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An American National Standard

Standard Specification for Ovens, Microwave, Electric[1]

This standard is issued under the fixed designation F 1360; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers commercial microwave ovens. These ovens use ultrahigh frequency electromagnetic radiation in the approved industrial, scientific, and medical bands to defrost, heat, and cook food.

1.2 *Limitations*—This specification does not include all types, sizes, groups, styles, and classes of the commodities indicated by the titles of the specification, or that are commercially available, but is intended to cover the types, sizes, groups, styles, and classes that are suitable for general requirements.

1.3 *Oven Selection And Application*— Prior to the use of the classifications given in 4.1, the user agency should ensure they are 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 classifications given in 4.1.

1.4 *Microwave Oven Availability*—Although 4.1 lists a wide range of sizes, classes, groups, and styles for commercial types of ovens, not all combinations are available.

1.5 The values stated in inch-pound units are to be regarded as the standard. The SI units given in parentheses are for information only.

1.6 The following precautionary caveat pertains to the test method portion only, Section 11, of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

A 167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip[2]

A 176 Specification for Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip[2]

A 240 Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels[2]

B 108 Specification for Aluminum-Alloy Permanent Mold Castings[3]

B 209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate[3]

D 3951 Practice for Commercial Packaging[4]

F 760 Specification for Food Service Equipment Manuals[5]

2.2 *ANSI Standards:*

B1.1 Unified Inch Screw Threads (UN and UNR Thread Form)[6]

C62.41 Guide for Surge Voltages in Low Voltage AC-Power Circuits[6]

WD-6 Wiring Devices—Dimensional Requirements[6]

Z1.4 Sampling Procedures and Tables for Inspection by Attributes[6]

2.3 *International Electrotechnical Commission Standard:*

Standard No. 705 Methods for Measuring the Performance of Microwave Ovens for Household and Similar Purposes[6]

2.4 *National Sanitation Foundation Standard:*

Standard No. 4 Commercial Cooking and Hot Food Holding Equipment[7]

2.5 *Underwriters Laboratories Standard:*

Standard No. 923 for Microwave Cooking Appliances[8]

2.6 *Federal Standard:*

FED-STD-123 Marking for Shipment (Civil Agencies)[9]

2.7 *Military Standards:*

MIL-STD-167-1 Mechanical Vibrations of Shipboard Equipment[9]

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[1] This specification is under the jurisdiction of ASTM Committee F-26 on Food Service Equipment and is the direct responsibility of Subcommittee F26.02 on Cooking and Warming Equipment.

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[2] *Annual Book of ASTM Standards*, Vol 01.03.

[3] *Annual Book of ASTM Standards*, Vol 02.02.

[4] *Annual Book of ASTM Standards*, Vol 15.09.

[5] *Annual Book of ASTM Standards*, Vol 15.07.

[6] Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

[7] Available from National Sanitation Foundation, 3475 Plymouth Rd., P.O. Box 1468, Ann Arbor, MI 48106.

[8] Available from Underwriters Laboratories, Inc. 333 Pfingsten Rd., Northbrook, IL 60062.

[9] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

MIL-V-173 Varnish, Moisture-and-Fungus Resistant (For Treatment of Communications, Electronic, and Associated Equipment)[9]

MIL-STD-461 Requirements For The Control of Electromagnetic Interference Emissions and Susceptibility[9]

MIL-STD-462 Measurement of Electromagnetic Interference Characteristics[9]

MIL-STD-1399/300 Interface Standard for Shipboard Systems Section 300A Electric Power, Alternating Current[9]

MIL-E-17555 Electronic and Electrical Equipment, Accessories, and Provisioned Items (Repair Parts): Packaging of[9]

2.8 *Federal Regulations:*

Title 21, Food and Drugs, Subchapter J—Radiological Health[10]

Title 29, Labor, Chapter 17, Occupational Safety and Health Administration, Department of Labor[10]

3. Terminology

3.1 *Descriptions of Terms Specific to This Standard:*

3.1.1 *cavity*—that portion of the microwave cooking appliance in which food may be heated, cooked, or defrosted.

