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Standard Guide for Serving Protocol for Sensory Evaluation of Foods and Beverages¹

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1. Scope

1.1 This guide describes suggested procedures for presenting samples to sensory respondents. The purpose of this guide is to provide general guidelines for developing serving protocols for evaluation of food and beverages, in a central location or laboratory on a variety of foods and beverages, excluding beverage alcohol which is addressed in Guide E1879.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

E253 Terminology Relating to Sensory Evaluation of Materials and Products

E1627 Practice for Sensory Evaluation of Edible Oils and Fats

E1810 Practice for Evaluating Effects of Contaminants on Odor and Taste of Exposed Fish

E1879 Guide for Sensory Evaluation of Beverages Containing Alcohol

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

2.2 IEC Standard:³

IEC 705 Guideline for Power Output Measurement of Consumer Microwave Ovens

3. Summary of Practice

3.1 This guide provides general guidelines and recommendations for presenting samples to respondents for sensory evaluation. Specific situations may require variations to these guidelines.

4. Significance and Use

4.1 Consistency must be maintained in all aspects of preparations and serving of samples to ensure reproducible data from sensory respondents. Guidelines for consistency may change with the test objective.

5. Procedure

5.1 *General Guidelines*—All test conditions and serving procedures are determined by the test objective, test method, test design, and decision risk.

5.1.1 *Pretest*—A practice session may be conducted with a few staff members or respondents to determine if the selected procedures are appropriate for the purposes of the test. For example, serving sizes and containers, carriers, number of samples, time between samples, questionnaire structure, palate cleansers, sample temperature, lighting, etc., may be determined by pretesting.

5.1.2 *Product Variability*—Variability exists in all products. How product variability is handled depends on the objective of the test, the size of the effect one is attempting to detect, and the risks associated with decision making. Unless the test is designed to understand the extent of product variability, the test variables should be controlled to minimize variation of the stimuli to which each respondent is exposed. Variability should, however, not be minimized to the extent where the sample is not representative of typical variability found in the product.

5.1.2.1 Samples should be representative of the product population and must be consistent and uniform regarding all

³ Available from International Microwave Power Institute, 13542 Union Village Circle, Clifton, VA 22024. Phone: (703) 830-5588.

controlled factors (for example, production lot, age, package size, storage conditions, and so forth). A descriptive test might have different requirements than an acceptance or preference test. It is important that all sample preparation and serving procedures be pretested.

5.1.2.2 Consider product variability when preparing samples for a test. Based on the objective of the test and nature of the product, contents of all containers may be blended for a given product prior to portioning individual samples or samples may be portioned from individual containers.

5.1.2.3 Another consideration is the pouring method for products that are not stable emulsions, for example, salad dressings. Each sample should be representative of the product in the way best suited to satisfy the design of the test, for example, salad dressings. Treatments used in an affective flavor test of oil and vinegar salad dressings should be uniformly shaken to mix layers before pouring and tasting samples. Samples for descriptive profile intended to assess separation over time would not be shaken and sampling might be taken from specific positions within the container.

5.1.2.4 Another consideration of product variability is the difference between exposed surfaces and interior surfaces. Some products, for example, peanut butter, mayonnaise, butter, jam, and frozen desserts, may require removal of exposed surfaces prior to evaluation. It may be important, however, to evaluate both exposed and interior surfaces, for example, potentially contaminated fish.

5.1.2.5 Consider a product's exposure to air and the environment. Relative humidity, air circulation, lighting, temperature, contact vibrations, and so forth can all impact the physical nature of a product.

5.1.3 *Serving Containers/Utensils*—The same type of containers and utensils should be used throughout the test. Consider the following when choosing the container/utensil:

- (1) The test objective, for example, a lid may be needed for aroma evaluation,
- (2) Maintaining sample characteristics, for example, size, shape, serving temperature, moisture, etc.,
- (3) Product/container interaction,
- (4) The amount of sample required to complete the evaluation,
- (5) The amount of effort required by respondents to remove the product from the container for evaluation, and
- (6) The neutrality of containers/utensils, for example, neutral in color (unless tint is needed to mask color differences) and made of materials that are inert, nonreactive, and odor-free.

5.1.3.1 Some plastic materials are less inert, more susceptible to temperature changes, and less odor-free than others so they should be pretested prior to their use. Wash, dry, and store glassware in a manner so as to leave no residual material, odors, or flavors. For example: use unscented detergents followed by water rinse, deionized (DI) water rinse, heat drying, and covered storage. Respondents should not be able to draw conclusions about the identity of the samples due to extraneous variables not related to the test objective. It may be possible to mask color differences with light filters, subdued lighting, tinted glassware, or combination thereof.

