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FEDERAL SPECIFICATION

OVENS, MICROWAVE, ELECTRIC

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

1. SCOPE AND CLASSIFICATION

1.1 Scope. This document covers household and commercial microwave ovens. These ovens use ultra high frequency, electromagnetic radiation in the approved industrial, scientific, and medical bands to defrost, heat and cook food.

1.2 Classification. Ovens will be of the following types, sizes, groups, style, classes and categories as specified (see 6.2. and 6.8). Section 6.6 contains ordering data and additional information pertaining to these classifications.

Type I - Household microwave oven.
 Type II - Commercial microwave oven.
 Type III - Commercial combination microwave and convection oven
 (size 1200 and 1800 only).

Size 600 - 600-1199 watt microwave power output.
 Size 1200 - 1200-1799 watt microwave power output.
 Size 1800 - 1800 and greater watt microwave power output.

Group 1 - over 0.8 to 1.2 cubic feet (cu ft) cooking cavity
 (22,653 to 33,980 cubic centimeter (cu cm)).
 Group 2 - over 1.2 to 1.5 cu ft cooking cavity (33,981 to 42,475 cu cm).
 Group 3 - over 1.5 cu ft cooking cavity (over 42,475 cu cm).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer (Code 156), Naval Construction Battalion Center, Port Hueneme, CA 93043-5000, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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Style 1 - Digital timer and touchpad controls (computer controlled).

Class 1 - 13.25 to 18 inches wide cooking cavity (337 to 457 millimeter (mm)).

Class 2 - over 18 to 24 inches wide cooking cavity (458 to 610 mm).

Category 1 - Shore use.

Category 2 - Shipboard use.

Category 3 - Foreign use (50 Hertz (Hz), 220/240 Volt (V) alternating current (ac), 1-phase).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. 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).

Federal Standards:

- FED-STD-123 - Marking for Shipment (Civil Agencies).
- FED-STD-376 - Preferred Metric Units For General Use by the Federal Government.
- FED-STD-H28 - Screw-Thread Standards for Federal Services.

Military Specifications:

- MIL-V-173 - Varnish, Moisture-and-Fungus Resistant (For Treatment of Communications, Electronic, and Associated Equipment).
- MIL-E-17555 - Electronic and Electrical Equipment, Accessories, and Provisioned items (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-147 - Palletized Unit Loads.
- MIL-STD-167/1 - Mechanical Vibration of Shipboard Equipment (Type I - Environmental and Type II - Internally Excited).
- MIL-STD-461 - Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference.
- MIL-STD-462 - Electromagnetic Interference Characteristics, Measurement of.
- MIL-STD-1472 - Human Engineering Design Criteria for Military Systems, Equipment and Facilities.
- MIL-STD-1399 - Interface Standard for Shipboard Systems.
- MIL-STD-1399/300 - Interface Standard for Shipboard Systems, Section 300 Electric Power, Alternating Current (Metric).

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(Unless otherwise indicated, copies of federal and military specifications and standards are available from the Naval Publications and Forms Center, (ATTN: NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

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

Federal Regulations:

Code of Federal Regulations

Title 21, Food and Drugs, Subchapter J - Radiological Health.

Title 29, Labor, Chapter 17 - Occupational Safety and Health Administration, Department of Labor.

Title 47, Telecommunication, Part 18 - Industrial, Scientific, and Medical Equipment.

(The Code of Federal Regulations (CFR) and the Federal Register are for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. When indicated, reprints of certain regulations may be obtained from the Federal agency responsible for issuance thereof.)

2.2 Non-Government publications. The following document(s) 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 which is current on the date of the solicitation (see 6.2).

National Sanitation Foundation (NSF):

NSF No. 4 - Commercial Cooking and Hot Food Storage Equipment. Listing of Food Service Equipment.

(Application for copies should be addressed to the National Sanitation Foundation, 3475 Plymouth Road, P.O. Box 1468, Ann Arbor, MI 48106.)

Underwriters Laboratories, Inc. (UL):

UL 923 - Microwave Cooking Appliances.

(Application for copies should be addressed to the Underwriters Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL 60062.)

American Society for Metals:

Metals Handbook, Ninth Edition, Vol. 3, Mill Finishes, pages 36-37.

(Application for copies should be addressed to the American Society for Metals, Metals Park, OH 44073.)

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American National Standards Institute, Inc., (ANSI)

ANSI C73.12 - Plugs and Receptacles - General Purpose 125 Volts,
20 Amperes, 2 Pole, 3 Wire Grounding Type, Dimensions of.

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

American Welding Society, Inc., (AWS)

AWS Welding Handbook, Eight Edition, Volume 1-1987.

(Application for copies should be addressed to the American Welding Society, Inc., 550 N.W. LeJeune Road, P.O. Box 351040, Miami, FL 33135.)

(Non-Government standards and other publications are normally available from the organizations which prepare or which 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 specification and the references cited herein (except for associated detail specifications, specifications sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Contractor certification. The contractor, as a minimum, shall certify and maintain substantiating evidence that the product offered meets the requirements of this specification, and that the product conforms to the producer's own drawings, specifications, standards and quality assurance practices. Additional or better features which are not specifically prohibited by this specification but which are a part of the manufacturer's standard product, shall be included in the oven(s) being furnished. The Government reserves the right to require proof of such conformance prior to first delivery and thereafter as may be otherwise provided for under the provisions of the contract (see 6.2).

