposed surfaces of all parts in the air stream, exterior surfaces of motors, exterior surfaces of fan casings, and conduit boxes not previously painted shall be painted in accordance with 3.2.6.2, or in accordance with anodizing process in accordance with MIL-A-8625, type II, class 1, nominal thickness 0.003 inch.

3.6 Vibration and balance.

3.6.1 Balance. Each fan shall be in satisfactory dynamic balance. The balance and vibration amplitude shall not exceed the limits for type II bearing vibration as specified in MIL-STD-167-1 (see 4.6.5).

3.6.2 Environmental vibration. Fan motors shall not be damaged or caused to malfunction by type I environmental vibration specified in MIL-STD-167-1 (see 4.6.4).

3.7 Identification.

3.7.1 Fan identification code. The size and characteristics of Navy standard gas turbine enclosure cooling fan-motor units shall be designated by a code formed by alternate letters and figures arranged in accordance with table II, as follows:

TABLE II. *Fan identification code*[1]

Symbol sequence	Characteristics	Code	Meaning
1 (letter)	Type of fan	TA	Turbine enclosure cooling vaneaxial
2 (figure)	Fan size	For size code see table II	Nominal A^3/min of standard air
3 (letter)	Type of current	A	60 Hz ac
4 (figure)	Voltage and phase	4	3-phase, 440 V 60 Hz
5 (letter)	Motor enclosure	W	Spray tight totally enclosed air over
6 (figure)	Maximum ambient temperature	6	65 °C

[1]For example, TA17A4W6 represents a type TA, nominal 17,000 cubic feet per minute (ft^3/min) vaneaxial fan driven by a 440 volt (V), 60 hertz (Hz), 3-phase, alternating current (ac), spraytight, 65 degrees celsius (°C) ambient temperature, Navy Service A motor.

3.7.2 Identification plates. Identification plates for fans having steel casings shall be of corrosion resistant steel plate and shall be attached with corrosion resistant steel rivets; those for fans having aluminum casings shall be of aluminum alloy, attached with aluminum alloy rivets. The background of the plate shall be etched and filled with black enamel, and characters shall be raised and unpainted, except that the serial number shall be depressed in the metal by means of stamping. Plates for all fans shall conform to figure 1. A duplicate motor identification plate shall be installed on the outside of the fan casing. This plate and the fan plate shall be located in the line axially with the conduit box or cable entrance. If there is insufficient space on the casing without drilling through the fan race, the motor plate shall be located adjacent circumferentially to the fan plate. It is acceptable to combine the fan and motor data in a single plate.

3.8 Design.

3.8.1 General. Fans shall conform to the requirements specified herein (see 6.3). Fans and motors shall operate in any position on shipboard, including vertical (with fan wheel either up or down), horizontal (on ship axis or athwartship), or inclined. Each fan-motor unit shall be a complete assembly.

3.8.1.1 Aerodynamic design parameters. The quantities of blades and vanes shall be chosen to avoid interacting frequencies within the audible range. The axial distance between blades and vanes shall be chosen with minimum noise amplitude as a prime consideration. The passing angle between a blade trailing edge and a vane leading edge shall be at least 10 degrees. The maximum blade tip clearance (radial clearance) shall not exceed 1/4 of 1 percent of the casing minimum inside diameter (see 4.6.10).

3.8.1.2 High impact shock resistance. The fan-motor units shall pass the shock test specified in 4.6.8 for grade A, class 1 equipment.

3.8.1.3 Interchangeability. In no case shall parts be physically interchangeable or reversible unless such parts are also interchangeable or reversible with regard to function, performance and strength.

3.8.1.4 Weight. The weights of the fan-motor units shall not exceed the limits specified in table III.

TABLE III. *Fan performance.*

Fan size	Design		Inside flange dimensions (in)	Length (in)	Horsepower maximum	Maximum weight
	Volume ft^3/min	Tp in W.G.[1]				
TA4-1/2	4,500	18	19	34	25	645
TA5	5,000	10	19	24-1/4	12-1/2	331
TA17	17,000	20	32	40	80	1390
TA22-1/2	21,200	22	32	40	130	1500

[1]Total pressure in watergauge.

3.8.1.5 Diameter and length. The diameter and length of the fan-motor unit shall be as specified in Table III.

3.8.1.6 Operating life. The equipment shall have an operating life of at least 223,800 hours (equivalent to approximately 30 years of ship operation). Any parts identified as planned replacement parts shall have an operating life, prior to replacement, of approximately 37,300 hours (equivalent to approximately 5 years of ship operation).

3.8.1.7 General shipboard conditions. General shipboard characteristics shall be as follows:

a. Power source – type I of MIL-STD-1399, section 300, 440 V, 3-phase, 60 Hz.

b. Capable of operating satisfactorily in a weather air intake of a ship when exposed to soaking atmospheric spray of seawater and rain.

c. Perform in accordance with the requirements herein under ambient temperatures between minus 29 and 60 °C, and relative humidity of 0 to 100 percent.

3.8.2 Fan casings and associated parts.

3.8.2.1 Material. Casings, flanges, and vanes shall be made from steel plate or they may be included in a single casting of aluminum alloy.

3.8.2.2 Material thickness. Steel casings shall be not less than 0.250 inch thick. Aluminum casings shall be not less than 0.375 inch thick. The machined fan race area is not exempt from this requirement.

3.8.2.3 Flanges. Flanges for duct connections shall be provided at each end of the fan casing. These flanges shall be separate steel rings welded to a steel plate casing; rolled extensions of a steel casing; or integral parts of a cast casing. The flanges shall be drilled as shown on Drawing 803-6397382 with equally spaced bolt holes straddling the conduit centerline and aligned in the two flanges. An additional flanged connection may be provided at the manufacturer's option for stiffening large casings or to permit use of a heavier gauge fan race section. This extra flange shall have the same bolting as the end flanges, as well as three unequally spaced dowels. The radius of rolled flanges shall be between 1/8 and 1/4 inch for casings up to 32-inch diameter, and 3/8 inch maximum for larger casings.

