

MIL-F-151E
 5 August 1968
 SUPERSEDING
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 (See 6.5)

MILITARY SPECIFICATION

FANS, CIRCULATING, CEILING, REFRIGERATED SPACE

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

1. SCOPE

1.1 Scope. - This specification covers nonoscillating class HI shockproof fans suitable for ceiling mounting in refrigerated storage space onboard surface ships.

1.2 Classification. - Fans shall be of the following classes and types, as specified (see 6.2):

Class 1. Magnetic.

Type I - Single speed, 115 volts alternating current (a. c.).

Type II - Single speed, 115 volts direct current (d. c.).

Class 2. Nonmagnetic.

Type I NM - Single speed, 115 volts a. c.

Type II NM - Single speed, 115 volts d. c.

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

FEDERAL

TT-P-645 - Primer, Paint, Zinc-Chromate, Alkyd Type.

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MIL-S-901 - Shock Tests, H. I. (High-Impact); Shipboard Machinery, Equipment and Systems, Requirements for.

MIL-P-997 - Plastic-Material, Laminated, Thermosetting, Electrical-Insulation: Sheets, Glass Cloth, Silicone Resin.

MIL-D-1000 - Drawings, Engineering and Associated Lists.

MIL-D-1000/2 - Drawings, Engineering and Associated Lists.

MIL-B-3743 - Brush, Electrical Contact.

MIL-P-15024 - Plates, Identification-Information and Marking for Identification of Electrical, Electronic and Mechanical Equipment.

MIL-P-15037 - Plastic Sheet, Laminated, Thermosetting, Glass-Cloth, Melamine-Resin.

MIL-E-15090 - Enamel, Equipment, Light-Gray (Formula No. 11).

MIL-I-17214 - Indicator, Permeability; Low-Mu (Go-No-Go).

MIL-E-17555 - Electronic and Electrical Equipment and Associated Repair Parts, Preparation for Delivery of.

MIL-S-19622 - Stuffing Tubes, Nylon, General Specification.

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STANDARD

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MIL-STD-167 - Mechanical Vibrations of Shipboard Equipment.

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Preproduction sample. - Prior to production, a fan of each class and type offered for delivery, constructed in accordance with an approved drawing (see 3.23), shall be examined, tested and approved as specified in 4.2.

3.2 Material. - The material shall be of the best commercial quality and suitable in every respect for the purpose intended. Cast iron shall not be used.

3.2.1 Class 1 - magnetic fans. - When class 1 fans are specified (see 6.2), the parts may be constructed of paramagnetic materials satisfactory to the procuring activity concerned.

3.2.2 Class 2 - nonmagnetic fans. - When class 2 fans are specified (see 6.2), all parts except the magnetic circuit shall be of nonmagnetic material. Nonmagnetic material is defined as material which has a maximum permeability of less than 2.0 after fabrication.

3.3 Blades and guards. -

3.3.1 Blades. - Fans shall have not less than three blades of the diameter specified (see 3.18), which shall be corrosion-resisting metal, polished and lacquered; or (for class 1 fans only) of a metal treated in a manner, satisfactory to the procuring activity to resist corrosion and finished to match frame, base, and guard; or of a laminated plastic approved by the procuring activity conforming to MIL-P-997 or MIL-P-15037, or of other suitable material, satisfactory to the procuring activity. Fan blades shall be of such design that normal cleaning and dusting will not result in their being bent out of alignment. When mounted as shown on figure 1, the plane of rotation of the fan blades shall be parallel to the ceiling.

3.3.2 Guard. - The guard shall be corrosion-resisting metal, polished and lacquered; or (for class 1 fans only) of a metal treated in a manner satisfactory to the procuring activity to resist corrosion and finished to match frame, blades, and base. It shall be sufficiently rugged to prevent distortion under normal operating conditions and shall adequately protect personnel from injury. The guard shall be securely fastened to the motor frame by screws or other means to permit ready removal and it shall not vibrate excessively when the fan is in operation.

3.4 Fan characteristics and mounting. -

3.4.1 Characteristics. - The characteristics of the fan shall be such that the air will be drawn from the area directly below the blades and delivered in a plane parallel to the ceiling when mounted as shown on figure 1.