3.1.1 Metric products. Products manufactured to metric dimensions will be considered on an equal basis with those manufactured using inch-pound units, provided they fall within specific tolerances using conversion tables contained in the latest revision of FED-STD-376, and all other requirements of this specification are met.

3.2 First article. When specified (see 6.2), the contractor shall furnish an oven for first article inspection and approval (see 4.2.1 and 6.4).

3.3 Codes and standards. Unless otherwise specified herein, the oven(s) shall conform to the requirements of Title 21 CFR, subchapter J; Title 29 CFR, chapter 17; Title 47 CFR, part 18; UL 923; and NSF No. 4 (type II and III ovens only) as applicable.

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3.4 Materials. Materials used shall be free from defects which would adversely affect the performance or maintainability of individual components or of the overall assembly. Materials not specified herein shall be of the same quality used for the intended purpose in commercial practice. Unless otherwise specified herein, all equipment, material, and articles incorporated in the work covered by this specification are to be new and fabricated using materials produced from recovered materials to the maximum extent possible without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products are allowed under this specification.

3.4.1 Hardware and fittings. All hardware and fittings shall be made with corrosion-resistant material. When specified, all fasteners shall be made with American Iron and Steel Institute (AISI) Type 316 stainless steel (see 6.2).

3.4.2 Threaded parts. All threaded parts shall conform to FED-STD-H28.

3.5 Design.

3.5.1 General. The oven shall include all components necessary to ensure a fully functional product.

3.5.2 Microwave energy source. Microwave energy shall be generated using one or more magnetron tubes or any other suitable generating source of microwave radiation. Microwave radiation shall be interrupted and the generating source shall be rendered inoperative (either turned off or switched to a standby mode) when the oven door is open or not securely latched in the closed position.

3.5.2.1 Warning label. A warning label (decalcomania), red background with contrasting white or black lettering, shall be affixed to the outer case assembly on or adjacent to each service access cover and adjacent to one of the fasteners which secures the outer case assembly to the oven chassis. A high voltage warning label shall also be placed near the high voltage components inside the outer case. The label shall include but is not limited to the following warnings:

- a. Warning - HIGH VOLTAGE.
- b. Power supply must be disconnected before servicing.
- c. Access covers must be secured in place during operation.
- d. Servicing shall be done by authorized personnel only.

3.5.2.2 Microwave energy distribution. Means shall be provided to maintain uniform distribution of microwave energy throughout the cooking cavity. It shall not be necessary to rotate food during the cooking cycle to obtain an even cooking pattern within the food item (see 4.5.5).

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3.5.3 Microwave radiation generating source (magnetron) protection.

3.5.3.1 Reflected energy. With the oven empty except for any required tray, sheet, or rack furnished by the manufacturer, the oven shall be capable of operation at maximum power output for one hour or one maximum timer cycle, whichever is shorter, without damage to the microwave radiation generating source or other oven components (see 4.5.6).

3.5.3.2 Thermal protection. Means shall be provided to protect the magnetron or other microwave radiation generating source from damage due to excessive heating. Protective devices shall be resettable (manual or automatic).

3.5.4 Power supply protection. The power supply shall be protected from damage occurring due to an over voltage (surge) condition. Replaceable fuses (accessible without removal of service access covers) or resettable circuit breakers (manual or automatic) shall be used for this purpose.

3.5.5 Cooking cavity. The cooking cavity shall be rectangular in shape with no dimension less than that specified in table I. The height measurement shall be made with any required sheet or tray in place. Type II and type III units shall have a stainless steel cooking cavity with vertically coved corners, or welded and dressed corners to facilitate cleaning. The cooking shelf shall be constructed of ceramic material and sealed to prevent spillage from draining into oven chassis.

TABLE I. Minimum cooking cavity dimensions.

Height (Inches) (millimeters)	Width (Inches) (mm)	Depth (Inches) (mm)
9 229	13 1/4 337	11 1/2 292

3.5.6 Ventilation systems. A forced air circulation system shall be provided which will exhaust water vapor and cooking vapors from the cooking cavity. Type II and III ovens shall be furnished with an air intake filter which shall be removable and readily accessible for cleaning or replacement.

3.5.7 Controls. All required oven controls shall be installed on the front of the oven except that for type II and III ovens a main power disconnect device may be located on the side in a location accessible from the front of the oven. When specified (see 6.2), a temperature sensing probe which is inserted into the food and terminates the cooking cycle when the desired food temperature has been reached, shall be provided.

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3.5.7.1 Timers. Oven timers shall provide minimum control functions of ON, OFF, timed cooking cycles, and automatic termination of the oven operation after completion of the cooking cycle. An audible tone or beep signal shall sound at the end of a cooking cycle. When specified, the end of cooking cycle signal shall repeat with one or more audible tones at 15 second intervals until the oven is opened (see 6.2).

3.5.7.1.1 Digital timer and touchpad controls. Touchpad controls shall utilize electronic solid-state components which process user instructions input by means of data entries to control the starting, stopping, timing, and heat-control power-level functions of the oven. A lighted digital read-out panel shall display each data segment when entered accompanied by an audible tone or beep, countdown time remaining to end of current cooking cycle, and indicate completion of cooking cycle prior to opening oven door after cooking cycle is finished.

3.5.7.2 Power level controls. All ovens shall have microwave power level controls that provide for selection of radiated power with a minimum designated "defrost", "medium" and "full" power settings. Type III ovens shall (in addition to the above) be equipped with a thermostatic control to regulate oven temperature and a control to allow selection of the convection heating elements selectively, upper element only (broil/brown), lower element only (bake), and both upper and lower elements (preheat/bake). When offered and specified, the power level controls shall have selection of radiated power in 10 percent increments from 10 percent of maximum rated output to 100 percent of rated output with a designated "defrost" power setting (see 6.2).

