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Standard Guide for Descriptive Analysis of Shampoo Performance¹

This standard is issued under the fixed designation E2082; 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.

1. Scope

1.1 The objective of this guide is to provide procedures which may be used in the design, execution, and analysis of studies to quantitatively assess the objective sensory attributes of shampoos. This is one of many appropriate techniques used in the hair-care industry. These attributes can then be used to define performance of shampoos and to provide direction in product formulation, research guidance testing, and claim substantiation. This guide includes the sensory properties involved in dispensing a product, as well as the attributes pertinent to shampooing swatches, half and whole heads. Although this guide is specific to shampoos, the procedures should be applicable to most hair-care products.

1.2 Guidelines are provided for the definition of terminology, procedures for manipulation of products, identification/selection of hair type, and assessor training. References for rating scales are not provided in this guide. The user should be aware that some sensory practices may require the use of attribute references (anchors) when training the assessors.

1.3 *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](#)

¹ This guide is under the jurisdiction of ASTM Committee E18 on Sensory Evaluation and is the direct responsibility of Subcommittee E18.07 on Personal Care and Household Evaluation.

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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 ASTM Publications:³

[MNL13 Descriptive Analysis Testing for Sensory Evaluation](#)

[MNL26 Sensory Testing Methods, 2nd Edition](#)

[MNL30 Relating Consumer, Descriptive, and Laboratory Data to Better Understand Consumer Responses](#)

[STP758 Guidelines for the Selection and Training of Sensory Panel Members](#)

2.3 Code of Federal Regulations:⁴

[21 CFR 50.25 Protection of Human Subjects—Elements of Informed Consent](#)

3. Terminology

3.1 Definitions:

3.1.1 Definitions of terms other than those given as follows appear in Terminology [E253](#).

3.2 Definitions:

3.2.1 *cosmetologist*—a licensed, trained professional who has been certified by state or government agencies to apply hair-care products to human heads; these individuals may be alternately described as beauticians, stylists, hairdressers, or cosmetologists.

3.2.2 *subjects*—those individuals recruited to participate in a study for the quality or condition of their hair, to serve as sample carriers.

3.2.3 *trained panel*—a group of assessors who have been formally trained to evaluate the visual and tactile properties of shampoo or hair, using a standard descriptive analysis method which quantifies attributes on a rating scale over a set time period; the number may vary depending on the complexity of the test and the skill of the assessor.

4. Equipment

4.1 The following equipment may be used during the evaluation process:

4.1.1 General:

4.1.1.1 *Light Source*—A consistent light source is recommended for use during evaluation of shine or luster. It is

³ Available from ASTM International Headquarters, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959

⁴ Available from U.S. Government Printing Office, Superintendent of Documents, 732 N. Capitol St., NW, Washington, DC 20401-0001, <http://www.access.gpo.gov>.

important to control the amount of light as well as the angle and distance from the hair.

4.1.1.2 *Water Source*—Temperature and hardness should be consistent. If controlled temperature sinks are used, they should all have the same, consistent flow rate.

4.1.1.3 *Blow Dryer*—Specifications should be documented (that is, wattage, voltage, power level, air velocity, and temperature).

4.1.1.4 *Syringes/Pipettes, Petri Dishes.*

4.1.1.5 *Towels* (cloth or paper, or both).

4.1.1.6 *Combs*—It is recommended that all combs be identical in material and construction (that is, tooth length, thickness, and distance between teeth). They should be appropriately cleaned before each use. For evaluations on subject heads, combs must be sanitized properly prior to use with each test subject.

4.1.1.7 *Thermometer.*

4.1.1.8 *Hygrometer.*

4.1.2 *Additional Equipment for Evaluation on Swatches:*

4.1.2.1 *Hair Swatches* (see Section 8 for preparation procedure).