3.4.2 Mounting. - Fans shall be designed for mounting in an overhead position, either directly or by means of an auxiliary bracket, as shown on figure 1.

3.4.2.1 Mounting holes. - The fan assembly shall have at least 4 mounting holes. The mounting shall be solid. Grommets or isolation mounts shall not be used.

3.5 Motor. -

3.5.1 Bearings. - The bearings shall be self-lubricating, and shall be so designed as to prevent dripping and throwing of the lubricating compound. Bearings may be ball or sleeve type.

3.5.2 Temperature rise. - The temperature rise of the motor, when measured by a thermometer in contact with the windings, shall not exceed 40° Centigrade (C.), and when measured by a change in resistance shall not exceed 50°C.

3.5.3 A. c. motors. - The design shall be such that no commutators, collector rings, or any automatic starting devices shall be used.

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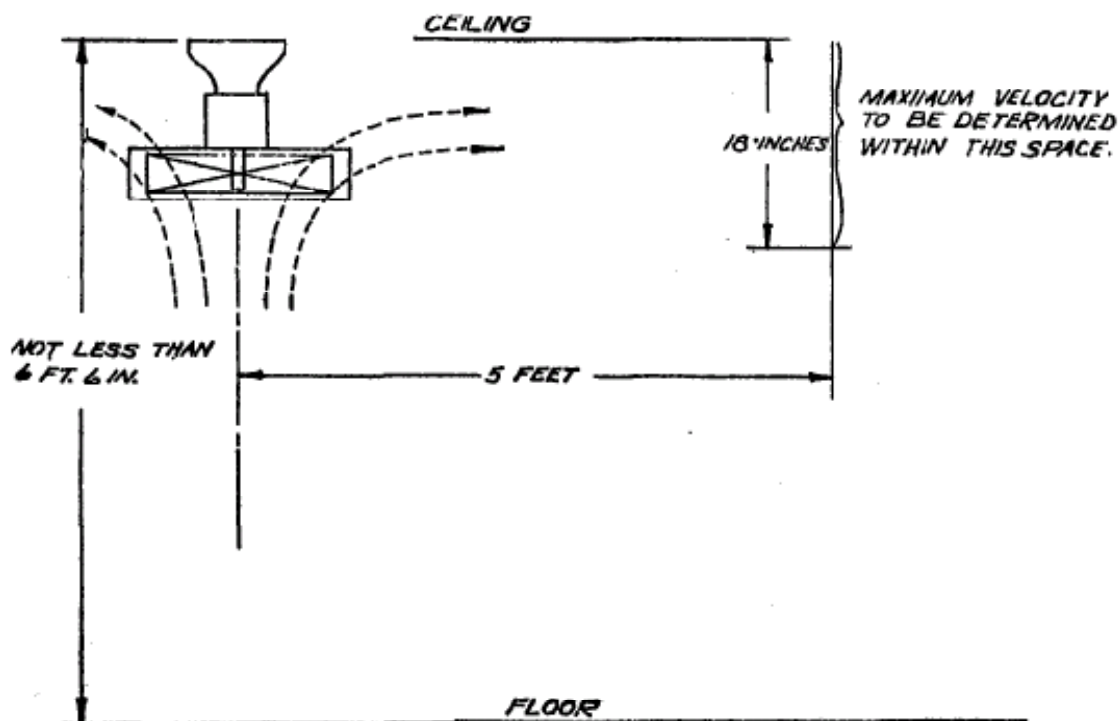


Figure 1 - Mounting.

3.5.4 D. c. motors. -

3.5.4.1 Brushes. - Brushes shall be rectangular in shape and shall conform to MIL-B-3743 except that the brand marking may be omitted. The sides of the brushes shall be smooth and free from saw marks.

3.5.4.2 Brush holders. - Brush holders shall be readily accessible for the renewal of brush or spring. The brush-feeding device shall insure proper brush contact under all conditions of brush and commutator wear. The brush holder caps shall be so constructed that no live parts are exposed.

3.5.4.3 Commutator. - The commutator shall be of sufficient depth to allow turning down to an extent of 0.10 inch reduction in diameter. The insulation between commutator bars shall be undercut.