3.8.2.4 Direction vanes. Vanes for steel plate casings shall be single thickness steel plate or of steel sheet formed into airfoil shape. Each steel vane shall be attached to the inside of the casing wall by means of a continuous weld on one side of the vane or by intermittent welds of equivalent total length, staggered on opposite sides of the vane. On casings of cast construction, airfoil vanes and a motor mounting flange shall be cast integral with the casing.

3.8.2.5 Motor mounting.

3.8.2.5.1 Face mounted. Motors shall be face mounted by capscrews, (see 3.8.4.1.3 for exception), and shall be removable for maintenance. The motor mounting flange shall be an integral part of the casing when the casing is an aluminum alloy casting; on steel plate casings, the motor mounting flange shall be of steel and shall be welded to the vanes by means of a continuous weld on each side of each vane. A secondary mounting or support may be provided between the motor frame and the vanes or the casing to prevent excessive motor excursion, especially under shock effect. In each of these mountings, damping of rotor vibration shall be achieved by avoiding metal-to-metal contacts.

3.8.2.5.2 **Integrally mounted.** Stator mounting may be integrally cast with fan casing. Means shall be provided to prevent rotational and axial displacement of stator after insertion. If mechanical fasteners are used, they shall be of corrosion-resistant material.

3.8.2.6 **Watertightness.** Casings shall be of watertight construction (see 4.6.6).

3.8.3 **Fan impeller.**

3.8.3.1 **Material.** The impeller, consisting of hub, web, rim, and blades shall be a one-piece sand casting or permanent-mold casting of aluminum alloy conforming to 3.2.3. The blades shall be of airfoil design.

3.8.3.2 **Strength.** Impellers shall have a safety factor of 8, based on the ultimate tensile strength of the material. This applies to all parts of the fan wheels.

3.8.3.3 **Hub inserts.** A 300-series corrosion-resistant insert shall be installed in the hub of each impeller. A keyway shall be machined in the bore of the insert. Inserts shall either be cast-in-place or pressed into the impeller, as specified in 3.8.3.3.1 and 3.8.3.3.2.

3.8.3.3.1 **Cast-in-place inserts.** These inserts shall have an irregularly shaped outer periphery and a circumferential groove or the equivalent to prevent all relative movement (whether axial, circumferential, or radial) between inserts and remainder of hub after being cast into the impeller.

3.8.3.3.2 **Pressed-in-place inserts.** Inserts for installation in the impeller castings shall be flanged to permit securing to the impellers by means of through-bolting, or non-flanged by means of setting screws positioned half in the wheel casting and half in the insert. There shall be an interference fit of the insert in the impellers, requiring substantial insertion pressure or shrinkage or both.

3.8.3.4 **Design.** To avoid unbalance, impeller shall be constructed so as to prevent retention of water when the fan is installed vertically with fan impeller up or horizontally. Where strength requirements permit, a dished web faired into the rim is the preferred design since it meets the moisture retention requirement and avoids the use of a separate nose piece. A web perpendicular to the rim is acceptable. If a nose piece is used, it shall be of aluminum, either cast or formed, and shall be match-marked with the impeller or shall attach to the impeller so as to assure reinstallation in the same position relative to the impeller. The outside diameter of the impeller rim shall be at least as great as the outside diameter of the motor mounting flange. If there is insufficient space between blades for use of an impeller puller, means (such as puller holes) for removing the impeller shall be provided in the hub.

3.8.3.5 **Balancing.** Balancing of the wheel shall be accomplished by removal of metal. Sufficient rim thickness or cast pads on the inside diameter of the impeller rim shall be provided for balancing the impeller.

3.8.3.6 Impeller mounting. The completed impeller assembly shall be mounted on the keyed motor shaft and held axially by either a tanged lockwasher and locknut or a heavy steel washer and a cotter pin castellated nut. The outside diameter of the flat washer shall be greater than the outside of the wheel hub insert. There shall be a slight positive clearance (loose fit) between the wheel assembly and the shaft.

3.8.4 Electric equipment.

3.8.4.1 Motors. In consideration of the cooling effect of the air stream, motors for vaneaxial fans need not conform to referenced motor specifications in regard to horse power rating of a standard frame size. Motors shall not have excessive horsepower, but shall have sufficient torque to start the fans at 90 percent of rated voltage, and to drive them continuously without overloading when fan delivery is above 50 percent of the minimum delivery as shown on Drawing 803-6397382 Motors shall be in accordance with MIL-M-17060.

3.8.4.1.1 General requirements. The motors shall conform to the following:

a. *Motor* – 60 Hz, ac, integral-horsepower

b. *Service* – Service A

c. *Ambient temperature* – 65 °C

d. *Voltage, phase, and frequency* – 440 V, 3-phase, 60 Hz

e. *Duty* – continuous air over

f. *Enclosure* – Spraytight in accordance with MIL-STD-108

g. Horsepower/efficiency as follows:

Fan size code	Maximum horsepower	Minimum motor efficiency (percent)
TA17	80	96
TA22-1/2	130	97
TA4-1/2	25	94
TA5	12-1/2	92

h. *Revolutions per minute (r/min)* – 3600 (synchronous) constant speed

i. *Type* – Squirrel cage induction. With not less than 80 percent power factor full load

j. *Slip* – 1.5 percent maximum at full rated load and temperature rise

k. *Mounting* – Motor; Face mounted by capscrews, or stator: Integrally mounted in fan casing.

l. *Insulation* – Class B or F sealed insulation – Motor temperature rise shall not exceed 70 °C in 50 °C ambient or 55 °C in 65 °C ambient for class B temperature rise.

m. Motor structureborne noise levels shall not exceed the levels shown for type II in MIL-STD-740-2 or lower when specified by auxiliary manufacturer.

n. *Shock test* – MIL-S-901, type A.