3.5.7.3 Indicating light. A light shall be installed on the front of the oven that indicates when the oven is operating. The digital display may be utilized as a "power-on" indicator, and shall display "cook time remaining" (minutes and seconds) countdown and indicate both visually and audibly completion of the cook cycle.

3.5.8 Electrical requirements.

3.5.8.1 Input power. Microwave generating equipment shall be adjustable to permit oven operation at maximum efficiency on the available supply voltage. Unless otherwise specified (see 6.2), the ovens shall be designed to operate on 120V or 208/240V, 60 Hz, single-phase ac. When specified for foreign use (see 6.2), the ovens shall be designed to operate on 220Vac, 50 Hz, single-phase or 380Vac, 50 Hz, 3-phase.

3.5.8.2 Power cord and connector. Unless otherwise specified (see 6.2), the power cord shall be not less than 5 feet in length, shall be Underwriters Laboratories (UL), Inc. rated, and shall contain conductors and connecting plugs conforming to ANSI C73.12 for the type, size and category of equipment ordered (except category 3 ovens shall have connectors and plugs conforming to Verband Deutscher Elektrotechniker (VDE) (German Federal Republic) codes for mechanical kitchen equipment using 50 Hz, 380 Vac, 3-phase, 4-wire, grounded neutral, or 50 Hz, 220Vac, single-phase, input power consonant with maximum power draw of the specific oven.

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3.5.8.3 Electric motors. All electric motors shall have permanently sealed bearings which require no additional lubrication for the life of the motor.

3.6 Construction.

3.6.1 Oven. The cooking surface shall be capable of supporting a load of 10 pound-force per square foot (psf) (0.48 kilo pascal) (kPa) without permanent deformation of the oven cavity (see 4.5.1). The ovens shall be suitable for mounting on a counter, wall, or in-wall when installed with adequate ventilation as specified by the manufacturer. When specified (see 6.2), ovens shall be provided with a suitable mounting to install the oven in the intended manner.

3.6.2 Oven door.

3.6.2.1 Viewing screen. Viewing screens shall be provided on all type I oven doors. Viewing screens shall be provided on types II and III oven doors unless specifically deleted (see 6.2).

3.6.2.2 Latching mechanism. The latching mechanism shall be single action design and shall be tested in accordance with 4.5.4.1.

3.6.2.3 Radio frequency (RF) suppression. RF suppression on doors for types I and II ovens shall be by the "choke" method or by a combination of the "choke and gasket" methods. RF suppression on doors for type III ovens shall be by a combination of "seal and gasket" or "choke and seal". Under no circumstances shall RF leakage exceed limits imposed by paragraphs 3.3, 3.12 or 3.13.7 for shipboard use ovens.

3.6.3 Cooking cavity light. Type I ovens and type II ovens with viewing screens shall have the cooking cavity illuminated. The light shall automatically activate when the door is opened and the light shall remain on while a cooking cycle is in progress. Type III ovens shall have an oven light which automatically activates when the oven door is opened; additionally, type III ovens with viewing screens shall be equipped with a front mounted switch to independently control the oven cavity light when the oven door is closed.

3.7 Interchangeability. All units of the same classification furnished with similar options under a specific contract shall be identical to the extent necessary to insure interchangeability of component parts, assemblies, accessories, and spare parts.

3.8 Performance.

3.8.1 Microwave power output. When tested in accordance with 4.5.2, the microwave oven power output shall be within ± 10 percent of the output power as stated by the manufacturer. The specific microwave power output or combination microwave/convection power output shall be within the output power parameters stated from the specific size oven and the maximum input power requirements shown in paragraph 3.5.8.1, when tested in accordance with 4.5.2.

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3.8.2 Reliability.

3.8.2.1 Type I ovens. When tested in accordance with 4.5.3.1, type I ovens shall be capable of not less than 24 hours of operation without failure of the major oven functional components including the microwave radiation generating components, power supply, and timer.

3.8.2.2 Type II and type III ovens. When tested in accordance with 4.5.3.2, type II and III ovens shall be capable of not less than 72 hours of operation without failure of the major oven functional components including the microwave radiation generating components, power supply, timer, and convection system.

3.9 Safety requirements.

3.9.1 General. The oven shall conform to all applicable Federal safety requirements and UL 923.

3.9.2 Bleeder resistor. A bleeder resistor or other suitable power dissipating device shall be provided to bleed the charge from the magnetron power supply capacitor when the oven is turned off. The voltage across the capacitor shall be less than 50V within 30 seconds after the power supply is turned off.

3.10 Lubrication. All bearings (unless lifetime lubricated), gears and sliding parts shall have provision and instructions for lubrication. There shall be no bearings or parts requiring lubrication internal to the ovens.

3.11 Fungus resistance. For type II and III ovens, when specified (see 6.2), electrical components and circuit elements, including terminal and circuit connections, shall be coated with varnish conforming to MIL-V-173, except that:

- a. Components and elements inherently inert to fungi or in hermetically sealed enclosures need not be coated
- b. Current-carrying contact surfaces, such as relay contact points, shall not be coated

3.12 Electromagnetic interference (EMI) control. Unless otherwise specified (see 6.2), the ovens shall meet the EMI control requirements and test limits for class C3, group I, equipment as specified in MIL-STD-461 when tested in accordance with MIL-STD-462 (see 4.6).