3.1.2 *door*—the moveable barrier that permits access to the cavity for placement or removal of food, and whose function is to prevent emission of microwave energy from the passage or opening that provides access to the cavity.

3.1.3 *interlock*—a device or system, either electrical, mechanical, or electromechanical, that serves to prevent exposure to an electric shock, or physical injury, or excessive radiation emission when a door, cover, or access panel is opened or removed.

3.1.4 *magnetron*—a type of microwave energy generator usually used in microwave cooking appliances.

3.1.5 *microwave oven*—a device that uses ultrahigh frequency electromagnetic radiation in the bands of 915 ± 25 and 2450 ± 50 MHz to prepare food.

3.1.6 *microwave radiation emission*—the microwave energy to which persons might be exposed during operation or user servicing of a microwave cooking appliance.

3.1.7 *viewing screen*—that feature of a microwave appliance, usually part of the door assembly, that is opaque to microwave energy but visually transparent to provide for viewing the oven contents.

4. Classification

4.1 Microwave ovens covered by this specification are classified by types, sizes, groups, styles, and classes as follows:

4.1.1 *Type*:

4.1.1.1 *Type I*—Commercial microwave oven.

4.1.1.2 *Type II*—Combination commercial microwave and convection/radiant heat oven.

4.1.2 *Size*:

4.1.2.1 *Size 600*—600 to 1199 W microwave power output.

4.1.2.2 *Size 1200*—1200 to 1799 W microwave power output.

4.1.2.3 *Size 1800*—1800 and greater watt microwave power output.

4.1.3 *Group*:

4.1.3.1 *Group 1*—0.5 to 0.8 ft^3 (0.014 m^3 to 0.0226 m^3) cooking cavity (minimum cooking cavity dimensions of 7.5 shall be met).

4.1.3.2 *Group 2*—Over 0.8 to 1.2 ft^3 (0.0226 m^3 to 0.034 m^3) cooking cavity.

4.1.3.3 *Group 3*—Over 1.2 to 1.5 ft^3 (0.034 m^3 to 0.042 m^3) cooking cavity.

4.1.3.4 *Group 4*—Over 1.5 ft^3 (0.042 m^3) cooking cavity.

4.1.4 *Style*:

4.1.4.1 *Style 1*—Dial type timer(s).

4.1.4.2 *Style 2*—Digital timer and touchpad controls (computer controlled).

4.1.4.3 *Style 3*—Dial or pushbutton timer(s), or both.

4.1.5 *Class*:

4.1.5.1 *Class 1*—10 to 15 in. (254 to 381 mm) wide cooking cavity.

4.1.5.2 *Class 2*—Over 15 to 18 in. (381 to 457 mm) wide cooking cavity.

4.1.5.3 *Class 3*—Over 18 to 24 in. (457 to 610 mm) wide cooking cavity.

4.1.5.4 *Class 4*—Over 24 in. (610 mm) wide cooking cavity.

5. Ordering Information

5.1 *Ordering Data*—Purchasers shall select the preferred options permitted herein and include the following information in procurement documents:

5.1.1 Title, number, and date of this specification,

5.1.2 Type, size, group, class, and style of oven required (see 1.2 and 4.1),

5.1.3 When oven hardware, fittings, door, cooking cavity, and exterior materials are other than as specified (see 6.2, 6.4, 6.5, and 6.6),

5.1.4 When an automatic oven shutdown is required for vending operation use (see 7.3.2),

5.1.5 When surge voltage protection is required (see 7.4.2),

5.1.6 When an air intake filter is required (see 7.6),

5.1.7 When a heat control is to be provided (see 7.7),

5.1.8 When convection heating capability is to be provided (see 7.7),

5.1.9 When a temperature sensing probe is to be provided (see 7.7),

5.1.10 When an infrared temperature sensing device is to be provided (see 7.7),

5.1.11 When power level controls are to be other than specified, or when selection of microwave power in 10 % increments is offered (see 7.7.2),