3.8.4.1.2 Motor shafts. Shaft shoulders shall be provided for axially positioning each bearing and the fan wheel. Shoulder positioning is preferred for the rotor of the motors. Keys and keyways shall be provided on the shaft extension. The diameter of the shaft extension shall be greater than the outside diameter of the insert in fan wheels having pressed-in-place inserts. (NOTE: This requirement may be averted by using wheels with cast-in-place inserts (3.8.3.3.1)). The end of the shaft extension shall be treated for use of a locknut and tanged lockwasher or threaded and drilled for a castellated nut, cotterpin and heavy steel washer. If the shaft is not of corrosion-resistant material, the shaft extension shall be in accordance with 3.2.6.2, before mounting of the fan wheel.

3.8.4.1.3 Motor end brackets. The material shall be cast steel, cast aluminum, nodular, or malleable iron. The motor end brackets for the face-type mounting and the integral mounting stator shall have the tapped mounting holes fitted with corrosion-resistant steel thread inserts and a sufficient quantity of mounting series screws is provided. Means shall be provided for pulling or prying brackets from the motor frame. Match mark depressions shall be made in the bare metal (before painting) on the outer periphery of brackets and frame to assure duplication of the original assembly.

3.8.4.1.4 Balancing. Precision with facilities for fine balancing. The preferred method of balancing motor rotating assemblies is by removal of material from the rotor or from discs provided for this purpose.

3.8.4.1.5 Drains. Tapped drain holes with 1/8-inch metal pipe plugs shall be furnished in each spraytight motor to drain condensate from the motor when the fan is installed vertically, with fan wheel up or down, or horizontally. For drainage in the horizontal position, four drains in one end of the frame or on the periphery in one bracket shall be positioned at 90, 135, 225, and 270 degrees from the conduit centerline. In ac motors, corresponding channels through the stator core at its outer periphery shall be provided, or a separate set of drains shall be furnished in the other end. For drainage in the vertical position, one drain in the face of each bracket is required unless the horizontal drains will adequately serve the purpose.

3.8.4.1.6 Magnet wire. Standard whole sizes of round wire listed in MIL-E-917 shall be used in all motors.

3.8.4.1.7 Conduit boxes. A conduit box shall be fabricated or integrally cast as a part of the casing. The material shall be cast steel, cast aluminum, nodular, or malleable iron. Preferably, the box should be mounted by means of four screws, permitting box rotation in 90-degree increments, and fitted with a single lead inlet with threaded fittings; if the box cannot be rotated, threaded holes shall be provided on three sides of the box. Leads connected within the box to terminals shall be fitted with solderless connectors. Boxes shall be the same degree of enclosure as the motors with which they are used.

3.8.4.1.8 Conduits. The lead wire from the conduit box to the motor shall be enclosed in a watertight conduit. Where the casing, vanes, and motor frame are included in a single casting, an acceptable conduit shall be provided by drilling one or more holes through a vane. Otherwise, a separate conduit shall be provided, consisting of braided copper tubing braised to threaded end fittings and covered with a neoprene cover, vulcanized to form a bond with the braid. This separate conduit shall be flexible and watertight; it shall form an effective electrical ground from the motor frame to the fan casing and conduit box.

3.8.4.1.9 Bearings. Motors shall be equipped with noise tested ball bearings conforming to FF-B-171, ABEC-5, or MIL-B-17931 (quiet type). Bearing sizes shall be as specified for the motor frame size in MIL-M-17060 and shall conform to the following:

a. Type 120 or 111, class 1

b. Internal clearance – normal

c. Grease – DOD-G-24508

d. Type 111 bearings shall be relubricable in accordance with MIL-M-17060.

e. *Grease slingers* – Slingers shall be provided which make the grease available to the bearing and to direct the grease away from the shaft seals.

f. *Grease seals* – Labyrinth non-rubbing type seals shall be provided on both sides of the bearings to prevent the leakage of oil or grease along the shaft.

g. *Mounting* – The inner ring of the fixed bearing on each end shall be held axially against a shaft shoulder by either a locknut and lockwasher or a locknut with nylon insert. The outer ring of the fixed-end bearing shall be held axially between a housing shoulder and a bearing cap. For the free bearing, a housing shoulder may be omitted when the bearing is held axially on the shaft; if a housing shoulder is provided, the axial clearance between the bearing and the shoulder shall accommodate thermal linear expansion of the shaft. A loading spring shall be installed between the outer ring of the free bearing and the motor rotor; the defection due to shaft expansion shall be included in the total spring deflection.

h. Bearing temperature rise shall not exceed 25 °C in 65 °C ambient as measured on bearing outer ring.

3.8.4.1.10 Speed-torque characteristics. The speed-torque characteristics shall be coordinated with the combined inertia of the rotating assembly, including fan wheel. It shall be possible to accelerate the fan unit from standstill to high speed at 90 percent of rated voltage when the current rating of the controller overload protective device does not exceed the motor rated full load current.

3.8.4.1.11 Motor thermostats. A thermostat protection device shall be installed in each of the motor phases wired such that any of them, when wired in connection with the motor starter control circuit, will cause motor shutdown if damaging heat buildup is encountered.

3.8.5 Fan performance.

3.8.5.1 Volume and pressure. The design volume-pressure point for each size fan shall be as specified in table III. The total pressure in inches of water shall rise continually from free delivery to a value at least as high as the stated volume as shown in table III and throughout this range of stable performance the volume in ft^3/min shall be within 5 percent of the volume on the applicable curve of Drawing 803-6397382, as indicated on system characteristic curves.

3.8.5.2 Aerodynamic stall. Effective stall, shall not occur at capacities greater than 85 percent of the fan design or rated ft^3/min (see 4.6.2).

3.8.5.3 Compressor surge. The fan assemblies shall withstand a gas turbine compressor surge condition defined below:

a. *Item 1, Cooling Air Fan for Propulsion Gas Turbines* – Single pressure pulse of approximately square wave form with a pulse magnitude of 3 lb/in^2 positive pressure and a duration of 20 milliseconds.

b. *Item 2, Cooling Air Fan for Ship's Service Gas Turbine Generator (SSGTG) Sets* – The requirements for the propulsion gas turbine fan specified in 3.8.5.3.a. shall also apply to the SSGTG Set fan assembly.