3.6 Voltage. - The fans shall be designed for operation on 115 volts, single phase, 60 cycles a. c. or 115 volts d. c. as specified (see 6.2). Fans shall operate satisfactorily in accordance with the requirements of this specification between the limits of 105 and 125 volts.

3.7 Operating temperatures. - Fans shall operate satisfactorily over an ambient temperature range from minus 18°C. (0°F.) to 38°C. (100°F.). The fans shall start and run smoothly at minimum rated voltage while in an ambient temperature of minus 18°C. after having remained idle in an ambient temperature of minus 18°C. for 24 hours. The fans shall also start and run smoothly at minimum rated voltage while in an ambient temperature of 38°C. after having remained in an ambient temperature of 38°C. for 4 hours.

3.8 Input. - The power input at rated voltage shall not exceed 35 watts. The power input of any individual fan shall not vary more than 15 percent from the average obtained when samples (see 4.4.1) are tested as specified in 4.5.4.

3.9 Speed. - The speed of any individual fan shall not vary more than 5 percent from the average speed obtained when samples (see 4.4.1) are tested as specified in 4.5.3.

3.10 Shock. - Fans shall be designed to withstand the shock tests specified in 4.5.13.

3.11 Mechanical balance and audible noise. - Fans shall be dynamically balanced and shall operate without objectionable noise at rated speed.

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3.12 Output. - The air output shall be such that the average velocity of the air delivered (see 4.5.7) shall be not less than 75 feet per minute, when measured at a radius of 5 feet from the center of the fan.

3.13 Terminal boxes. - A metal terminal box shall be furnished, mounted as part of the fan assembly. The box shall be of such size that undue crowding of the connections between the motor leads and the incoming cable will not result. Each box shall be provided with a 1.26 inch diameter hole to accommodate a size 4, stuffing tube in accordance with MIL-S-19622. Each box shall also be equipped with a metal cover which shall be secured by machine bolts.

3.14 Life. - Fans shall operate satisfactorily in accordance with the requirements specified herein at rated voltage without showing defects or undue wear, when tested as specified in 4.5.12. At the end of the life period specified, the wear shall not have exceeded the following:

- (a) Commutator: 0.030 inch in diameter.
- (b) Sleeve bearings: 0.003 inch in diameter.
- (c) Brushes shall not be worn to the extent of causing the fan to become inoperative during the life test (see 4.5.12).

3.15 Dielectric. - The insulation shall withstand the dielectric test specified in 4.5.5.

3.16 Insulation resistance. -

3.16.1 The insulation resistance shall be not less than 16 megohms when measured in accordance with 4.5.2.

3.16.2 The insulation resistance shall be not less than 2 megohms when measured in accordance with 4.5.10.

3.17 Electromagnetic interference. - When required, electromagnetic interference shall be as specified (see 6.2).

3.18 Weight and dimensions. - The weight and dimensions of the fan shall not exceed those specified in table I.

Table I. Weight and dimensions.

Weight	Projection downward from mounted position	Blade diameter
14 pounds	9 1/2 inches	8 1/2 inches

3.19 Grounding. - An electric conducting path shall exist between all exposed metal parts and mounting. In the case where the fan motor is electrically isolated from the mounting (for example, in rubber grommets for noise isolation purposes), a stranded wire shall be used for grounding purposes. This wire shall be sufficiently long so that there will always be slack regardless of the fan position. It shall be of at least the same cross-sectional area as each wire which supplies power to the motor, and shall be secured in such a manner that it will not become entangled in any part of the fan assembly.

3.20 Vibration. - Fans shall be designed to withstand type I, (environmental) vibration as specified in MIL-STD-167.

3.21 Designation and marking. -

3.21.1 Designation. - The Government designation for the fans shall be shown as type I, type II, type INM or type IINM. The class of fan shall not be shown.

3.21.2 Identification plates. - Identification plates and other designating marking shall be provided in accordance with type A, B, C, or D of MIL-P-15024, except that aluminum alloy or plastic material will not be permitted. These plates shall be installed on and furnished as a part of the equipment for which they are intended. They shall be attached to the part of the equipment which will not ordinarily be renewed during its normal service life, and shall be located in a readily accessible position where they can be read at all times without danger to personnel.