3.13 For shipboard use only.

3.13.1 Type and category. Ovens for Naval shipboard installation shall be type II or III, category 2.

3.13.2 Shipboard installations. Category 2 ovens shall conform with the Marine Supplement of UL 923, Microwave Cooking Appliances for Marine Use, except as indicated in 3.13.3 through 3.13.9.

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3.13.3 Power compatibility. Unless otherwise specified (see 6.2), type II category 2 ovens shall be compatible with shipboard type I, 60 Hz, 115 Vac, single-phase, alternating current as specified in MIL-STD-1399 and MIL-STD-1399/300; and type III, category 2 ovens shall be compatible with shipboard type I, 60 Hz, 440 Vac, 3-phase or 60 Hz, 115 Vac, single-phase, specified in MIL-STD-1399/300.

3.13.4 Mounting. Provision shall be made to mount the oven on a horizontal surface. The frame shall be provided with drilled or threaded bosses or retaining nuts for this purpose. Mounting bolt size shall be 3/8-inch (9.5 mm) minimum and four symmetrically spaced mounting holes shall be provided. The threaded boss or retaining nut shall provide a thread engagement not less than the bolt diameter plus one thread.

3.13.5 Access. Ovens for naval surface vessels shall pass through a 26-inch (660 mm) wide shipboard hatch without major disassembly. Ovens for submarines shall pass through a 25-inch (635 mm) diameter circular hatch without major disassembly.

3.13.6 Inclined operation. Category 2 ovens shall operate satisfactorily when inclined at an angle of 30 degrees ($^{\circ}$) each side of the vertical in each of two vertical planes at right angles to each other when tested as specified in 4.7.

3.13.7 Electromagnetic interference (EMI) control. Microwave ovens shall meet the requirements and test limits of class A4 for surface ships and class A5 for submarines of MIL-STD-461 shall apply. Shipboard equipment shall meet the emission and susceptibility requirements for CE01, CE03, and RE02 (see 4.6).

3.13.8 Environmental suitability. Category 2 ovens shall be capable of withstanding ships vibration and motion. Controls, switches, moving parts and electrical circuits shall operate under shipboard conditions without malfunction, binding, excessive looseness, or damage when tested as specified in 4.8..

3.13.9 Human factors criteria. Human factors engineering criteria, principles, and practices, as defined in MIL-STD-1472, shall be used in the design of microwave ovens when for shipboard use. Maintenance and operational activities shall permit safe and efficient performance by the 5th percentile female to the 95th percentile male as defined in sections 5.6 and 5.9 of MIL-STD-1472. Controls, switches, and indicator lights shall be selected and integrated into the oven so as to meet the applicable requirements of sections 5.2 and 5.4 of MIL-STD-1472. An audible tone or beep shall have a tone in the range of 500 to 3000 Hz. The microwave oven shall be insulated such that the exterior surface temperature does not exceed 140 degree Fahrenheit ($^{\circ}$ F) 60 $^{\circ}$ Centigrade (C) and any hand gripped areas shall not exceed 120 $^{\circ}$ F (49 $^{\circ}$ C). The microwave door handle shall have an audible click for positive indication that it is completely closed. Clearance or free area required around an item shall permit an individual with applicable body dimensions and physical capabilities to safely operate, maintain, remove or replace that item. When establishing

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accessibility requirements, both physical and visual access must be provided along with access for any tools, test equipment or replacement parts needed. While inspecting for defects and performing tests (see section 4), the equipment shall adhere to the human factors engineering considerations listed here.

3.14 Exterior dimensions and weights. Except for ovens used aboard naval vessels, the exterior dimensions and weight restrictions of the ovens will be governed by the intended use and limitations of the installation location. Dimensional limits of ovens for shipboard use are controlled by the restrictions of 3.13.5.

3.15 Treatment and painting. Unless otherwise specified (see 6.2), type I ovens shall be treated and painted in accordance with the manufacturer's best standard practice. Type II and type III ovens shall have a cabinet constructed of AISI type 316 Stainless Steel with a #4 sheet finish or better (reference Metals Handbook, Ninth Edition, Vol 3, Mill Finishes, pg 36-37).

3.16 Workmanship.

3.16.1 Steel fabrication. The steel used in fabrication shall be free from kinks, sharp bends, and other conditions which would be deleterious to the finished product. Manufacturing processes shall not reduce the strength of the steel to a value less than intended by the design. Manufacturing processes shall be done neatly and accurately. All bends shall be made by controlled means to insure uniformity of radius and angularity.

3.16.2 Bolted connections. Boltholes shall be accurately punched or drilled and shall have the burrs removed. Washers or lockwashers shall be provided in accordance with good commercial practice, and all bolts, nuts, and screws shall be tight.

3.16.3 Riveted connections. Rivet holes shall be accurately punched or drilled and shall have the burrs removed. Rivets shall be driven with pressure tools and shall completely fill the holes. Rivet heads, when not countersunk or flattened, shall be of approved shape and of uniform size for the same diameter of rivet. Rivet heads shall be full, neatly made, concentric with the rivet holes, and in full contact with the surface of the member.

3.16.4 Welding. Welding procedures shall be in accordance with the American Welding Society (AWS) "Welding Handbook, 8th Edition". The surface of parts to be welded shall be free from rust, scale, paint, grease, or other foreign matter. Welds shall be of sufficient size and shape to develop the full strength of the parts connected by the welds. Welds shall transmit stress without permanent deformation or failure when the parts connected by the weld are subjected to proof and service loadings.