5.1.12 Voltage and frequency (Hz) of input power, if other than specified (see 7.8.1),

5.1.13 When the power cord length is other than specified (see 7.8.2),

5.1.14 Treatment and painting, if other than specified (see 7.9),

5.1.15 When windows are required in oven doors (see 7.12),

5.1.16 When a mounting is required for the oven (see 8.1).

[10] Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

5.1.17 When a cavity light for ovens without viewing screens is other than specified (see 8.2),

5.1.18 When the contractor is to have responsibility for, and use facilities other than specified for inspection requirements (see 10.3),

5.1.19 When a first article is required for inspection and approval (see 10.6),

5.1.20 When an oven light is required to be on (see 11.5.2),

5.1.21 Level of preservation and packing required if other than as stated in Practice D 3951 (see 12.1),

5.1.22 When sides of shipping containers are to be marked other than as specified (see 12.2),

5.1.23 When Federal/Military procurements are required, review and implement the applicable supplemental requirements (see S1.1 thru S7.2.3),

5.1.24 When specified in the purchase order or contract, the purchaser shall be furnished certification that samples representing each lot have been either tested or inspected as directed in this specification and the requirements have been met. When specified in the purchase order or contract, a report of the test results shall be furnished.

6. Materials

6.1 *General*—Microwave ovens shall conform to the referenced documents listed in Section 2. Materials used shall be free from defects that would 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 that 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 unless otherwise specified.

6.2 *Hardware and Fittings*—Unless otherwise specified (see 5.1), all hardware and fittings shall be corrosion-resistant or suitably processed to resist corrosion in accordance with the manufacturer's standard practice.

6.3 *Threaded Parts*—All threaded parts shall conform to ANSI B1.1.

6.4 *Cooking Cavity*—Unless otherwise specified (see 5.1), the cooking cavity shall be constructed of Types 302, 304, or 316 corrosion-resistant steel conforming to Specifications A 167 or A 240, or aluminum alloy Type 3003-0 conforming to Specification B 209. The cooking cavity shall be constructed and sealed to prevent spillage from draining into the oven chassis.

6.5 *Door*—Unless otherwise specified (see 5.1), the door shall be constructed of Types 302 or 304 corrosion-resistant steel conforming to Specifications A 167 or A 240. Aluminum alloy Types 356 or 319 conforming to Specification B 108 or Type 6061 aluminum alloy conforming to Specification B 209 may also be used alone or in combination with the corrosion-resisting steel described.

6.6 *Exterior*—Unless otherwise specified (see 5.1), material shall be Types 302, 304, 316 or 430 corrosion-resistant steel conforming to Specification A 240 or to Specifications A 167 or A 176 as applicable, and thickness shall be 20 gage min. (0.0375 in. (1 mm) U.S. revised standard gage).

7. Design, Construction, and Physical Requirements

7.1 *General*—Microwave ovens shall conform to the referenced documents listed in Section 2. The oven shall be delivered assembled with all components necessary to ensure a fully functional product.

7.2 *Microwave Energy Source*—Microwave energy shall be generated using one or more magnetron tubes or any other suitable generating source of microwave energy. Microwave energy 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.

7.2.1 *Warning Label*—A warning marking shall be affixed to the outer case assembly or adjacent to each service access cover and adjacent to one of the fasteners that 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:

7.2.1.1 A warning of high voltage,

7.2.1.2 Power supply must be disconnected before servicing,

7.2.1.3 Access covers must be in place during use, and

7.2.1.4 Servicing should be done only by authorized individuals.

7.2.2 *Microwave Radiation Distribution*— Means shall be provided to maintain uniform distribution of microwave radiation throughout the cooking cavity (see 11.6).

7.2.3 *Door Latch Mechanism*—The mechanical door latch mechanism shall be certified to be operable for no fewer than 10 000 cycles without any visible deformation or inoperation.