3.21.3 Identification plate markings. - Data marked on identification plates shall include the information specified in MIL-P-15024, the character of current and the voltage and Federal stock number.

3.22 Finish. - The frame, base and guard shall be given a prime coat of zinc-chromate primer conforming to TT-P-645, or any equally suitable primer approved by the procuring activity, and a coat of smooth, durable, baked-on enamel conforming to type III, class 2 of MIL-E-15090.

3.23 Drawings. - Drawings shall be category F, form 1 of MIL-D-1000 and type II of MIL-D-1000/2. Drawings shall be submitted to the procuring activity concerned for approval prior to the preproduction tests. Certification data shall not be furnished. Previously approved drawings need not be resubmitted.

3.23.1 Class 1 fans, types I and II. - A list of material shall not be required. Drawings shall contain the following information:

- (a) An outline drawing giving front and side view, dimensions and mounting hole diameter and spacing.
- (b) Brush length, width, and thickness, and number of brushes per stud, number of studs, manufacturer's and Navy grade, and name of manufacturer.
- (c) File number and date of the shock test report and file number and date of the Government's letter forwarding the report.
- (d) Weight of complete fan in pounds.
- (e) List of insulation materials.
- (f) Material and thickness of fan blade.
- (g) Type of bearings—if ball bearings, manufacturer's name and identification.
- (h) Detail showing means provided for installing incoming cable.
- (i) Permissible reduction in commutator diameter.
- (j) Nominal power input and speed.
- (k) Schematic circuit diagram.
- (l) Test number and date of the test report applicable to the fan.

3.23.2 Class 2 fans, types INM and IINM. Drawings shall contain the information specified in 3.23.1 and the following:

- (a) Sectional view, with additional detailed and sectional views as necessary, showing and identifying all parts of the fan.
- (b) A list of material, as required for MIL-D-1000/2.
- (c) Material identification of all metal parts.
- (d) Unit weights of all magnetic parts (parts whose permeability is equal to or greater than 2.0 after fabrication).

3.24 Repair parts. - When required (see 6.2), the following repair parts shall be provided:

- 1 set of brushes and 1 set of brush springs for each d. c. fan. (When brushes are supplied with springs as a component part of each brush, it is not necessary to furnish springs as a separate item.)
- 1 repair motor with each 10 fans or fraction thereof. (Where start-run capacitors are used with a. c. fans, these capacitors shall be included with the repair motor.)

3.25 Workmanship. - The workmanship shall be first class in every respect.

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

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for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Preproduction sample. - Each preproduction sample tested for approval shall successfully pass the examination and tests specified in 4.5 (see 6.3). Production units shall be identical to the preproduction sample as approved.

4.3 Sampling for quality conformance inspection. -

4.3.1 Lot. - For purposes of sampling, a lot shall consist of all electric fans of the same class and type offered for delivery at one time.

4.3.2 Sampling for group A examination and tests. - A random sample of fans shall be selected from each lot and shall be subjected to each of the group A examination and tests specified in 4.4.1, with lot acceptance based on table II.

Table II. Sampling for group A tests, AQL
(approx.) = 1.5 percent defective.

Number of fans in lot	Number of fans in sample	Number of equipments nonconforming on any group A examination and tests	
		Acceptance number	Rejection number
2 to 8	6	0	1
9 to 15	8	0	1
16 to 25	10	0	1
26 to 40	13	0	1
41 to 65	17	0	1
66 to 110	22	1	2
111 to 180	28	1	2
181 to 300	35	1	2
301 to 500	45	2	3
501 and over	55	3	4

4.3.3 Sampling for group B test. - A sample number of fans shall be selected in accordance with table III from the end of each month's production and shall be subjected to the group B test specified in 4.4.2.

Table III. Sampling for group B tests.