3.8.5.3.1 Surge stress. Surge stress, when combined with normal operating stress, shall not exceed 80 percent of the material static yield stress. Testing is not required.

3.9.5.4 Differential pressure. The fan assembly when installed in the ship's ducting system shall withstand a maximum differential pressure of 20 inches H_2O between the outside and the inside of the fan. The lower pressure shall be inside the fan.

3.8.5.5 Self-generated vibration. All parts of the fan equipment shall be free of self-induced vibration in accordance with the type II requirements of MIL-STD-167-1 for both steady-state and transient conditions. Dynamic balancing and tolerance control shall be employed over the complete operational range to ensure smooth operation of all rotating parts.

3.8.5.6 **Noise levels.**

3.8.5.6.1 **Airborne noise.** Noise levels shall not exceed the levels (see tables IV and V) at rated conditions. The noise level shall be measured at a point midway between casing inlet and outlet flange, 3 feet from fan casing. The fan inlet and discharge ducting shall be insulated as necessary to facilitate the isolation and measurement of fan casing noise. The fan casing itself shall not be insulated.

TABLE IV. *Airborne noise acceptance levels.*

Fan model	Freq. Hz	Sound power level in decibels (dB) with reference to 10^{-12} watts								
		31[1]	63	125	250	500	1K	2K	4K	8K
12½ HP		99	95	94	90	93	104	102	98	91
25 HP		104	100	99	95	98	109	107	103	96
80 HP		110	106	105	101	104	115	113	109	102
130 HP		112	108	107	103	106	117	115	111	104

[1]Data at 31 Hz reported for information only.

TABLE V. *Casing transmission noise acceptance levels.*

Fan model	Freq. Hz	Sound pressure level in dB with reference to 0.0002 microbar								
		31	63	125	250	500	1K	2K	4K	8K
12½ HP		62	65	72	64	63	82	72	71	61
25 HP		67	70	77	69	68	87	77	76	66
80 HP		73	76	83	75	74	93	83	82	72
130 HP		75	78	85	77	76	95	85	84	74

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 (examinations and tests) 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 this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program (see 6.3). The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of the manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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

a. First article inspection (see 4.3).
b. Quality conformance inspection (see 4.4).

4.3 First article inspection. First article inspection shall consist of the examinations and tests as specified in table VI (see 3.1 and 6.2).

4.4 Quality conformance inspection. Quality conformance inspection shall consist of the examinations and tests of table VI. The tests specified in 4.6.3.1, 4.6.3.2, 4.6.4, 4.6.5, 4.6.6, and 4.6.7 shall be performed on each fan-motor unit.

TABLE VI. *Test agenda.*

Test	First article[1]	Quality conformance	Requirement	Test
Performance	all	all	3.8.5	4.6.1
Aerodynamic stall	all	all	3.8.5.2	4.6.2
Noise				
-by meter	all	all	3.8.5.6	4.6.3.1
-by ear	–	all	–	4.6.3.2
Vibration/balance	all	all	3.6	4.6.4 and 4.6.5
Casing tightness[1]	–	all	3.8.2.6	4.6.6
Speed	–	all	3.8.4.1.1	4.6.7
Shock	all	–	3.8.1.2	4.6.8
Motor heat - with fan	all	all	–	4.6.9
Blade tip Clearance Measurement	all	all	3.8.1.1	4.6.10

[1]Casing tightness test is required only when specified (see 6.2).

4.5 Material inspection and dimensional examination.

4.5.1 Cast wheel and casing. Test samples shall be inspected for chemical content and mechanical properties in accordance with ASTM B26. There is no requirement for radiography of visually sound castings. Repairs of cast wheels are not permitted. Cast casings may be repaired in emergencies by welding or impregnation, subject to radiographic inspection and NAVSEA approval for each casting involved.

4.5.2 Fabricated steel casing. Visual examination for defects is required, especially at the base of flanges. Cracks in the radius of spun flanges or in the welds of welded flanges may be repaired by welding. After proper preparation, cracks shall be repaired in accordance with NSTM NAVSEA S9086-CH-STM-010/CH-074 VI. Wall thickness shall be measured on at least 10 percent of the casings (see 3.8.2.2 and 3.8.2.3 for wall thickness and flange construction requirements).

4.6 Tests. Tests shall be as specified in 4.6.1 through 4.6.11 (see 6.3).

4.6.1 Performance. Performance tests shall be conducted in accordance with AMCA 210. Any of the alternate test stands and associated instrumentation may be used.

4.6.2 Aerodynamic stall. The effective stall capacity shall be determined from the largest capacity measurement of the following three stall measurement methods.

4.6.2.1 Throttled stall capacity. The capacity at which the fan goes into stall when slowly closing the discharge throttle with the fan operating.

4.6.2.2 Stall recovery capacity. The capacity at which the fan recovers from a stalled condition when the fan is operating in a stalled condition and the discharge throttle is slowly opened.

4.6.2.3 Stable start-up capacity. The capacity at which stable, stall-free operation first occurs, as the fan is started from a no spin condition with the throttle fixed at progressively larger openings.

4.6.3 Noise. The test shall be a meter test consisting of sound power determination. These tests shall include structureborne noise tests, airborne noise tests, and ear tests.

4.6.3.1 Sound pressure. With the fan installed horizontally and connected to a discharge duct, broadband sound pressure shall be measured on flat response with slow needle at eight or more test points from free delivery to no delivery. Seven measurements in a horizontal plane through the fan centerline shall be made, and they shall be averaged arithmetically to determine the rating at each test point. These seven measurements shall be made 5 feet from the fan casing: on the inlet centerline, 45 degrees on each side of the inlet and discharge flanges, and on each side of the casing perpendicular to the axis. The test should be made in as near a free field as possible, but correction for background noise may be made in accordance with AMCA 300. The discharge duct may terminate outside of the test space. Sound level meters used in this test, and their calibration, shall conform to AMCA 300.