5.1.4 *Serving Size*—Consider the test objective when determining serving size. Provide enough of the sample to ensure the respondent evaluates the overall product, not just one or two components. The amount and size of the sample must be consistent for each respondent. Scoops, measuring cups, and top loading balances are effective for maintaining consistency.

5.1.4.1 Consider all of the test variables and product characteristics when determining sample preparation and serving protocol, for example, the top crust of bread is different from the bottom crust. Pretesting is helpful to accurately determine the needed serving size. For example, the perceived spice level of a barbecue sauce may be markedly higher on the third or fourth bite than the first, so consider providing enough sauce for evaluation of both the first and third bites. Provide instructions to ensure that the samples are evaluated in a manner that addresses the intended objectives and test design. For example, “place entire sample in mouth,” “be sure your bite includes the crust,” etc.

5.1.4.2 It may be necessary for the respondents to eat an entire serving portion based on the test objective. Respondents should be informed of the quantity they will be required to consume prior to beginning the test. In some case to ensure that respondents comply, require them to finish the portion before completing the evaluation.

5.1.5 *Serving Temperature*—Consider the test objective in determining the sample serving temperature. The serving temperature of all samples must be consistent and within a predetermined range. The serving temperature, however, may be different than the evaluation temperature due to heat gain or loss. For example, a sample that is to be evaluated at 70°C may need to be served at 85°C. Since serving temperatures vary with product type, recommended ranges are provided in 5.4. If no range is provided, ambient temperature is recommended. Maintain the selected temperature range using hot trays, hot boxes, water baths, steam tables, crushed ice, ice water, or other suitable equipment. Ranges larger than those recommended may result in differences due to temperature rather than the test variables. The sample's temperature should not be so hot that the respondent cannot comfortably hold it in one's mouth. The time/temperature combination for holding samples should be selected to ensure the sample is microbiologically safe. It is important to monitor the temperature of the samples throughout serving and evaluation. Preheating serving containers will minimize heat loss. A new sample may need to be provided during a test period to maintain a consistent temperature. Also, consider the effect of temperature loss or gain on a product's moisture content, viscosity, sensory attribute intensity, and other characteristics.

5.1.6 *Cleansers*—May be used before evaluation and between samples.

5.1.6.1 *Palate Cleansers*—May be used before and between samples evaluated by mouth. The palate cleanser should be bland and easily cleared from the mouth or otherwise appropriate to the objectives of the evaluation. The most effective palate cleanser has been shown to be room temperature, water, and time. Bottled or filtered water and unsalted saltine/soda crackers are commonly used cleansers. The temperature of the water can be manipulated to aid in palate cleansing of certain

products, for example, warmed water to clear oily residue products and cold water for hot spicy foods. Other cleansers, such as unflavored yogurt or milk, a salt rinse (0.2 % NaCl in water), or extended rest periods between samples also may be effective. Often, only extended rest periods will sufficiently eliminate the carryover effects of a product. Determine which cleanser or combination of cleaners is best for a product during pretesting.

5.1.6.2 Nasal Cleansers—Should be used before and between samples evaluated by nose. The nasal cleanser needs to be as neutral in odor as possible and easily cleared from the nasal cavity. The best nasal cleansers are also time and rest. Recommendations, however, include sniffing water, the respondent's odor free forearm, the back of the respondent's odor free hand, or an unperfumed napkin.

5.1.7 Carriers—Consider the test objective and nature of the product when determining if a carrier is needed. Carriers most often are used to present products in a form that is more typical of how the product is used or consumed by consumers. In addition, some products may require being evaluated with a carrier, for example, fruit flavors may need to be evaluated in a sucrose/citric acid solution or a soy sauce may need to be evaluated on rice because of its high flavor intensity when evaluated plain. Product and carrier can be combined prior to serving or served separately for the assessor to combine.

5.1.7.1 Several things need to be considered when selecting a carrier. The carrier should be appropriate for the product being tested. This often includes selecting a carrier that represents one of the more common usages of the product, for example, chicken for a BBQ sauce or turkey sandwich for mayonnaise. The carrier should have a neutral influence on the evaluation of the product. The carrier should not mask product attributes critical to the evaluation, distract attention from the product, or exceed/fall short of common consumer expectations for the carrier. For example, iceberg lettuce for a pourable salad dressing evaluation or saltine crackers for a margarine evaluation are neutral, yet similar to common usage, and enable a respondent to focus on evaluating the product sample rather than the carrier. The carrier should be consistent in aroma, flavor, texture, and appearance across all presentations of the samples; any inconsistencies can bias responses to the products themselves. In addition, the same amount of carrier should be used for each sample.