7.3 *Magnetron Protection*:

7.3.1 *Reflected Energy*—With the oven empty except for any required tray or sheet furnished by the manufacturer, the oven shall be capable of operation at maximum power output for 1 h or one maximum timer cycle, whichever is shorter, without damage to the magnetron or other oven components.

7.3.2 *Automatic Shutdown*—When specified (see 5.1), the ovens shall automatically shift to a standby condition after a nominal 60 s of nonoperation.

7.3.3 *Thermal Protection*—Means shall be provided to protect the magnetron from damage due to excessive heating. Protective devices shall be automatically resetable, or manually resetable without requiring any disassembly of the oven.

7.4 *Circuit Protection*:

7.4.1 *Excess Current Draw*—The power supply shall be protected against any damage that would occur as a result of an overload (excess amperage) condition. Fuses or resetable circuit breakers shall be used for this purpose, and shall be accessible without disassembly of the oven.

7.4.2 *Surge Voltage Protection*—When specified (see 5.1), protection shall be provided for surge voltages experienced in low-voltage (120 and 240 vac) indoor alternating current

power circuits as defined in ANSI C62.41, paragraphs 5.3 and 5.3.1. Protection shall be provided for oven semiconductor circuits from surge voltages origination from source defined in ANSI C62.41, Section 3, for the waveshape described in 5.3.1, Fig. 2 (0.5 µs − 100 Hz ring wave (open circuit voltage)).

7.5 *Cooking Cavity*—The cooking cavity shall be rectangular in shape with no dimension less than that specified. The cavity construction shall meet NSF Standard 4 requirements as applicable for food contact zones. (Minimum cubic capacity must conform to 4.1.3):

Minimum Cooking Cavity Dimensions

Height (in.)/(mm)	Width (in.)/(mm)	Depth (in.)/(mm)
7.5/(191)	10/(254)	11.5/(292)

7.6 *Ventilation System*—A forced air circulation system shall be provided that will exhaust water vapor and cooking vapors from the cooking cavity. When specified (see 5.1), the ovens shall be furnished with an air intake filter that shall be removable and readily accessible for cleaning or replacement.

7.7 *Controls*—All required oven controls shall be installed on the front of the oven. A main power switch device may be located in a position accessible from the front of the oven. When specified (see 5.1), the following option(s) shall be provided: a heat control function that varies the power level output in the cooking cavity, convection heating capability, an infrared sensing device that automatically senses food temperatures and terminates the cooking cycle when the desired food temperature has been reached, and a temperature sensing probe.

7.7.1 *Timers*—Oven timers shall provide minimum control functions of OFF, timed cooking cycles, and automatic termination of the oven operation after completion of the timing cycle. An audible signal shall sound at the end of the timing cycle or at the end of a cooking cycle. Maximum control graduations shall not exceed 1 s intervals for models with touch pad controls. For models having dial-type timers, maximum control graduations shall not exceed 12 s intervals per graduation marking on the timer control dial. Touch pad timers shall be accurate to ±1 s of selected time. Dial type timers shall be accurate to ± 5 s of selected time.

7.7.1.1 *Dial Type Timers*—Dial type timers shall employ either an electric timing motor as the timing element, or solid-state, electronic timing circuitry for the timing element. When a single dial type timer is provided, the minimum time setting shall be not more than 15 s, and the maximum time setting shall be not less than 5 min.

7.7.1.2 *Digital timer And Touchpad Controls*—Touchpad controls shall utilize electronic solid-state components that 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 the cooking cycle is finished.

7.7.2 *Power Level Control*—Unless otherwise specified, all ovens shall have microwave power level controls that provide for selection of microwave power with a minimum designated “defrost/low,”“ medium,” and “full” power settings. In addition to these settings, Type II ovens shall 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 microwave power in 10 % increments from 10 % of maximum rated output to 100 % of rated output with a designated“ defrost” power setting (see 5.1).

7.7.3 *Indicating Light*—A light shall be installed on the front of the oven that indicates when the oven is operating. When digital display is offered, it functions as a “Power-On” indicator.