4.1.3 *Additional Equipment for Evaluation on Subjects (Salon Setting):*

4.1.3.1 *All-purpose Styling Chair.*

4.1.3.2 *Capes.*

4.1.3.3 *Wet/Dry Sanitizers.*

5. Summary of Guide

5.1 This guide provides guidelines for the identification, selection, and training of assessors, using a common procedure, so they may effectively evaluate the sensory attributes of shampoos and the effects of their use on hair. This guide describes the evaluation using hair swatches and subjects (half and whole heads).

5.2 During swatch evaluation, a panel of trained assessors treats hair swatches with the shampoo products, and evaluate the appearance, product pick-up, application, foaming, and wet hair and dry hair attributes of the shampoo.

5.3 Evaluations using live subjects are typically performed in a salon-type setting. In some cases, the services of a licensed cosmetologist may be required by state or local law. Licensed cosmetologists may bring an expanded frame of reference and may be trained as descriptive assessors. Many of the attributes evaluated on subject heads are similar to those evaluated on swatches.

5.4 A comparative overview highlighting the characteristics of shampoo evaluation using swatches and using live subjects is provided in **Table 1**.

6. Significance and Use

6.1 The methods outlined in this guide can be used to qualitatively and quantitatively describe the performance and sensory characteristics of shampoos.

6.2 The methods described in this guide may be used for product formulation and research guidance as well as for quality control.

TABLE 1 Comparative Overview of Shampoo Testing Using Trained Evaluators Swatches Versus Subjects

Swatch	Subject: Half or Whole Head
<p><i>Highly Controlled Testing:</i></p> <ul style="list-style-type: none"> Controlled procedure, limited variability Uniform hair samples (typically commercially blended "virgin" hair) Often may purchase/create desired/target hair types <p><i>Artificial:</i></p> <ul style="list-style-type: none"> Lack scalp/sebum involvement, packing/scalp orientation effects, single hair type represented <p><i>Initial Investment:</i></p> <ul style="list-style-type: none"> Lower capital requirements per station Controlled environment should include controlled lighting, water flow, and individual assessor stations Several approaches available, varying in sophistication and expense Depending on testing volume and scheduling, may require a greater total number of stations <p><i>Initial Training and Maintenance:</i></p> <ul style="list-style-type: none"> Variable, but probably grossly similar for swatch and subject testing <p><i>Lower Cost for Testing:</i></p> <ul style="list-style-type: none"> Assessor fees, consumables (syringes, etc.) Hair reusable over extended periods <p><i>Sample Turn Around:</i></p> <ul style="list-style-type: none"> Rapid testing, high throughput, assessors available as needed — little to no lead time <p><i>Evaluations/Evaluators :</i></p> <ul style="list-style-type: none"> Typically requires fewer total evaluations but more (minimum of 7 to 10) evaluators, usually 2 or more reps/product 	<p><i>Less Controlled:</i></p> <ul style="list-style-type: none"> Controlled procedure but highly variable hair/scalp types and conditions (length, diameter, oiliness, dirtiness, damage, etc.) In special cases, may screen/target specific hair types <p><i>Less Artificial:</i></p> <ul style="list-style-type: none"> Scalp /sebum involvement, packing/whole-head effects, usually incorporates a range of hair types/conditions <p><i>Initial Investment:</i></p> <ul style="list-style-type: none"> Higher capital requirements per station Requires suitable salon-style facilities/stations with controlled lighting, water flow, etc. May require fewer total stations <p><i>Initial Training and Maintenance:</i></p> <ul style="list-style-type: none"> Variable, but probably grossly similar for swatch and subject testing <p><i>Higher Cost for Testing:</i></p> <ul style="list-style-type: none"> In addition to assessors' fees and consumables; there are subject fees, recruiting costs May require services of a licensed cosmetologist for some types of testing <p><i>Sample Turn Around:</i></p> <ul style="list-style-type: none"> Less rapid testing, assessors available, but may require additional lead time for subject recruiting <p><i>Evaluations/Evaluators:</i></p> <ul style="list-style-type: none"> Requires more total evaluations (subjects), but may require fewer trained assessors (see 10.1) Simultaneous descriptive and subject self-assessment possible

6.3 These methods may be used by individuals who familiarize themselves with these procedures and who have previous experience with sensory evaluation.