4.6.3.2 Noise by ear. Fan-motor units not undergoing a meter test shall be operated at maximum speed and free delivery. Any unusual or excessive noise heard by the human ear shall be corrected if the cause is apparent or the unit shall be tested by meter to establish whether it meets the noise requirements of this specification.

4.6.4 Vibration test. Fan-motor units shall be subjected to type I environmental vibration tests as specified in MIL-STD-167-1 (see 6.3). The exploratory vibration as specified in MIL-STD-167-1 shall include frequencies up to and including 33 Hz at the table amplitude specified herein. The vibration test shall be conducted as specified in 4.6.11. Any unit which fails to meet any requirements shall be rejected.

4.6.5 Balance. In this test, the fan-motor unit shall be operated at maximum speed and free delivery, with shaft horizontal (see 6.3). It shall be suspended from a stand by means of two elastic vibration cords, one secured to each end flange. The cords shall have a natural frequency of less than one-fourth of the minimum rotational frequency of the unit in Hz. The static deflection shall be within the limits of MIL-STD-167-1 for elastic mounting elements, and this shall be the basis for determining cord size for each unit tested. As an alternative to this suspension test, rigid brackets shall be bolted to the fan end flanges, and these brackets shall be elastically mounted on a rigid, level floor. In the latter case, the natural frequency and the static deflection of the four elastic mounting elements shall meet the requirements specified above for vibration cords. With

either method, the internally excited vibrational displacement (single amplitude of vibration) shall be measured in mils as follows: four axial measurements 90 degrees apart on the face of each end flange, one horizontal measurement perpendicular to the axis on the edge of each flange, and one vertical measurement on the top edge of each flange. The maximum amplitude of vibration shall be the maximum single reading, and not an average. The frequency at which the maximum amplitude occurs shall be measured. For this test, the vibration instrument shall be mounted independently, and not hand held. Exceeding vibration limits specified in 3.6.1 is cause for rejection.

4.6.6 Casing tightness. When this test is required (see 6.2), the requirement as well as the test conditions shall be specified (see 6.2). If conditions are not specified, the test shall be conducted as follows: Blind flanges (one with air supply and gauge connections) shall be bolted to gasketed fan flanges. Air at a pressure 50 percent higher than the maximum pressure capability of the fan shall be supplied to the casing interior. The pressure drop in 10 minutes shall not exceed 5 percent of the test pressure.

4.6.7 Speed. The fan-motor shall be operated at each speed at free delivery to determine whether the speed conforms to design speed at rated voltage.

4.6.8 High impact shock. The fan-motor shall be tested in accordance with MIL-S-901. The fan-motor with fixture and mounting bracket shall be conducted on the medium weight shock machine. In this test bolts shall be used in each of the flange bolt holes. Resilient mountings shall not be used unless specified (see 6.2) or unless the fan will always be resiliently mounted on shipboard. Units which have passed this test may be used as production units after replacement of motor bearings. The high impact shock test shall be conducted as specified in 4.6.11.

4.6.8.1 Shock on medium weight machine. The test of a fan-motor unit shall consist of the six blows indicated in table VII. The required mountings shall be in accordance with MIL-S-901. Auxiliary channels shall be used to bolt the mounting brackets or plate to standard fixtures.

TABLE VII. *Test on medium weight shock machine.*

Blow No.	Group No.	Hammer drop	Anvil travel (inches)	Operating conditions	Fan orientation[1]
1	I	(based	3	Secured	No. 1
2	II	on	3	Operating	No. 1
3	III	weight,	1.5	Secured	No. 1
4	I	see	3	Operating	No. 2A
5	II	MIL-S-901)	3	Secured	No. 2A
6	III	(based	1.5	Operating	No. 2A
7	I	on	3	Secured	No. 2B
8	II	weight	3	Operating	No. 2B
9	III	see MIL-S-901)	1.5	Secured	No. 2B

[1]See figure 2.

4.6.8.2 Upon completion of shock test, post-shock test inspection, and specified tests, the fan-motor unit shall be returned to the contractor for examination and further testing.

4.6.9 Heat. Motor heating shall be measured as specified in the applicable motor specification. In each test, the motor shall be installed in the fan, and a duct shall be attached to the fan discharge. Full load shall be obtained by means of a terminal throttle on the test duct. Since neither the fan nor a suitable test stand will normally be available at the motor plant, the heat test may be conducted at the plant of the fan manufacturer.

4.6.10 Blade tip clearance measurement. The fan blades shall be in a stationary position for the entire measurement. Inspect visually to locate an apparent maximum clearance (radial clearance) from the blade tip to the inside of fan casing. Measure this apparent maximum clearance and move the measurement to three different locations at 90, 180, and 270 degrees relative to the apparent maximum clearance. Compare the four measurements to determine the true maximum blade clearance. This maximum clearance shall not exceed 1/4 of 1 percent of the casing inside diameter.

4.6.11 Test schedule. The schedule for testing the fan shall be in the following order.

a. Balance (4.6.5).

b. Casing tightness (4.6.6).

c. Blade tip clearance measurement (4.6.10).

d. Performance (4.6.1), stall (4.6.2), speed (4.6.7), and heat (4.6.9). These tests shall be conducted concurrently.

e. Noise (4.6.3).

f. Vibration test (4.6.4). The correction of damages, which may have occurred during the vibration tests, shall not be performed prior to the test specified in 4.6.8.

g. High impact shock (4.6.8). After conducting the high impact shock test, tests specified in 4.6.1 and 4.6.2 shall be conducted without correction of damages which may have been occurred during shock test. Shock test in accordance with these requirements shall demonstrate that the fan-motor unit performs its function with acceptable change in performance and stall. Shock test acceptance shall be contingent upon the ability of the equipment, after shock testing, to satisfy performance within 7 percent of the volume indicated in table III, and stall with capacities not to occur greater than 90 percent of the fan design or rated ft^3/min.