7.8 *Electrical Requirements*:

7.8.1 *Input Power*—Unless otherwise specified (see 5.1), the ovens shall be designed to operate on 120 V, or nominal 220 to 240 V, 60 Hz, single-phase, alternating current (ac).

7.8.2 *Power Cord and Connector*—Unless otherwise specified (see 5.1), the power cord length shall be in accordance with UL Standard No. 923, and shall contain conductors and connecting plugs conforming to ANSI WD-6 for the type, size and category of equipment ordered.

7.8.3 *Electric Motors*—All electric motors shall have bearings that require no additional lubrication for the life of the motor.

7.8.4 *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 50 V within 30 s after the power supply is turned off.

7.9 *Treatment and Painting*—Unless otherwise specified (see 5.1), treated and painted components used on the microwave ovens shall comply with the applicable requirements of NSF Standard 4.

7.10 *Steel Fabrication*—The steel used in fabrication shall be free from kinks, sharp bends, and other conditions that 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 ensure uniformity of size and shape.

7.11 *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 oven cavity.

7.12 *Viewing Screen*—Unless otherwise specified (see 5.1), viewing screens are not required on the ovens.

7.13 *Codes and Standards*—The oven(s) shall conform to the requirements of Title 21 Code of Federal Regulations, Subchapter J: Title 29 CFR, Part 18; UL 923; and NSF Standard 4 as applicable unless otherwise specified herein. Acceptable evidence of meeting the requirements of UL 923 and NSF Standard 4 shall be the UL or NSF certification symbol or label affixed to the oven, listing of the equipment by model number and name of manufacturer in the UL or NSF directory of approved equipment respectively, or a certified test

report from a recognized independent testing laboratory, acceptable to the user agency, indicating the oven has been tested and conforms to UL 923 and NSF Standard 4.

8. Performance Requirements

8.1 *Oven*—The cooking surface shall be capable of supporting a load of a 10-psf (0.48 kPa) without permanent deformation of the oven cavity (see 11.1). 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 5.1), ovens shall be provided with a suitable mounting to install the oven in the intended manner.

8.2 *Cooking Cavity Light*—Ovens with viewing screens shall have the cooking cavity illuminated. The light shall automatically activate when the door is opened. It shall also remain lighted while a cooking cycle is in progress. Unless otherwise specified (see 5.1), ovens without viewing screens shall be equipped with an oven cavity light that automatically illuminates when the oven door is opened.

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

8.4 *Microwave Rated Power Output*—When tested in accordance with 11.2, the oven microwave power output shall be within ±10 % of the rated output power as stated by the manufacturer.

8.5 *Operation*—When tested in accordance with 11.3 the ovens shall be capable of not less than 20 h of operation without failure of the major oven functional components including the magnetron, power supply and timer.

9. Workmanship, Finish, and Appearance

9.1 *Bolted Connections*—Bolt holes shall be accurately punched or drilled and shall have the burrs removed in accordance with good commercial practice. Washers or lockwashers shall be provided in accordance with good commercial practice, and all bolts, nuts, and screws shall be tight.

9.2 *Riveted Connections*—Rivet holes shall be accurately punched or drilled and shall have the burrs removed in accordance with good commercial practice. 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.

9.3 *Welding*—Welding procedures shall be in accordance with a nationally recognized welding code. 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.

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

9.5 *Machine Work*—Tolerances for contact and bearing surfaces shall conform to standards prevailing among manufacturers normally producing ovens.

10. Sampling and Inspection

10.1 *Sampling*—Sampling and inspection procedures shall be in accordance with ANSI Z1.4. 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. The inspection level shall be Level II and the Acceptable Quality Level (AQL) shall be 2.5 % defective. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for a complete reinspection. Resubmitted lots shall be reinspected using tightened inspection. If the rejected lot was screened, reinspection shall be limited to the defect causing rejection. If the lot was reprocessed, a reinspection shall be performed for all defects. Rejected lots shall be separated from new lots, and shall be clearly identified as reinspected lots.