6.4 Variables that may affect results include, but are not limited to, water conditions (for example, hardness), hair type, and hair condition. These variables should be controlled or accounted for in the experimental design.

6.5 These are suggested procedures and are not intended to exclude alternate methods, which may effectively provide the same or similar results.

7. Trained Panel Selection and Descriptive Training

7.1 The objective is to select and train assessors to evaluate the visual and tactile properties of shampoos on hair swatches using a descriptive analysis method. The selection process should include the principles embodied in ASTM STP758. The task of the assessor is to describe product and hair attributes by rating the perceived quantity and quality of specified attributes.

7.2 Trained Panel Selection:

7.2.1 Assessors may be recruited from within the company, or from the local community. The use of licensed cosmetologists as trained assessors adds an additional qualification to the community recruit.

7.2.2 The choice to use internal employees allows a company to have assessors on site and control proprietary information. It may, however, create potential resource and scheduling conflicts, since panel evaluation will not be the employees' primary job focus.

7.2.3 The use of local community residents allows the company to schedule more panel time per week and may lower the risk of losing assessors. A large pool of potential assessors is usually available.

7.2.3.1 A screening questionnaire is recommended to determine availability, interest, general knowledge of tactile properties, ability to use descriptive words, and ability to use rating scales. This questionnaire is used to eliminate unsuitable candidates. Some questions on the screening questionnaire relate to previous and current employment. Assess if any of these questions conflicts with individual company policy (see [Table 2](#)) It is recommended that the form be approved by the company's human resources department.

7.2.4 With specific training, licensed cosmetologists may represent a special type of descriptively trained assessor. In some states, licensing is required to apply certain hair-care products to live models (subjects). Information concerning the legal requirements for licensing professional cosmetologists may be obtained through the states' Board of Beauty Culture.

7.2.5 Licensed cosmetologists typically will require higher compensation than non-licensed candidates. Since licensed cosmetologists are experienced, they may require a shorter training period. They may also have some preconceived biases.

7.2.6 When cosmetologists are trained as descriptive evaluators, the difference between their traditional role and their role as a trained descriptive evaluator should be carefully explained.

7.3 Recruitment and Screening:

7.3.1 A large group of candidates may be recruited from the local community or from within the company (50 to 70 recommended, with necessarily fewer if licensed cosmetologists are to be used). If candidates are recruited from the local community, recommendations include contacting community groups, placing newspaper ads, and an announcement on the recruiting company's website. If candidates are recruited within the company, interoffice memos or emails, or notices posted on the company's website or bulletin boards are effective.

7.3.2 Prior to completing a screening questionnaire, the time commitment for training (orientation and practice sessions), potential duration of the panel, panel objectives, and assessor commitment should be discussed with each candidate. In addition, in the case of a cosmetologist assessor, the differences between conduct and responsibilities as a trained evaluator and those of a cosmetologist should be emphasized.

7.3.3 A screening questionnaire is recommended (refer to [7.2.3.1](#)).

7.3.4 Select 15 to 20 assessors. This number may vary depending on the complexity of the test and the skill of the assessors. The following criteria may be used as a guideline. Other approaches are described in ASTM MNL13 and ASTM STP758.

7.3.4.1 Screening Questionnaire:

(1) Availability for the complete orientation and 80–100 % of the training practice sessions.

(2) No health-related problems, such as, skin irritations, central nervous system disorders, or medications which might interfere with the central nervous system or reduce skin and muscle activity.

(3) Correct and comprehensive descriptive answers to 75 % or more of the open-ended tactile questions in the screening questionnaire.

(4) Correct rating of 80 % or more of the scaling exercises in the screening questionnaire (see [Figs. 1 and 2](#)).

7.3.4.2 Interview—Each candidate should be interviewed by the panel administrator or trainer to determine attitude, interest, and ability to learn and work in a group situation. The candidate should demonstrate good verbal skills, a high interest in descriptive dynamics, and a cooperative yet confident personality (see [Table 3](#)).