3.16.5 Castings. All castings shall be sound and free from patching, misplaced coring, warping, or any other defect which reduces the castings ability to perform its intended function.

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3.16.6 Machine work. Tolerances for contact and bearing surfaces shall conform to standards prevailing among manufacturers normally producing ovens.

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 the specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must 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. 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 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.

4.1.2 Component and material inspection. Components and materials shall be inspected in accordance with all the requirements specified herein and in applicable referenced documents.

4.1.3 Standards compliance. The contractor shall make available to the contracting officer or his authorized representative evidence of compliance with the applicable standard(s) cited in 3.3. The Government reserves the right to examine and test all ovens to determine the validity of the certification.

4.1.4 Microwave Cooking Appliances, UL 923. Acceptable evidence of meeting the requirements of UL 923 shall be the UL certification symbol or label, listing in the UL Directory, or a certified test report (see 6.3) from a recognized independent testing laboratory indicating the oven has been tested and conforms to UL 923. Such evidence must be acceptable to the contracting officer.

4.1.5 National Sanitation Foundation No. 4. Acceptable evidence of meeting the requirements of NSF No. 4 shall be the NSF certification symbol or label, listing in the NSF Listing of Food Service Equipment, or a certified test report (see 6.3) from a recognized independent testing laboratory indicating the oven has been tested and conforms to NSF No. 4. Such evidence must be acceptable to the contracting officer with the advice of the Army Surgeon General.

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

- a. First article inspection (see 4.2.1).
- b. Quality conformance inspection (see 4.2.2).

4.2.1 First article inspection. The first article inspection shall be performed on one microwave oven when a first article is required (see 3.2 and 6.2). This inspection shall include the examination of 4.4, the tests of 4.5.1 through 4.6, and when specified, the first article pack inspection of 4.9 and shipboard use tests 4.6 through 4.8. The first article may be either a first production item or a standard production item from the supplier's current inventory provided the item meets the requirements of the specification and is representative of the design, construction, and manufacturing technique applicable to the remaining items to be furnished under the contract.

4.2.2 Quality conformance inspection. The quality conformance inspection shall include the examination of 4.4, the tests of 4.5.4 and 4.5.4.1, and the packaging inspection of 4.9. This inspection shall be performed on the samples selected in accordance with 4.3.

4.3 Sampling. Sampling and inspection procedures shall be in accordance with MIL-STD-105. The unit of product shall be one microwave oven. All ovens of the same classification offered for delivery at one time shall be considered a lot for the purpose of inspection (see 6.9).

4.4 Examination. Each oven selected shall be examined for compliance with the requirements specified in section 3 of this specification. Any redesign or modification of the contractor's standard product to comply with specified requirements, or any necessary redesign or modification following failure to meet specified requirements shall receive particular attention for adequacy and suitability. This element of inspection shall encompass all visual examinations and dimensional measurements. Noncompliance with any specified requirement shall constitute one defect.

4.5 Tests.

4.5.1 Cavity weight load test. The cooking surface of the oven cooking cavity shall be subjected to a uniformly distributed load of 10 psf (0.48 kPa). After 2 minutes, the load shall be removed and the oven cavity examined to determine conformance with 3.6.1. Nonconformance with 3.6.1 shall be cause for rejection.

4.5.2 Microwave power output test. This test as required by 3.8.1 is a four part test in which four water loads of varying volumes are separately placed in the cooking cavity and the oven operated at full power (100 percent maximum microwave generation power and full convective heat generation power if so equipped) to obtain a specified temperature increase for each of the water loads. The average microwave/convection power output of the oven will

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be calculated as in 4.5.2.c. Results shall be within 10 percent of the output wattage specified by the manufacturer. Failure of this test shall be deemed nonconformance with 3.8.1 and be cause for rejection.

- a. Preparation. The electrical frequency and supply voltages shall be accurate to ± 1 percent of the values shown on the nameplate. The fluid used in these tests shall be distilled water and the volumes of the water test loads shall be accurate to ± 1 percent. The temperature measuring instruments shall be of the fast response variety and shall be accurate to $\pm .1^{\circ}\text{C}$. Prior to each test the temperatures of the ambient air, water loads, and equipment which could influence the test results shall be stabilized to $20^{\circ}\text{C} \pm 1^{\circ}\text{C}$. The oven shall be thermally stabilized prior to the start of each test. Volume of the test water loads shall be 275, 500, 1000, and 2000 cu cm. The 275 and 500 cu cm water loads shall be placed in thin-wall glass vessels approximately 85 mm in diameter. The 1000 and 2000 cu cm water loads shall be placed in thin-wall glass vessels approximately 110 mm in diameter. For each part of this test, the water load shall be placed at the center of the load carrying surface provided by the manufacturer except that the 2000 cu cm water load shall be distributed equally between two thin-wall glass vessels approximately 110 mm in diameter which shall be located contiguously, side by side, in the approximate center of the load carrying surface provided by the manufacturer.
- b. Procedure. The first part of the test shall be conducted using the 2000 cu cm water load properly placed in the cooking cavity. The oven shall then be operated at full power until the temperature of the water load has been raised $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ above its initial temperature. Following this test there will be a one minute interval during which the water load is replaced with the next smaller water load and the test repeated with the new water load. This sequence shall be repeated until all water loads have been tested. For each part of the test the initial and final temperatures ($^{\circ}\text{C}$) of the water loads and the full power operating time (seconds) required to raise the temperature of the water load to its final temperature shall be recorded. The final temperature of each water load shall be taken immediately upon completion of that part of the test. While the temperatures are being measured, the water shall be stirred to reduce the effects of any temperature stratification.
- c. Output calculation. The power output of the oven shall be calculated for each part of the test as follows:

$$\text{Microwave Power Output (watts)} = \frac{W (\Delta T)}{t} \quad (4.18)$$

- W = Volume of water load in cc
 ΔT = Final temperature of water load ($^{\circ}\text{C}$) minus initial temperature of the water load ($^{\circ}\text{C}$)
 t = Time of microwave/convection operation (seconds)

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The average microwave power output shall be the simple average of the test results obtained for each water load. If required the tests may be repeated to obtain stabilized results. Failure of this test shall be cause for rejection.