4.7 Inspection of packaging. Sample packs, and the inspection of the preservation, packing, and marking for shipment, stowage, and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

5. PACKAGING

(The packaging requirements herein apply only for direct Government acquisition. For the extent or applicability of the packaging requirements of documents listed in section 2, see 6.2.)

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

5.1.1 Level A. Fan-motor units shall be preserved method II in accordance with MIL-P-116 (sub-method at the contractor's option) dependent on the size and weight of the fan unit.

5.1.1.1 Modified method II. The following will be acceptable in accomplishing the required method II preservation procedure for fan-motor units:

a. Preservative application is not required.

b. The threaded connections in the conduit box shall be fitted with pipe plugs.

c. Bagged desiccant shall be attached to the inside of the casing in accordance with MIL-P-116.

d. A rubber disc gasket and a blind gasket of 1/2 inch plywood or minimum 20 gage steel plate shall be bolted to the face of each of the casing flanges.

e. A plug type humidity indicator shall be installed in accordance with MIL-P-116 in one of the blind flanges.

f. The unit as protected shall be marked, "Method II Modified. Remove Desiccant Prior to Installation".

5.1.1.2 Commercial. Fan-motor units shall be preserved as specified in 5.1.1.1, except that desiccant, humidity indicator and the marking specified is not required.

5.2 Packing. Packing shall conform to MIL-E-16298 level A, B, C, or Commercial as specified (see 6.2).

5.2.1 Shock and vibration mitigation. All levels of packing shall employ a shock and vibration mounting system that will ensure the close tolerance requirements of the unit. Each unit preserved as specified in 5.1 shall be mounted in it's shipping container or commercial pallet box with the fan mounted vertically and the impeller end of the fan pointing up. Shock mounts shall be fastened to the lower fan casing, located equidistant around the casing and shall consist of four metal heli-coil flex type wire mounts. The contractor is responsible to determine the proper mounts for the weight and size of the fan unit to be packed.

5.3 Marking. In addition to any special marking required (see 6.2), marking shall be in accordance with MIL-E-16298 except that for the critical close tolerance requirement, such marking shall be placed on the top and on all four sides of the shipping container.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The fan-motor units specified herein are intended for gas turbine enclosure cooling applications only on board ships of the United States Navy. The direction of airflow into and out of the fans is axial. The fans are of nonsparking construction.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of this specification.

b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).

c. When first article is required (see 3.1 and 4.3).

d. When casing pressure test is required and test conditions if other than standard (see table VI and 4.6.6).

e. Resilient mounting shall not be used unless the fan will be resiliently mounted on shipboard (see 4.6.8).

f. Level of preservation, packaging, packing, and marking required (see 5.1, 5.2, and 5.3).

6.3 Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DID's) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DOD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

Reference Paragraph	DID Number	DID Title	Suggested Tailoring
3.8.1 and Appendix A	DI-DRPR-80651	Engineering drawings	Level 2 Design Activity Designation – Contractor Design Activity Drawing Numbers – Contractor
4.6 and Appendix B	DI-MISC-80653	Test Reports	–
4.1.1	DI-R-4803	Inspection System Program Plan	–

The above DID's were those cleared as of the date of this specification. The current issue of DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

6.4 Technical Manuals. The requirement for technical manuals should be considered when this specification is applied on a contract. If technical manuals are required, military specifications and standards that have been cleared and listed in DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL) must be listed on a separate Contract Data Requirements List (DD Form 1423), which is included as an exhibit to the contract. The technical manuals must be acquired under separate contract line item in the contract.

6.5 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be a preproduction sample, a first article sample, a first production item, a sample selected from the first ____ production items, a standard production item from the contractor's current inventory (see 3.1), and the number of items to be tested as specified in 4.3. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.6 Provisioning. Provisioning Technical Documentation (PTD), spare parts, and repair parts should be furnished as specified in the contract.

6.6.1 When ordering spare parts or repair parts for the equipment covered by this specification, the contract should state that such spare parts and repair parts should meet the same requirements and quality assurance provisions as the parts used in the manufacture of the equipment. Packaging for such parts should also be specified.

6.7 Bellmouth intakes. Inlet bells for fans are shown on Drawing 810-451223. These bells are required when ducts are not attached to fan inlets.

6.8 Drainage of motor condensate. It is intended that the lowest condensate drain plug in the motor be removed and discarded when the fan is installed to permit continual drainage of condensate by gravity to the airstream.

6.9 Avoiding drainage to conduit box. For horizontal installation on shipboard, a fan should be installed with conduit box above the horizontal centerline. This will prevent drainage of motor condensate to conduit box. Preferred installation is with conduit box 45 degrees above horizontal centerline.

6.10 Sub-contracted material and parts. The packaging requirements of referenced documents listed in section 2 do not apply when material and parts are acquired by the contractor for incorporation into the equipment and lose their separate identity when the equipment is shipped.

6.11 Cushioning and wrapping materials (see 5.1.1). Materials having properties for resistance to fire and acceptable for use within unit packs and shipping containers for Navy shipboard stowage furniture items acquisition are:

Material	Specification
Paper, kraft, treated (fire-resistant)	A-A-1894
Paper, kraft, wrapping	UU-P-268, type II, grade C or D
Fiberboard	PPP-F-320, class – domestic/fire-retardant
Plastic film, flexible, cellular	PPP-C-795, class 3 – fire-retardant
Polystyrene expanded, resilient	PPP-C-850, grade SE
Plastic, open cell, cushioning	PPP-C-1842, type I, style B
Bound fiber	PPP-C-1120, type III or IV, class C
Rubber, latex foam	MIL-R-5001, grade A
Rubber, cellular	MIL-R-6130, grade A
Fibrous glass	MIL-C-17435
Polystyrene foam	MIL-P-19644, type II
Rubber, cellular, synthetic	MIL-R-20092, class 5
Polyurethane foam	MIL-P-26514
Polyurethane foam, flexible, open cell	MIL-F-81334
Foam, combustion retardant for cushioning supply items aboard Navy ships	MIL-F-87090

6.12 Approval. Unless drawings for each contracting fan size have been previously approved and are within a five year time frame from the date of approval, the contractor is responsible to submit to the acquisition activity, for approval, the following: (1) two prints of the fan assembly drawing; and (2) two prints of the motor proposed for use with the fan.