7.4 Trained Panel Orientation/Training:

7.4.1 The panel trainer needs to orient assessors first to the general concepts, such as, the definition, components, and application of descriptive analysis testing. This will take approximately two hours.

7.4.2 Assessors are introduced to the need for strictly controlled sample application procedures and for the careful definition of each sensory attribute. This will take approximately two hours.

7.4.3 A discussion and demonstration of each attribute is conducted at each stage of the evaluation. This establishes the overall structure of the descriptive analysis of hair-care properties. Assessors are encouraged to discuss each term, its definition, the evaluation procedure(s), and the corresponding rating scale after they are demonstrated by the panel trainer. The time involved completing this step depends on the number of attributes selected and the length of discussions. See [Section 9](#) for suggested procedures and attributes.

7.4.4 For each attribute, the procedure, definition, and scale are discussed again in greater depth. Each is demonstrated again with three references when possible. References should represent the full intensity range from none to high. The time involved completing this step will again depend on the number of attributes selected.

TABLE 2 Screening Questionnaire

Name _____ Phone No. _____

Address _____
(city/state) (zip code)

GENERAL:

1. Are you currently employed outside the home? Yes () No () If yes, what hours and days do you work?

2. Are there any weekdays (Monday through Friday) that you are NOT available on a regular basis? Please list the hour(s) and day(s) you are committed: _____

3. Do you have your own transportation? Yes () No ()
4. Do you or any member of your immediate family work for a consumer product manufacturer, a marketing research firm, or advertising company?
 Yes () No ()

HEALTH:

1. Have you ever had an allergic or adverse reaction to a shampoo, hair rinse, soap, or any hair-care or cleanser product? Yes () No () If yes, please describe: _____

2. Do you have any of the following?

	Yes	No
Psoriasis	()	()
Eczema	()	()
Central nervous system disorder	()	()
Unusually cold or warm hands	()	()
Skin rashes	()	()
Calluses on hands/fingers	()	()
Hypersensitive skin	()	()
Tingling in the fingers	()	()

3. List the name of any medications you are currently taking: _____

TOUCH QUIZ: (please answer each question in your own words)

1. What tactile characteristics of a lotion would make you think it is rich? _____

2. What is thicker, an oily or greasy film? _____
3. When you rub an oily film on your skin, how do your fingers move?
 Slip _____ or Drag _____ (check one)
4. What properties make a tissue feel soft? _____

5. How might the appearance of a hand cream influence your perception of the feel of it? _____

6. Name some things that are sticky? _____

7. When your skin feels moist, what other words or properties could describe it? _____

8. Name some things that are rough: _____
 What makes them rough? _____
9. Briefly, how would you define absorbent in a lotion? _____

10. What properties make a deodorant feel sticky? _____

SCALING EXERCISE

INSTRUCTIONS: LOOK AT THE FIGURE ON THE LEFT. DETERMINE THE AMOUNT THAT IS SHADED. PLACE A MARK ON THE SCALE AT THE RIGHT TO INDICATE THE PROPORTION OF THE AREA THAT IS SHADED.

EXAMPLE:

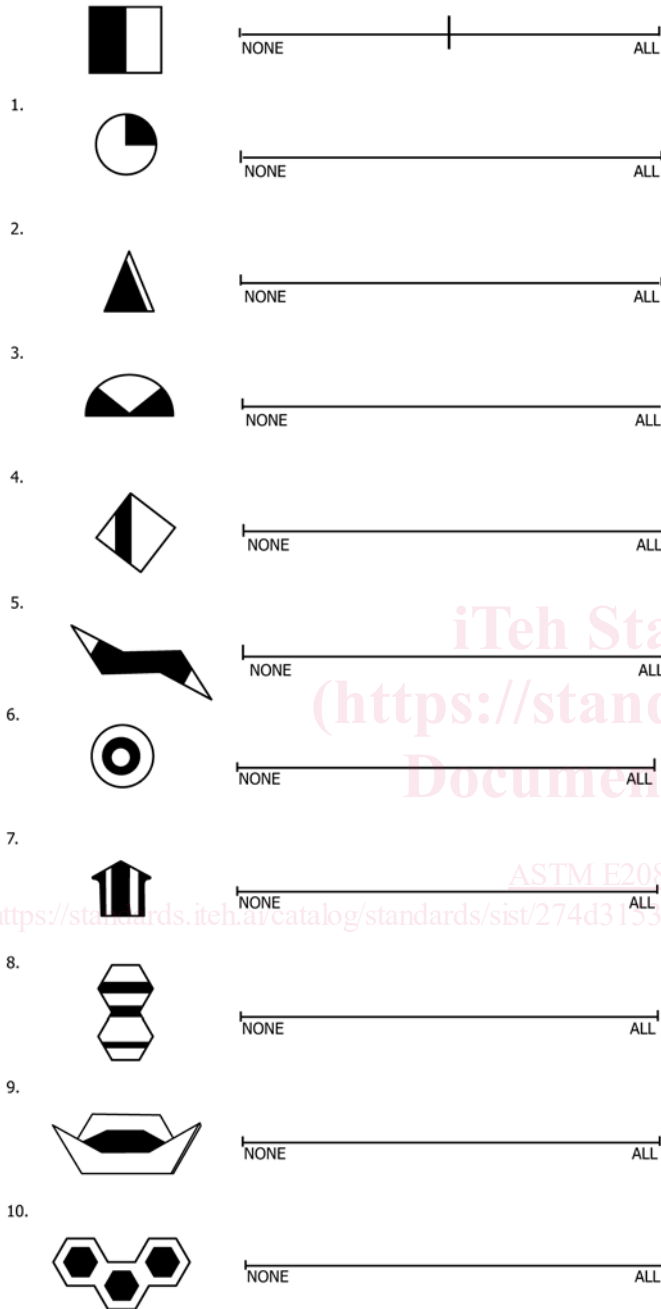


FIG. 1 Scaling Exercise

SCALING EXERCISE

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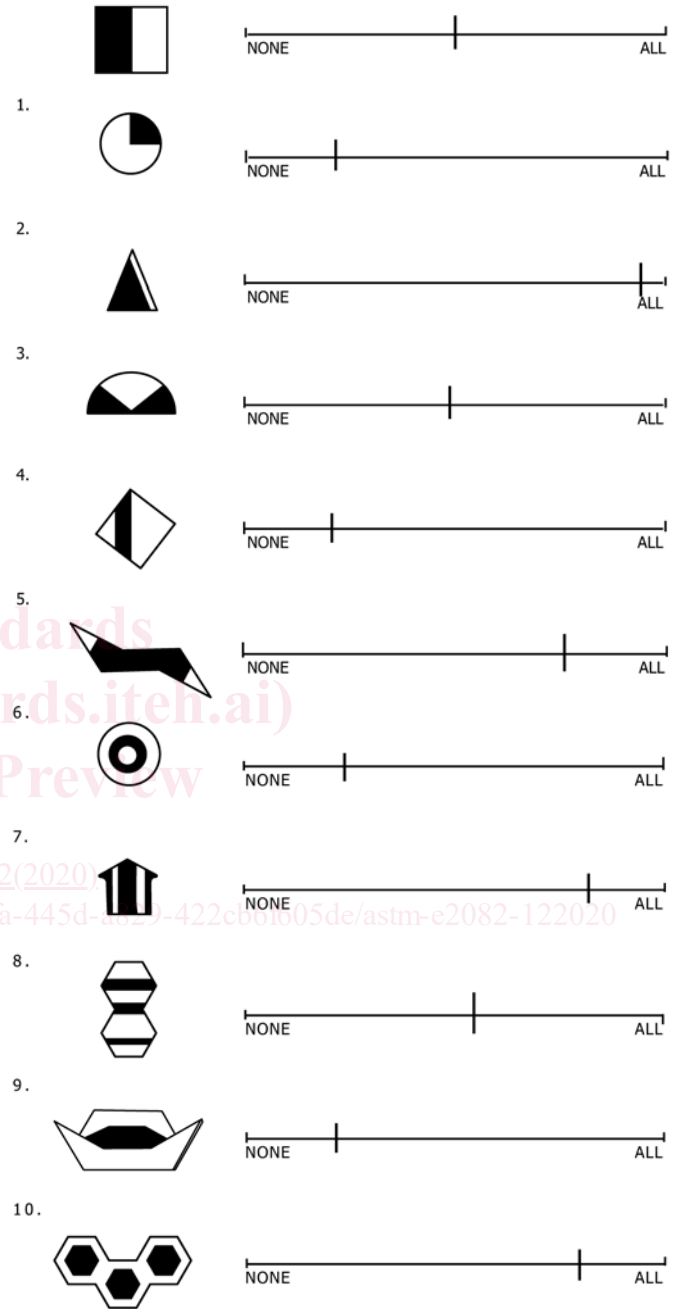