10.2 *Examination*—Each oven selected shall be examined for compliance with the requirements specified in Section 7. 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.

10.3 *Responsibility For Inspection*— Unless otherwise specified in the contract or purchase order (see 5.1), the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order (see 5.1), the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the purchaser. The purchaser reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to ensure that supplies and services conform to prescribed requirements.

10.4 *Responsibility For Compliance*— All items must meet all requirements of Sections 6-12. The inspections set forth in this specification shall become a part of the contractor's overall inspection system or quality program. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the purchaser to acceptance of defective material.

10.5 *Classification Of Inspections*— The inspection requirements specified herein are classified as follows: first article inspection (see 10.6); and quality conformance inspection (see 10.7).

10.6 *First Article Inspection*—The first article inspection shall be performed on one microwave oven when a first article is required (see 5.1). This inspection shall include the examination of 10.2 and the tests of 11.1-11.6. 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.

10.7 *Quality Conformance Inspection*— The quality conformance inspection shall include the examination of 10.2 and the tests of 11.4-11.6. This inspection shall be performed on the samples selected in accordance with 10.1.

11. Test Methods

11.1 *Cavity Weight Load Test*:

11.1.1 *Significance*—The purpose of this test method is to determine the load carrying capability of the cooking surface within the oven cooking cavity.

11.1.2 *Procedure*—The cooking surface of the oven cooking cavity shall be subjected to a uniformly distributed load of 10 psf (0.48 kPa). After 2 min, the load shall be removed and the oven cavity examined to determine conformance with 8.1. Nonconformance with 8.1 shall be cause for rejection.

11.2 *Microwave Rated Power Output Test*:

11.2.1 *Significance*—The purpose of this test method is to determine the conformance with 8.4 in testing the microwave power output of the oven as stated by the manufacturer.

11.2.2 *Procedure*—This test method shall be conducted in accordance with the International Electrotechnical Commission (IEC) Publication 705. If required, the test may be repeated to obtain stabilized results. Failure of this test shall be deemed as nonconformance with 8.4, and be cause for rejection.

11.3 *Commercial Microwave Oven Reliability Test*:

11.3.1 *Significance*—The purpose of this test method is to determine conformance with 8.5 for commercial ovens in testing the durability of the major oven functional components.

11.3.2 *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-s interval in which the timer and convective temperature is reset and the water load replenished if necessary. This cycle shall be repeated continuously until 20 h 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.

11.4 *Production Unit Tests*:

11.4.1 *Significance*—The purpose of this test is to determine conformance to the codes and standards cited in 7.13.

11.4.2 *Procedure*—Production units shall be tested in accordance with the contractor's standard procedures to verify conformance to the codes and standards cited in 7.13.

11.5 *Operational Tests*:

11.5.1 *Significance*—The purpose of this test method is to determine operational ability of the oven and its features.

11.5.2 *Procedure*—All ovens selected in accordance with 10.7 shall be operated for not less than 1 min at full power with a suitable load to determine that oven operation is satisfactory. When specified (see 5.1), the light in the oven cooking cavity shall turn on when the door is opened or during the operation of the oven. The light in Type II ovens with viewing screens shall have the front mounted on-off switch checked for 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 s per operation to ensure the timer controls are fully operational. Optional features such as a temperature sensing probe or infrared temperature sensing device, shall be operated for the minimum time necessary to ensure correct operation. The convection controls shall be activated for not less than 30 s to verify proper functioning. Any malfunction including excessive vibration, inoperable fan, or loose parts shall be cause for rejection.

11.6 *Microwave Energy Distribution Test*:

11.6.1 *Significance*—The purpose of this test method is to ensure that the microwave energy is uniformly distributed throughout the cooking cavity.

11.6.2 *Procedure*—The test shall be conducted in accordance with IEC Publication 705. A simple average of all temperatures recorded in the tests 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 ±6°C. Failure of this test shall be deemed nonconformance with 7.2.2 and be cause for rejection.