4.5.3 Reliability tests. Ovens shall be tested for conformance with 3.8.2.1 or 3.8.2.2, as applicable. Failure to meet these requirements shall be cause for rejection.

4.5.3.1 Household microwave oven reliability test (type I). This test is to determine conformance with 3.8.2.1, shall be conducted in 24 hours and shall test the ability of the oven to operate continuously, except for short intervals, at full power.

Procedure. The oven shall be operated at full power for the maximum setting of the timer. This shall be followed by a 60 second interval in which the timer is reset and the water load replenished if necessary. This cycle shall be repeated continuously until 24 hours of operation have been completed. The water load shall be of sufficient volume that replacement during timer operation is not required. Failure of any major component including the magnetron, power supply, or timer shall constitute a failure of the test.

4.5.3.2 Commercial microwave oven and commercial combination microwave and convection oven (types II and III) reliability test. Commercial ovens shall be tested to determine conformance with 3.8.2.2 in a manner similar to 4.5.3.1 except that the test shall be conducted in 72 hours.

Procedure. The oven shall be operated at full power for the maximum setting of the timer and convective temperature controls. This shall be followed by a 60 second interval in which the timer and convective temperature is reset and the water load replenished if necessary. This cycle shall be repeated continuously until 72 hours of operation have been completed. The water load shall be of sufficient volume that replacement during the timer or convective temperature control operation is not required. During this test, failure of any major component including the magnetron, or other microwave generating source, power supply, timer or convection system shall constitute a failure of the test.

4.5.4 Production unit tests. Production units shall be tested in accordance with the contractor's standard procedures to verify conformance to the codes and standards cited in 3.3.

4.5.4.1 Operational tests. All ovens selected in accordance with 4.2.2 shall be operated for not less than one minute at full power with a suitable load to determine that oven operation is satisfactory. The light in type I, II and III oven cooking cavities shall turn on when the door is opened and during the operation of the oven. The light in type III ovens with viewing screens shall have the front mounted on-off switch checked for

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operation while the oven door is closed. The door latch mechanism shall be opened and closed a minimum of 100 times to ensure proper operation. The timer shall be activated for not less than one operation at a minimum of 15 seconds per operation to ensure the timer controls are fully operational. The convection controls shall be activated for not less than 30 seconds to verify proper functioning. Any malfunction including excessive vibration, inoperable fan or loose parts shall be cause for rejection.

4.5.5 Microwave energy distribution test. The purpose of this test is to ensure that the microwave energy is uniformly distributed throughout the cooking cavity. The test consists of placing five identical water loads at specific locations within the cooking cavity and operating the oven at maximum power output for a period of time dependent upon its rated power output. The temperature of each water load shall then be measured and recorded. The test shall be conducted a total of four times and the variations of the temperatures at each of the test locations shall be evaluated as described in 4.5.5.c.

- a. **Test preparation.** The electrical frequency and supply voltages shall be adjusted to ± 1 percent of the values shown on the nameplate. The fluid used in these tests shall be distilled water and the volumes of the water test loads shall be accurate to ± 1 percent. The temperature measuring instruments shall be of the fast response variety and shall be accurate to $.5^{\circ}\text{C}$. Prior to each test the temperatures of the ambient air, water loads, oven, and equipment which could influence the test results shall be stabilized to $20^{\circ}\text{C} \pm 1^{\circ}\text{C}$. All test water loads shall be placed on the standard cooking surface provided by the manufacturer for the oven being tested.
- b. **Test procedures.** The total water load for each test shall be 500 cu cm of distilled water distributed equally among five thin-wall glass vessels each of approximately 50 millimeters (mm) diameter. For each test, one water load shall be placed at the center of the cooking cavity. The remaining four containers shall be placed on the diagonals between opposite corners at one-half the distance between the center of the cooking cavity and the four corners. After proper placement of the water load containers, the ovens shall be operated at full rated power as follows: For ovens with a rated output of less than 800 watts, the oven shall be operated five seconds for each 100 watts of rated output. For ovens of 800 watts or greater output, the oven shall be operated two seconds for each 100 watts of rated power output. Immediately following oven operation, the water load containers shall be removed from the oven and the temperature of each water load measured and recorded. All temperature measurements shall be made within 15 seconds after removal of the container from the oven.

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- c. Test results. The test shall be repeated four times ensuring compliance with 4.5.5.a and 4.5.5.b prior to each test. After completion of the required tests, a simple average of the four maximum temperatures recorded for each test location shall be calculated. A simple average of all temperatures recorded in the four tests (20 values) shall also be calculated and will be referred to as the base line temperature. The average temperature calculated for each of the test locations shall individually be compared with the base line temperature and shall differ from it by not more than $\pm 6^{\circ}\text{C}$. Failure of this test shall be deemed nonconformance with 3.5.2.2 and be cause for rejection.