5.1.7.2 It may be difficult to determine whether a carrier is the proper choice for the product evaluation. Testing both with and without the carrier can be used to determine the impact on the samples.

5.1.7.3 Another application of carriers to be considered is as an end-use. For example, it may be appropriate to test cereal with milk added or pancakes with syrup added. Consumer research about how the product is used may help determine if a carrier is appropriate.

5.1.8 Time Intervals—Pretesting will determine how much time is needed to allow a respondent's senses to recover between samples due to nature or flavor, or both, impact including aftertaste linger and temporal profile. For products with low to moderate impact, a 60 second delay between samples is recommended; a longer delay >60 seconds may be

required for products with high impact and linger. When specific time intervals are required, steps need to be taken to ensure that all respondents maintain the same intervals. Timers, stopwatches, or time-delays, which are common on many computerized sensory softwares are recommended. Samples should be presented monadic sequentially, with new samples only being served once the time interval is complete.

5.1.9 Expectoration—Consider the test objective in determining if respondents are allowed to or need to expectorate. Differences in expectoration techniques may affect respondent results. It may be desirable to standardize the technique. Minimally, individual respondents should treat all samples consistently. Provide respondents with an appropriate and sanitary means of expectoration. Sixteen-ounce opaque cups with lids work well, since respondents can place their mouths completely and discretely in the cup opening.

5.1.10 Product Holding/Equilibration Time—Ensure that adequate time between finished products production and evaluation occurs. Some products may change following preparation or when exposed to the environment so it may be important to control the time between sample preparation and serving. For example, bread and meat may dry out, candy may get tacky, soups and sauces may thicken, ice cream may melt, French fries may get soft/limp, etc. Pretest to determine the appropriate holding time and conditions. It may be appropriate to prepare product in batches throughout the testing period.

5.1.11 Test Environment—The testing environment should be quiet and odor-free. Respondents and those serving the samples should keep conversation to a minimum and speak quietly when necessary. Cologne, perfume, aftershave, etc., that may interfere with the evaluation of products, should not be worn by either the serving staff or the respondents (refer to STP 913 (1)).

5.1.12 Number of Samples—Consider respondent fatigue, both physiological and psychological, when determining the number of samples to be evaluated in a test session. The flavor of the samples, number of questions, and length of test session should also be considered.

5.1.13 Marking/Coding of Products and Samples—Ensure the sample labeling method does not contribute odors to the sample. Grease pencils or coded stickers are recommended for marking sample containers. Felt markers or pens may introduce odor.

5.1.14 Sample Randomization/Sample Ordering—The order of taste sampling may influence how a respondent perceives a product. To reduce these types of effects, the serving order can be randomized, balanced, or balanced in blocks.

5.2 Heated Foods Guidelines:

5.2.1 Consistency in the preparation of all samples is important. Use the appliances that is commonly associated with product preparation. When using multiple cooking units, ensure the cooking performance is comparable. It is recommended to acquire multiple units of the same make/model. Special precautions should be taken to avoid cross contamination from volatile aromatics between flavored samples. Cooking units should be routinely calibrated. Most foods should be cooked to a specific internal temperature. Some foods require heating to a specified condition. For example, a pie needs to be

heated long enough to bake the crust. The location in the sample where the temperature will be taken needs to be determined and remain consistent throughout testing. The internal temperature is sometimes lower than surface temperature. Once cooked, foods should be held at a minimum of 57°C for microbiological safety. Determine the effect of holding, or tempering, samples. This effect includes changes in the initial internal temperature, as well as other physical changes. Reheating is not recommended.

5.2.1.1 Many products do not cook uniformly, for example, a crust may form on the top and side surfaces, the outside edges may cook to a higher temperature or become browner than the interior, etc. Prior to the test, determine if only the interior portions will be used or if the entire product will be used. If the entire product is served, care must be taken to ensure that each respondent evaluates similar portions.

5.2.1.2 Several items can be used to maintain the recommended temperature of samples prior to serving and during testing, for example, heated sand, electrical pads/plates, heat lamps, water baths, preheated glass/borosilicate serving containers with lids, steam tables, etc. Equipment should be similar in terms of wattage, energy source, shelf height, etc.