12. Packaging and Package Marking

12.1 *Preservation And Marking*—Unless otherwise specified (see 5.1), the complete oven shall be packaged and marked in accordance with Practice D 3951.

12.2 *Special Markings*—The sides of each shipping container unless otherwise specified (see 5.1), 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 in. (25 mm) high. In addition, the top panel shall be marked in letters not less than 1 in. (25 mm) high with the following: "THIS SIDE UP"," FRAGILE—HANDLE WITH CARE." The package shall also be marked showing the name of the product, model number, serial number, and manufacturer's name.

13. Manuals

13.1 Manuals shall be in accordance with Specification F 760.

14. Keywords

14.1 food service equipment; microwave; ovens

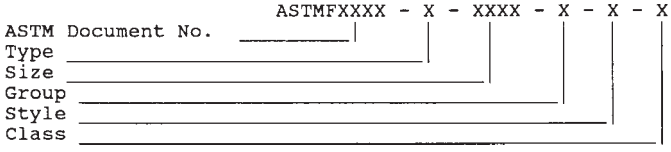

FIG. 1 Suggested Recording Form

SUPPLEMENTARY REQUIREMENTS

S1. These requirements apply only to Federal/Military procurement, not domestic sales or transfers.

S1.1 When specified for shipments to the Department of Defense, (see 5.1), preservation and packing shall be Level A or B in accordance with MIL-E-17555.

S1.2 When specified (see 5.1), shipments to civil agencies shall be marked in accordance with FED-STD-123.

S1.3 When specified (see 5.1), electrical components and circuit elements, including terminal and circuit connections, shall be coated with varnish for fungus resistance conforming to MIL-V-173, except those components and elements inherently inert to fungi, those in hermetically sealed enclosures, and, current-carrying contact surfaces, such as relay contact points.

S2. Part Identifying Number

S2.1 The part identifying number (PIN) that corresponds to the type, size, group, style, and class 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 PIN.

S2.1.1 *Cataloging Data*—For cataloging purposes, the PIN for the units is assigned as follows:

S2.1.1.1 The type of microwave oven units (see 4.1.1) is identified by a single numerical character (see Table 1).

S2.1.1.2 The size of the microwave oven units (see 4.1.2) is identified by a set of four numerical characters (see Table 2).

S2.1.1.3 The groups of microwave oven units (see 4.1.3) is identified by a numerical character (see Table 3).

S2.1.1.4 The styles of microwave oven units (see 4.1.4) is identified by a numerical character (see Table 4).

S2.1.1.5 The classes of microwave oven units (see 4.1.5) is identified by a numerical character (see Table 5).

S3. Electromagnetic Interference (EMI) Control

S3.1 When specified (see 5.1), the ovens shall meet the EMI control requirements and test limits for Class C3, Group I equipment as specified in MIL-STD-461. 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. The purchaser reserves the right to witness 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. Nonconformance with the requirements specified shall constitute failure of the test.

S4. Preparation For Delivery Inspection

S4.1 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 5.1), a first article pack shall be furnished for examination and tested within the time frame required.

TABLE 1 Code Number To Type

Type	Code
I	1
II	2

TABLE 2 Code Numbers To Size

Size	Code
600	0600
1200	1200
1800	1800

TABLE 3 Code Numbers To Group

Group	Code
1	1
2	2
3	3
4	4

TABLE 4 Code Number To Style

Style	Code
1	1
2	2
3	3

TABLE 5 Code Number To Class

Class	Code
1	1
2	2
3	3
4	4

S5. Timer Signal

S5.1 When specified (see 5.1), the end of cooking cycle signal shall repeat with one or more audible tones at 15 s intervals until the oven is opened.

S6. Microwave Radiation Distribution

S6.1 It shall not be necessary to rotate food during the cooking cycle to obtain an even cooking pattern within the food item (see 11.6).