4.6 EMI control tests. The first article or the initial production unit, as applicable, shall be tested by the supplier in accordance with test methods CE03 and RE02 of MIL-STD-462. When required for shipboard use, the unit shall be tested by the contractor in accordance with test methods CE01, CE03 and RE02 of MIL-STD-462. The Government reserves the right to witness the tests performed by the supplier or an independent testing agency. The contractor shall furnish written certification that the equipment meets the requirements of MIL-STD-461. Non-conformance with the requirements specified shall constitute failure of the test.

4.7 Inclined operational test. Position the microwave oven with the base set at an angle of 30° , then operate for 30 seconds at each side of the vertical in each of two vertical planes at right angles to each other. At each of these positions observe for conformance with specified requirements in 3.13.6.

4.8 Shipboard environmental test. The microwave oven under normal operating conditions, shall be tested in accordance with MIL-STD-167/1, type I equipment. The oven shall be secured to the test machine in the same manner that it will be secured on shipboard (see 3.13.4). Failure of the microwave oven to perform its function during and after testing shall constitute failure of this test.

4.9 Preparation for delivery inspection. The inspection of the preservation, packaging, packing, palletization, and marking shall be in accordance with the requirements of section 4 of MIL-E-17555. The inspection shall consist of the quality conformance inspection; and, when specified (see 6.2), a first article pack shall be furnished for examination and test within the time frame required.

5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging, and packing. Preservation, packaging, and packing shall be in accordance with the Level A, B or commercial requirements of MIL-E-17555 and as specified herein. The level of preservation and packaging and the level of packing shall be as specified (see 6.2). When specified (see 6.2) flammable, combustible, or toxic packaging materials (e.g., loose-fill polystyrene, wood excelsior, shredded paper, newspaper, wax paper, etc.) shall not be used.

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5.1.1 Palletization. Material shall be palletized in accordance with MIL-STD-147 when the following criteria are met:

- a. Load to consist of four or more unskidded containers; and,
- b. Load shall utilize a minimum of 80 percent of the pallet base.

5.2 Marking.

5.2.1 Military agencies. Shipments to military agencies shall be marked in accordance with MIL-STD-129.

5.2.2 Civil agencies. Shipments to civil agencies shall be marked in accordance with FED-STD-123.

5.2.3 Special markings. In addition to the marking required in 5.2.1 and 5.2.2, the sides of each shipping container shall be marked with the word "UP" and an arrow pointing to the top of the container. "UP" shall be printed in letters not less than 1-inch high. In addition, the top panel shall be marked in letters not less than 1-inch high with the following: "THIS SIDE UP" "FRAGILE - HANDLE WITH CARE".

6. NOTES

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

6.1 Intended use. Microwave ovens are intended for use as a means of cooking, defrosting and heating food.

6.2 Ordering data. Purchasers should select the preferred options permitted herein and include the following information in acquisition documents:

- a. Title, number, date, type, size, group, style, class and category of this specification (see 1.2 and 6.8).
- 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 proof of contractor certification of conformance is required prior to first delivery (see 3.1).
- d. When first article is required for inspection and approval (see 3.2, 4.2.1, and 6.4).
- e. When all fasteners shall be made with corrosion-resistance material (see 3.4.1).
- f. When a temperature sensing probe is to be provided (see 3.5.7).
- g. When it is required to have the end of cooking cycle signal repeat one or more audible tones at 15 second intervals until the oven door is opened (see 3.5.7.1).
- h. When offered and required to have selection of radiated power in 10 percent increments (see 3.5.7.2).
- i. When electrical requirements for domestic or foreign use are other than specified (see 3.5.8.1).

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- j. When the power cord is to be other than five feet in length (see 3.5.8.2).
- k. When a mounting is required for the oven (see 3.6.1).
- l. When windows are not required in type II and III oven doors (see 3.6.2.1).
- m. When fungus-resistant treatment is required for type II ovens (see 3.11).
- n. If EMI testing is other than that specified (see 3.12).
- o. When electrical requirements are other than specified for shipboard use (see 3.13.3).
- p. Treatment and painting, if different (see 3.15).
- q. When a first article pack is required for examination and test and the time frame required for submission (see 4.2.1 and 4.9).
- r. Level of preservation and packaging and level of packing required (see 5.1).
- s. When flammable, combustible or toxic packaging materials should not be used (see 5.1).

6.3 Data requirements. When this specification is used in an acquisition and data are required to be delivered, the data requirements should be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved Contract Data Requirements List (CDRL), incorporated into the contract. When the provisions of DOD FAR Supplement, Part 27, Sub-Part 27.410-6 (DD Form 1423) are invoked and the DD Form 1423 is not used, the data should be delivered by the contractor in accordance with the contract or purchase order requirements.

6.4 First article. When a first article inspection is required, the item will be tested and should be a first production item or it may be a standard production item from the contractor's current inventory as specified in 4.2.1. The first article should consist of one microwave oven. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examination, test, and approval of the first article.

6.5 Limitation of scope. Federal specifications do not include all types, sizes, groups, style, classes, and categories of the commodities indicated by the titles of the specification, or which are commercially available, but are intended to cover the types, sizes, groups, style, classes, and categories which are suitable for Federal Government requirements.

6.6 Oven selection and application. The following notes are intended to help the procurement activity select the oven most suitable to its needs. Prior to use of 1.2 classifications, the procuring agency should ensure the user is not restricted by some aspect of the microwave oven design such as a weight or external dimension limitation that would prevent the unrestricted use of the 1.2 classifications.