FIG. 2 Key for Scaling Exercise

7.4.5 The attributes (characteristics) and procedures identified in this guide are suggested (see Section 9). Additional attributes may be observed, identified, and evaluated by different panels. Individual panels may choose to rename the attributes.

7.5 Trained Panel Practice:

7.5.1 Several practice sessions totaling at least 20 to 24 h should be conducted to review the orientation material. These sessions should include reviewing the procedure, definition and rating scale for each attribute, and the evaluation of one or two products using the scale references.

7.5.2 During the practice sessions, five to six pairs of samples should be evaluated on all attributes for each stage.

TABLE 3 Interview Questionnaire

Name _____ Date _____

1. Are you comfortable working in a group situation?

2. How do you feel about voicing your opinion?

3. How do you feel about opinionated people?

4. How do you feel about committing your time to a training program?

5. Are you interested in being an assessor?

6. Do you have any questions for me?

Comments _____

Accepted: YES NO

The initial pairs of samples should be very different from each other. This will take from ten to twelve hours.

7.6 Trained Panel Validation:

7.6.1 If possible, correlate results from a recently trained panel to results from an established panel. Otherwise, panel performance can be validated by comparing the results of replicate evaluations. For this purpose, each test material should be presented a minimum of three times.

7.6.2 Alternate methods of validation may be suitable. Refer to ASTM MNL30, ASTM MNL26, ASTM MNL13, or ASTM STP758, or combination thereof, for a more detailed discussion on panel validation.

7.7 Trained Panel Monitoring—Several different aspects can be monitored when reviewing panel and assessors’ data.

7.7.1 A measure of the variability among the assessors can be determined with three replications of three samples for all attributes and all assessors. This permits the panel leader to determine if one or more assessor is (1) rating consistently higher or lower than the panel as a whole on one or more attributes, (2) rating all products consistently the same, (3) rating over a larger or smaller range than other assessors, or (4) rating products as opposite in intensity to the rest of the panel. If inconsistency is noted, a review of definitions, evaluation procedure, or reference standards, or combination thereof, are recommended.

7.7.2 A measure of the reproducibility of the panel as a whole can be monitored by analyzing three replications of the panel’s evaluation of two or three samples of the same product type. Each attribute should be examined.

7.7.3 Refer to ASTM MNL26 for more detailed information on statistical procedures for sensory evaluation.

8. Preparation Procedures for Using Hair Swatches

8.1 These procedures are designed for the evaluation of shampoos on hair swatches and can be used with a trained panel or a cosmetologist, or both.

8.2 Swatches should be from the same bundle or lot number, and should be checked for uniformity and quality.

8.3 Hair swatches should be mounted to a tab or other fastening device. The hair should be cut to the same length, approximately 15 to 25 cm. Depending on the test, the hair should be washed with either a standard non-conditioning shampoo or detergent solution (for example, 5 % TEA lauryl sulfate or 15 % sodium lauryl sulfate). The swatches should be dried at room temperature. Preparation of the swatches should include orientation of the hair in the same direction (root to tip) to avoid swatch to swatch differences from frictional effects created by the cuticle scales during combing.