5.2.2 *Microwaves*—It is recommended that the same brand, model, and wattage ovens be used for product preparation (see IEC 705). Microwave ovens vary in their output, even those with the same brand and model. Therefore, ensure microwave ovens and methods maintain consistent heating effects. All microwave ovens should be clean before each sample is placed in them. For preheating, consider placing a microwave safe container with 1000 mL of water in the microwave oven for 10 min on high power. Ice bags or cold towels may be appropriate for cooling microwave ovens.

5.2.2.1 If several microwave ovens will be operating at once, they must be tested/calibrated while all are operating at the same time to be sure they are heating products similarly. Check circuit voltage to ensure uniform power supply conditions, one microwave oven per circuit breaker is recommended. Line voltage may vary throughout the day. Extension cords are not recommended for use with microwave ovens.

5.2.2.2 Place all samples in approximately the same position in the microwave oven. Minimize the effect of hot and cold spots by rotating samples, stirring, and using turn tables. If samples are rotated, schedule the rotation, and rotate all samples similarly. Develop a procedure for maintaining microwave oven temperature throughout the test. Leaving the microwave oven door open a predetermined amount of time between heating samples allows the air in the oven to cool down. It is recommended that samples be similar in weight, size, shape, etc., to ensure even cooking, however, identical cooking time may not achieve the same end temperature. Pretesting the sample cook time is necessary.

5.2.3 *Baked/Broiled*—Standardize and monitor oven temperature throughout the test. Determine the oven temperature cycle and be consistent placing products in the ovens during that cycle. Be consistent in using electric or gas ovens for a test.

5.2.3.1 Use the proper size pans, trays, cookie sheets, etc., to ensure even cooking of the samples. It is better to have fewer

samples in each oven and have them cook evenly on all sides. Allow a minimum of 5 cm between pans and oven walls for proper air circulation. Be sure that the rack is in the same position in all ovens and samples always are placed in the same position.

5.2.3.2 *Toasters, Toaster Ovens, Convection Ovens, and Conventional Ovens*—Heat products differently. Toasters and toaster ovens generally are not recommended as substitutes for conventional ovens. Food service equipment may be appropriate for selected applications.

5.2.4 *Stove Top*—Be consistent in using electric or gas burners for a test. Use uniform burner size, flame size, and heating container. Control for hot spots or variations across cooking surfaces. Heating containers vary in the way they conduct and hold heat. Consider using stainless steel double boilers for maximizing temperature maintenance over time.

5.2.5 *Deep Fried*—Condition fresh oil by heating oil for 1 h at 185 to 190°C. Fry at least two preliminary batches prior to frying samples for evaluation. The recommended free fatty acid level is 1.5 %, but no more than 2 % of the U.S.D.A. maximum for processing plants. Constantly monitor the temperature of the cooking oil during a test. A hanging thermometer is ideal for this purpose. Stir the oil to ensure even heating and to help eliminate hot/cold spots before the food is put into the fryer.

5.2.5.1 When putting food into the fryer, be cautious of ice crystals causing the oil to splatter. As a general guideline, do not fill the container more than $\frac{2}{3}$ full, and maintain a constant level throughout the test. Fry under a hood, if possible, and be aware of fire hazards. Pretest to determine if food will be flipped or stirred during cooking. This ensures even frying.

5.2.5.2 Maintain a constant holding time, determined by pretesting. When holding fried foods that are coated with breading, control for moisture buildup in the food warmer.

5.2.6 *Pan Fried/Grilled*—Monitor the surface temperature in several locations of each frying pan or food service grill using a surface temperature thermometer. Calibrate the temperature dial setting of the appliance for equivalent surface temperature for all sections of the grill or each frying pan. Do not cook samples on hot or cold spots. It is recommended that the same brand and model of frying pan be used for product preparation. Be consistent placing products on cold or preheated surfaces. For products with low moisture or low fat, it may be necessary to preseason the grilling surface with oil to ensure the product does not stick to the cooking surface.

5.2.6.1 If several frying pans will be operating at once, they must be tested/calibrated while all are operating at the same time to be sure they are heating products similarly. Check circuit voltage to ensure uniform power supply conditions. Frying pans need separate circuit breakers.

5.2.6.2 When preparing samples side-by-side on the same cooking unit, take care to keep product variables separated. Construct dividers or use enough distance between product variables so that grease runoff or the product itself does not contact other products. For food service grills, establish protocol to clean and possibly re-season the grill surface between cooking samples.