S7. Naval Shipboard Requirements

S7.1 *Marine Use*—Microwave ovens shall conform with the Marine Supplement of UL 923, except as indicated in S7.1.1 through S7.2.3.

S7.1.1 *Power Compatibility*—Unless otherwise specified (see 5.1), Type I, Size 600, ovens shall be compatible with shipboard 60 Hertz, 115 Vac, single phase, alternating current. Type I, Size 1800 requires a 440/208 V transformer with a center tapped secondary winding. Type II, Size 1800 ovens require 440 volt, three phase, three wire ungrounded system in accordance with MIL-STD-1399/300.

S7.1.2 *Environmental Suitability*—Ovens shall be capable of withstanding ship 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 S7.2.3.

S7.1.3 *Access*—Ovens for naval surface vessels shall pass through a 26 in. (660 mm) wide shipboard hatch without major disassembly. Ovens for submarines shall pass through a 25 in. (635 mm) diameter circular hatch without major disassembly. Both physical and visual access must be provided from the front for any tools, test equipment or replacement parts needed for maintenance and repair.

S7.1.4 *Mounting*—Provisions shall be made to mount the ovens 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 ⅜ in. (10 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. Four stainless steel legs shall be provided, 1 in. (25 mm) in diameter and 6 in. (152 mm) long.

S7.1.5 *Inclined Operation*—Ovens shall operate satisfactorily when inclined at an angle of 15°, each side of the vertical in each of two vertical planes at right angles to each other when tested as specified in S7.2.2.

S7.2 *Quality Assurance Provisions:*

S7.2.1 *EMI Control Tests*—When specified (see 5.1), Type I ovens shall be tested by the contractor in accordance with Test Methods CE01, CE03, and RE02 of MIL-STD-462. The first article or the initial production unit, as applicable, shall be tested. The contractor shall furnish written certification that the equipment meets the requirements of MIL-STD-461. Nonconformance with the requirements specified shall constitute failure of the test.

S7.2.2 *Inclined Operational Test*—Position the microwave oven with the base set at an angle of 15°, then operate for 5 min 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 S7.1.5.

S7.2.3 *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. Failure of the microwave oven to perform its function during and after testing shall constitute failure of this test. The government reserves the right to witness/perform all tests of microwave ovens procured for naval shipboard use, whether performed by the supplier or an independent testing agency.

APPENDIX

(Nonmandatory Information)

X1. ADDITIONAL INFORMATION

X1.1 *Type I and II Ovens*—Type I and II ovens are designed for commercial use. These ovens are suitable for continuous operation and hard usage such as that encountered in restaurants and fast-food facilities. Type II ovens are usually designed for commercial use. The convection system circulates heated air to brown, bake, broil and crisp foods. There are numerous combinations of the convection/microwave control functions for obtaining different browning, baking, broiling and crisping capabilities.

X1.2 *Sizes*—The size classification of a microwave oven indicates the rated 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 V), and intended use. For Type I and II ovens, sizes 600 and 1200 are widely used in the commercial market. 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.

X1.3 *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 that can be placed in the oven, since cavity dimensions and geometry vary from one manufacturer to the next.

X1.4 *Styles*—The style of oven indicates the type of cooking timer. In general, dial type timers are the least expensive and normally permit a wide selection of cooking timers. This range varies typically from a minimum setting of 15 s to a maximum setting of 5 to 30 min, depending upon the type of oven and the manufacturer. Microprocessor or touchpad type timers provide the greatest versatility. These timers allow cooking cycles from 1 s to several minutes in 1 s increments. In addition, they commonly have computation and memory capability which permits the user to enter cooking times and heat control settings in the memory of the microprocessor. The microprocessor then automatically controls the cooking process by executing the previously entered commands. Countdown to the end of the cooking cycle is also computed and displayed.

X1.5 *Classes*—The class of the oven indicates the comparative widths of the cooking cavities.

X1.6 *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 restaurant or food service equipment dealers. Some of the more common and

popular options are variable heat or power control functions (see 7.7.2), 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 that are required can be written into the procurement contract as desired.