Number of fans in 1 month's production	Number of fans to be selected for group B tests
65 and under	1
66 to 300	2
301 to 800	3

4.4 Quality conformance inspection. -

4.4.1 Group A examination and tests. - Each of the sample fans selected in accordance with table II shall be subjected to the examination and each of the tests specified herein and the results of the examination and each test compared with requirements of this specification. Failure to conform to the requirements of this specification for any group A examination and tests shall be counted as a defect, and the fans shall not be offered for delivery. If the number of such nonconforming fans in any sample exceeds the acceptance number for that sample, the lot represented by the sample shall be subject to rejection.

<u>Group A examination and tests</u>	<u>Reference</u>
Visual examination	4.5.1
Insulation resistance (cold)	4.5.2
Speed	4.5.3
Power input	4.5.4
Dielectric strength	4.5.5

4.4.2 Group B test. - Each of the sample fans selected in accordance with table III shall be subjected to the tests specified herein and the results of the test compared with specification requirements. In the event of any failure to conform to the specification requirements for the group B test, the contractor shall correct the cause of failure and repair the deficiency in any fans not yet shipped.

<u>Group B tests</u>	<u>Reference</u>
Output	4.5.7
Operation for 4 hours to cause heating	4.5.8
Audible noise	4.5.9
Insulation resistance	4.5.10
Low temperature starting	4.5.11
Permeability	4.5.14

4.5 Examination and tests. -

4.5.1 Visual examination. - Each sample fan shall be subjected to a careful visual examination to ascertain that the structural details and character of workmanship conform to this specification. The selected sample shall also be checked against the approved master drawings.

4.5.2 Insulation resistance (cold). - The insulation resistance of the complete fan shall be measured to determine compliance with 3.16.1.

4.5.3 Speed. - The actual speed shall be determined by any convenient means to determine compliance with 3.9. The test should be conducted at room temperature. The temperature shall be recorded.

4.5.3.1 Starting characteristics. - The time required to accelerate from standstill to full speed shall be recorded. The fan shall be checked for any tendency to stall.

4.5.4 Power input. - The power input at full load shall be measured by any convenient means to determine compliance with 3.8.

4.5.5 Dielectric test. - The fan shall be subjected to a.c. potential of 900 volts for 1 minute applied between the current-carrying parts and the frame, upon the completion of the tests specified in 4.5.1 through 4.5.3.

4.5.5.1 Capacitor test. - Where capacitors are used, the suitability of the installation shall be determined. The dielectric test shall include the capacitors.

4.5.6 Effect of variations in power supply. - All types of fans shall be operated briefly throughout the specified voltage range to determine compliance with 3.6.

4.5.7 Air movement. - The fan output shall be determined as follows:

- (a) The fan shall be mounted on a ceiling whose height is not less than 6-1/2 feet from the floor (see figure 1).
- (b) The ceiling shall be unobstructed within a 10-foot radius of the fan.
- (c) The space in which the fan is mounted shall be free from extraneous drafts.
- (d) The velocity of the air delivered shall be determined at a distance of within 18 inches from the ceiling and at the specified radius from the fan (see 3.12). The velocity shall be measured with a calibrated anemometer, velometer, or any other approved instrument. At least eight readings shall be taken in a like manner at points approximately equidistant from the center of the fan around the circumference of the circle described by the specified radius.

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4.5.8 Operation for 4 hours. - Each sample selected as specified in 4.4.2 shall be operated for 4 hours at rated voltage to ascertain satisfactory operation in respect to the bearings, input, speed, temperature rise, and voltage.

4.5.9 Audible noise. - The audible noise shall be noted to determine compliance with 3.11. Tests with noise instruments are not required unless specifically required by the contract or order.

4.5.10 Insulation resistance. - The insulation resistance of the complete fan shall be measured at the conclusion of the 4 hour operation test (see 4.5.8) to determine compliance with 3.16.2.

4.5.11 Low temperature starting. - Starting tests after the fan has been at a temperature of minus 18°C. (0°F.) or lower for at least 24 hours shall be conducted to determine compliance with 3.7. Similar tests shall be conducted after the fan has been at a temperature of 38°C. (100°F.) for 4 hours.