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6.6.1 Type I ovens. Type I ovens are designed for household use. They are functionally the same as type II ovens, except that they are not required to undergo the more stringent testing of type II ovens. Type I ovens are suitable for general purpose use where the ovens are not subjected to continuous operation or hard use.

6.6.2 Type II and type III ovens. Types II and III ovens are designed for commercial use. They are suitable for continuous operation such as that encountered in restaurants, fast-food facilities, and commercial food preparation kitchens. Testing is more stringent for these types.

6.6.3 Sizes. The size classification (see 1.2), of a microwave oven indicates the microwave power output available for preparing the food. In general, the larger the size classification, the faster the food is capable of being cooked or defrosted. Factors to be considered in selecting the proper size include: initial cost, operating costs, the available electric power (120 or 240 volts), and intended use. For type I ovens, size 600 is the most practical and widely available. For types II and III ovens, sizes 1200 is used in the commercial market. Types II and III, size 1800 is used for special applications in which larger quantities of food are to be cooked quickly, such as in restaurants, mess halls, and hospitals.

6.6.4 Groups. The group indicates the cooking cavity volume. The cavity volume is a relative measure of the amount of food that can be placed in the oven at one time. It is not necessarily indicative of the largest food item which can be placed in the oven, since cavity dimensions and geometry vary from one manufacturer to the next.

6.6.5 Classes. The class of the oven indicates the comparative widths of the cooking cavities. Class 1 ovens are sized to hold a single 9-11 inch dinner plate. Class 2 ovens are sized to hold a microwavable half size steam table pan or sheet. Class 2 ovens will hold two 9-11 inch dinner plates or a full size steam pan or sheet depending upon the manufacturer.

6.6.6 Styles. Due to the need for high reliability and longer service life, the Federal Government has standardized on the requirement for touchpad microprocessor controls. This style of cooking timer is widely available with the commercial market.

6.6.7 Added features. Most manufacturers offer additional features that extend the versatility of the ovens. The tremendous variety of options available today make it impossible to list all of them but a good source of general information can be found in the literature available at any general kitchen appliance store. Some of the more common and popular options are variable heat or power control functions (see 3.5.7.2), infrared temperature sensing, and numerous combinations of the convection/microwave control functions to obtain different browning, baking, broiling and crisping capabilities. Typically, these options are added to basic models at additional cost. Any additional options which are needed can easily be written into the contract as desired.

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6.7 Definitions. Additional microwave oven terminology is explained in the glossary of UL 923.

6.8 Definitive specification part number. The specification part number which corresponds to the type, size, group, type class and category of units covered by this specification, and defines the requirements of the options presented under this specification. The specification number, the type, size, group, style and class code numbers are combined to form the definitive specification part number.

6.8.1 Cataloging data. For cataloging purposes, part numbers for the units are assigned as follows:

	S-0-1425	-	X	-	XXXX	-	X	-	1	-	X	-	X
Federal Specification No.	_____		_____		_____		_____		_____		_____		_____
Type	_____												
Size	_____												
Group	_____												
Style	_____												
Class	_____												
Category	_____												

6.8.2 The type of microwave oven units (see 1.2), are identified by a single numerical character (see table II).

TABLE II. Code numbers to type.

Type	Code
I	1
II	2
III	3

6.8.3 The size of the microwave oven units (see 1.2), are identified by a set of four numerical characters (see table III).

TABLE III. Code numbers to size.

Size	Code
600	0600
1200	1200
1800	1800

6.8.4 The groups of microwave oven units (see 1.2), are identified by a numerical character (see table IV).

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TABLE IV. Code numbers to group.

Group	Code
1	1
2	2
3	3

6.8.5 The styles of microwave oven units (see 1.2), are identified by a numerical character (see table V).

TABLE V. Code number to style.

Style	Code
1	1

6.8.6 The classes of microwave oven units (see 1.2), are identified by a numerical character (see table VI).

TABLE VI. Code numbers to class.

Class	Code
1	1
2	2

6.8.7 The categories of microwave oven units (see 1.2), are identified by a numerical character (see table VII).

TABLE VII. Code numbers to category.

Category	Code
1	1
2	2
3	3

6.9 Sampling procedures. Recommended inspection level is II and the AQL is 2.5 percent (see 4.3).

6.10 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

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MIILITARY INTERESTS:

Custodians:

Army - GL
Navy - YD
Air Force - 99

Review Activities:

Army - MD
Navy - SA, SH
Air Force - 84
DLA - GS

User Activities:

Army - CE, TS
Navy - CG, MC, MS

CIVIL AGENCY COORDINATING ACTIVITIES:

VA - OSS
FDA - HHS
GSA - FSS

PREPARING ACTIVITY:

Navy - YD

DOD project 7310-0684

Orders for this publication are to be placed with General Services Administration, acting as an agent for the Superintendent of Documents. See section 2 of this specification to obtain extra copies and other documents referenced herein.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER

S-O-1425B

2. DOCUMENT TITLE

OVENS, MICROWAVE, ELECTRIC

3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION (Mark one)

 VENDOR USER MANUFACTURER OTHER (Specify): _____

b. ADDRESS (Street, City, State, ZIP Code)

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER (Last, First, MI) - Optional

b. WORK TELEPHONE NUMBER (Include Area Code) - Optional

c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional

8. DATE OF SUBMISSION (YYMMDD)

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)