6.13 Subject term (key word) listing.

Blade
Casing
Duct
Impeller
Vane

Preparing activity:
Navy – SH
(Project 4140-NO59)

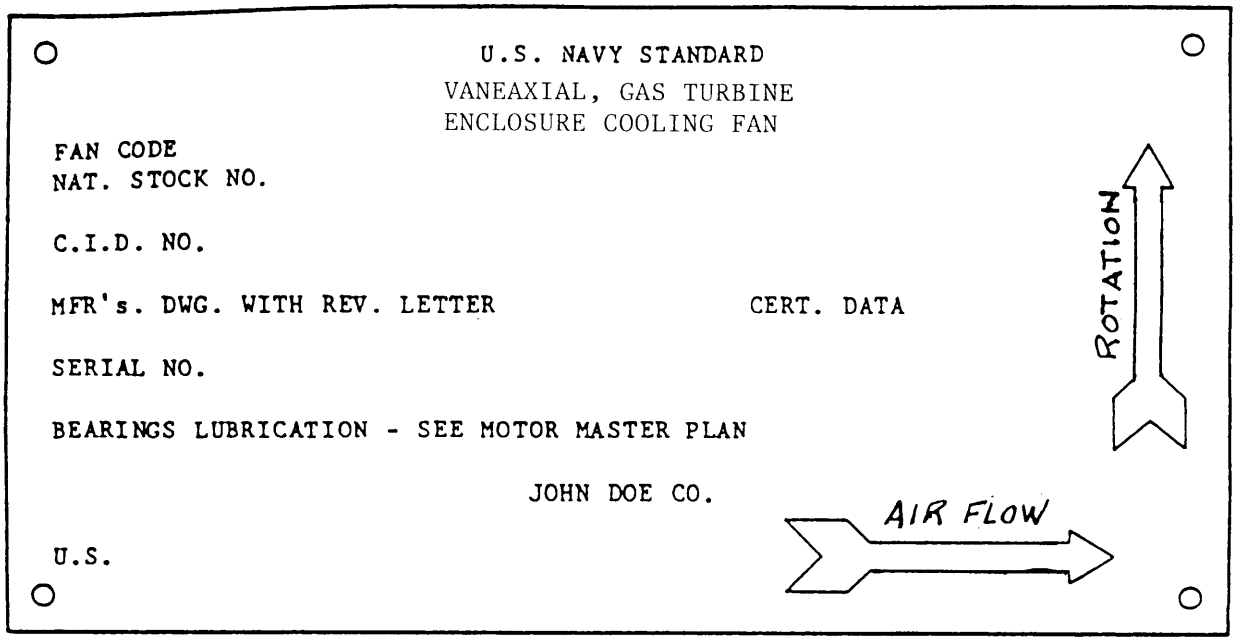
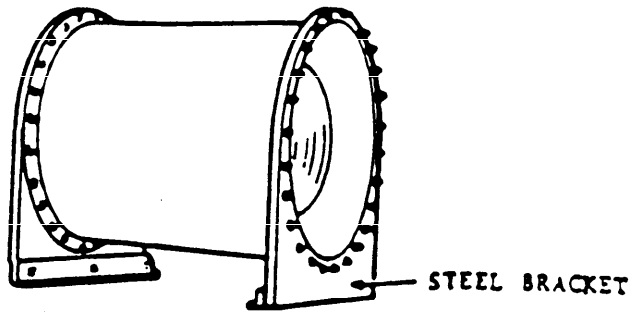
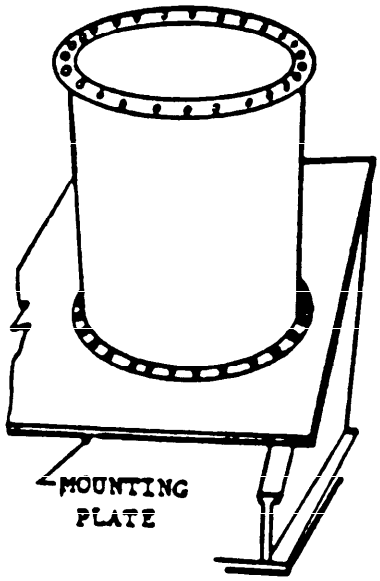


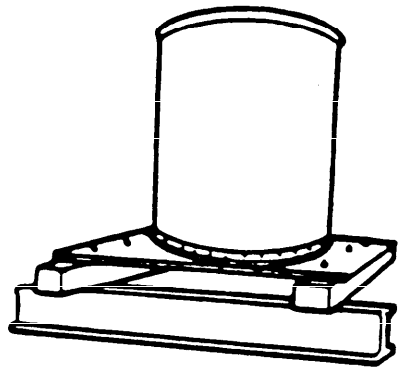
FIGURE 1. *Identification plate, Navy standard vaneaxial, gas turbine enclosure cooling fan.*



ORIENTATION NO. 1
(HORIZONTAL)



ORIENTATION NO.2B
FAN WHEEL UP
(INCLINED 30 DEGREES)



ORIENTATION NO. 2A
FAN WHEEL DOWN
(VERTICAL)

FIGURE 2. *Mountings for medium shock machine.*

ENGINEERING DRAWINGS TECHNICAL CONTENT REQUIREMENTS

10. SCOPE

10.1 Scope. This appendix covers the technical requirements that should be included on drawings when required by the contract or order. This appendix is mandatory only when data item description DI-DRPR-80651 is cited on the DD Form 1423.