4.5.12 Life tests. - The fans selected for test shall be subjected to a 14 cycle life test; each cycle to consist of 360 hours running at room temperature and at rated voltage and frequency, then 24 hours idle at a temperature of minus 18°C. (0°F.), followed by 8 hours running at minus 18°C. (0°F.) and rated voltage and frequency. At the end of each 8-hour run, power input and speed shall be measured, while the fans are still subjected to a temperature of minus 18°C. (0°F.). The power input and speed shall be measured to determine conformance with this specification.

4.5.12.1 Dielectric. - Upon completion of the life test, the fans shall be subjected to an a. c. potential of 900 volts for 1 minute, applied between the current-carrying parts and the frame.

4.5.12.2 Wear. - Upon completion of the dielectric test (see 4.5.12.1), the fans shall be dismantled and examined for wear and defects to determine compliance with 3.14.

4.5.13 Shock. - The fans shall be subjected to class HI shock in accordance with the method specified in MIL-S-901. The features of test shall be as follows:

- (a) Type - type A.
- (b) Weight - light.
- (c) Principal functions- circulating air.
- (d) Cause for rejection:

- (1) Breakage of any part of the fan tested, or cracks indicating incipient breakage.
- (2) Deformation of parts that will cause an increase in vibration, an increase of noise, or cause active interference between parts.
- (3) Changing of position of the fan after it has been secured in set position.

- (e) Mounting. The fan shall be mounted by means of mounting fixture 4A as shown on figure 5 of MIL-S-901.

4.5.14 Permeability (class 2 fans only). - The permeability of nonmagnetic material shall be determined by the use of permeability indicators conforming to MIL-I-17214.

4.5.15 Vibration. - Vibration tests shall be conducted in accordance with type I (environmental vibration) requirements of MIL-STD-167.

4.5.15.1 Test feature. - The test feature for shock test (see 4.5.13) shall also apply to vibration tests. The unit of equipment selected for vibration tests shall be the same unit as selected for class HI shock tests.

4.6 Inspection of preparation for delivery. - The packaging, packing and marking shall be inspected for compliance with section 5 of this document.

5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging, packing and marking. - The equipment accessories, technical publications and repair parts shall be preserved and packaged by level A or C; packed by level A, B or C and marked by levels A, B or C as specified (see 6.2) in accordance with MIL-E-17555.

6. NOTES

6.1 Intended use. -

6.1.1 Class 1. - Types I and II fans are intended primarily for surface ship use.

6.1.2 Class 2. - Type INM and type IINM fans are intended for use on nonmagnetic construction mine sweepers.

6.2 Ordering data. - Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Class and type required (see 1.2, 3.2.1 and 3.2.2).
- (c) Voltage required (see 3.6).
- (d) Electromagnetic interference, when required (see 3.17).
- (e) Whether repair parts are required (see 3.24).
- (f) Selection of applicable level of preservation, packaging, packing and marking (see 5.1).

6.3 Preproduction. - Invitations for bids should provide that the Government reserves the right to waive the requirement for preproduction samples as to those bidders offering a product which has been previously procured 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 procurement.

6.4 Army purchases. Equipment procured under this specification for the Army should conform to the tactical support or administrative requirements of MIL-E-55301 depending upon the intended deployment.

6.5 CHANGES FROM PREVIOUS ISSUE. THE OUTSIDE MARGINS OF THIS DOCUMENT HAVE BEEN MARKED "¶" TO INDICATE WHERE CHANGES (DELETIONS, ADDITIONS, ETC.) FROM THE PREVIOUS ISSUE HAVE BEEN MADE. THIS HAS BEEN DONE AS A CONVENIENCE ONLY AND THE GOVERNMENT ASSUMES NO LIABILITY WHATSOEVER FOR ANY INACCURACIES IN THESE NOTATIONS. BIDDERS AND CONTRACTORS ARE CAUTIONED TO EVALUATE THE REQUIREMENTS OF THIS DOCUMENT BASED ON THE ENTIRE CONTENT AS WRITTEN IRRESPECTIVE OF THE MARGINAL NOTATIONS AND RELATIONSHIP TO THE LAST PREVIOUS ISSUE.

Custodians:
Army - ME
Navy - SH

Preparing activity:
Navy - SH
(Project 4140-0045)

Review activities:
Army - ME, EL
Navy - SH