20. APPLICABLE DOCUMENTS

20.1 Government documents.

20.1.1 Specifications and standards. The following specification and standard form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

MILITARY

DOD-D-1000	Drawings, Engineering and Associated Lists (Metric)

STANDARDS

MILITARY

MIL-STD-100	Engineering Drawing Practices

(Unless otherwise indicated, copies of military specifications and standards are available for the Standardization Documents Order Desk, Building 4D 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

30. DRAWINGS

30.1 Drawings. Drawings shall be identified by the contractor's identification and document number and shall be in accordance with DOD-D-1000 for level 2 drawings.

Complished in accordance with ... of spot checking of weldments shall be ac

30.1.1 Fan assembly drawing. The fan assembly drawing shall be in accordance with MIL-STD-100, level 2 and include the following:

a. A longitudinal, sectional view of the fan, showing arrangement of component parts which are identified by piece number flagging. All welds shall be indicated by standard weld symbols. The following additional data shall be shown in this view:

(1) Overall (flange face-to-face) fan length and mounting flange outside diameter to the nearest 1/16th inch.

(2) Fan casing inside diameter and wheel (blade) tip diameter to thousandths of an inch with tolerance.

(3) Axial length of vanes.

b. If necessary for clarity, separate details of the motor face mounting (and secondary mounting if provided), conduit, and conduit box.

c. Separate details of the motor-mounting gasket; fan identification plate; a section of the wheel showing undimensioned, end profile of a blade with stagger angle at blade root and blade tip indicated; the wheel hub insert; and the fit of the nose to the wheel (if the wheel has a separate nose or cap).

d. A complete list of material. The quantity of blades and vanes shall be indicated, as well as the thickness of casing, vanes, and motor-mounting flange, unless the thickness is dimensioned in a view. Thread data of threaded fasteners shall be given.

e. General notes, including the following:

(1) A statement directing reference to a fan certification data sheet for identification of electrical components and specific fan-motor test data, center of gravity, and moments of inertia.

(2) A statement stating an allowable tolerance of plus or minus 1/32 inch for parts affecting the performance of the fan or parts required to be machined, and plus or minus 1/16 inch for all other parts.

(3) Indication of the method of securing the wheel hub insert in the wheel; if by press fit, the interference fit and the minimum insertion pressure shall be stated.

(4) A caution statement directing connections of a ground wire if applicable.

(5) Statements identifying the plating, welding, painting, or anodizing process of components or assemblies.

(6) Indication of the method of balancing the fan wheel.

(7) Indication of the passing angle, viewed axially, of a blade trailing edge and a vane leading edge.

(8) A statement of the minimum casing wall thickness (including the fan raceway which is normally machined).

(9) Identification of any carbon steel surface which may be machined after plating, and a statement of the treatment of such area prior to painting or anodizing process.

(10) Any other statements necessary for clarity.

(11) At the manufacturer's option, statements for manufacturer's use only, so designated.

(12) A statement that the fan conforms to MIL-F-24751.

f. A nonlogarithmic graph, with cubic feet of standard air per minute (ft^3/min) as the abscissa, and total pressure, static pressure, speed (r/min), brake horsepower, power input (kW) or input horsepower and overall (set) efficiency as ordinates. The graph shall be identified by fan code and by the test number and date.

TEST REPORT TECHNICAL CONTENT REQUIREMENTS

10. SCOPE

10.1 Scope. This appendix covers the technical requirements that should be included in test reports when required by the contract or order. This appendix is mandatory only when data item description DI-MISC-80653 is cited on the DD Form 1423.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30. TEST REPORTS

30.1 Report of performance, noise, balance, and motor heating. The figure number of AMCA 210 shall be identified, together with duct or chamber dimensions and the diameter of nozzle if used. The following values shall be reported in tabular form: ambient barometric pressure, dry bulb and wet bulb temperatures, and air density; voltage and current (in each phase), motor input kilowatts or horsepower; brake horsepower; fan speed; air velocity; total static, and velocity pressure; air quantity (ft^3/min); mechanical (total) efficiency; electrical efficiency. The maximum amplitude of vibration at free delivery and frequency at which it occurs shall be reported. Computations need not be included in the report if made strictly in accordance with AMCA 210. A curve sheet shall be included in the report showing motor input, brake horsepower, fan speed, total and static pressures of standard air at fan discharge, as ordinates, and cubic feet of standard air pre minute at fan inlet as the abscissa. Motor heating and sound power at design point in each octave band shall be included in this report. An additional curve sheet shall also be included in the report showing results of the tabulated data for speed and torque. The data should be plotted with synchronous speed-percent as the ordinate and the abscissa as torque-percent of full load. The starting, pull-up, breakdown and full load torque shall be indicated on the curve.

30.2 Report of shock test. The report shall be made by the shock test laboratory on the forms specified in MIL-S-901 and shall include drawing number identification of the fan and motor, as well as photographs of the fan unit in each test mounting.

30.3 Calculations. Calculations required by the contractor shall be recorded.

30.4 Dimensional measurements and visual examinations. Records of the visual examinations and dimensional measurements made as a requirement of the specification shall be recorded.

30.5 Chemical or mechanical analyses. A record of chemical or mechanical analyses is required of castings.

*U.S. GOVERNMENT PRINTING OFFICE: 1990--504-034/50005

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-F-24751(SH)	2. DOCUMENT DATE (YYMMDD) 1 NOVEMBER 1990

3. DOCUMENT TITLE
FANS, VANEAXIAL GAS TURBINE ENCLOSURE COOLING NAVAL SHIPBOARD

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME Technical Point of Contact (TPOC): Mr. Tien Ngo (SEA 56Y11) PLEASE ADDRESS ALL CORRESPONDENCE AS FOLLOWS:	b. TELEPHONE (Include Area Code) (1) Commercial TPOC: (703) 602-7591	(2) AUTOVON 8-332-7591
c. ADDRESS (Include Zip Code) Commander, Naval Sea Systems Command (55Z3) Department of the Navy Washington, DC 20362-5101	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	