8.4 The hair swatches should be preconditioned prior to use. This would require storing the swatches in an area in which the temperature and humidity are controlled (and recorded) until equilibration.

8.5 Prior to evaluation, assessors should wash their hands with a 5 % aqueous solution of a surfactant such as TEA lauryl sulfate in a standard manner at the test facility. Immediately following, hands should be rinsed with tepid tap water and dried thoroughly with absorbent paper towels.

8.6 The temperature level and if possible, the relative humidity of the panel room should be maintained at a constant comfortable level. Room lighting should be consistent for each assessor and remain standard within a given test.

8.7 For each evaluation, the panel leader should dispense a uniform amount, such as 1.0 mL, of the shampoo sample from a syringe or repeater pipette. Presentation of samples should be balanced and blinded. Syringes or pipettes should be loaded immediately prior to their use.

9. Evaluation Procedures for Use With Hair Swatches

9.1 *Appearance Characteristics*—Panel trainer dispenses a circle (2 cm in diameter) of each shampoo onto a petri dish for the evaluator(s) to observe. Products should be packaged and

dispensed from the same type of container or dispenser, such as a syringe or repeater pipette. The amount dispensed should be controlled as well as the speed or force with which it is dispensed. The distance and angle from dispense to the dish surface should be controlled. Evaluate for visual firmness, integrity of shape, intensity of color, brightness of color, transparency, gloss, and pearlescence.

Visual firmness (immediate)	degree to which the product mounds, not spreads, as it is dispensed onto the dish (soft/liquid.....firm)
Integrity of shape (10-15 s)	degree to which the product holds its original shape in the dish (This is related to visual firmness, however, integrity of shape provides information on the effect of time.) (none/loses shape.....high/maintains shape)
Intensity of color	strength of color from light to dark (light.....dark)
Brightness of color	chroma (or purity) of the color, ranging from dull, muddled to pure, bright color (for example, fire engine red is brighter than burgundy) (dull.....bright)
Transparency	degree to which light passes through the sample or product (opaque.....clear/transparent)
Gloss	degree to which the sample reflects light (none.....high)
Pearlescence	degree of mother of pearl-like or opalescent character (none.....high)

9.2 Pickup Characteristics—The panel leader delivers a controlled amount of product to the thumb of each evaluator. The evaluator compresses the product between the thumb and forefinger three times, opening and closing fingers to a predetermined distance. The tempo or speed should be controlled. Evaluate for firmness, stickiness, and stringiness.

Firmness	force required to compress the product between the fingers (low.....high/firm)
Stickiness	force required to separate the fingers (low.....high/stringy)
Stringiness	amount the product strings or stays connected when the fingers are separated. (low.....high/stringy)

9.3 Application and Foam Characteristics—A standard amount of product is dispensed onto a wet hair swatch. The procedure for wetting the swatch and the placement of the product on the swatch should be uniform. The evaluator should use a standard procedure for spreading the product, handling the swatch, and manipulating the subsequent foam. Evaluate for ease of spreading, speed to foam, amount of foam, cushion of foam, bubble size, and wetness of foam. Rinse product from fingers for predetermined number of seconds under running water. Rinse swatch and evaluate for ease of rinsing.

Ease of spreading	ease of distributing the product evenly over the surface of the hair prior to generating the foam (not easy/difficult.....easy)
Speed to foam	measure of the time or degree of manipulation required to generate foam (slow.....fast)
Amount of foam	assessment of the volume of foam after each of several points (none.....high)
Cushion of foam	measure of the force to compress the foam between the thumb and forefinger (none.....high)
Wetness of foam	amount of moisture perceived in the foam mass (dry.....wet)
Bubble size	visual size of the majority of bubbles (small.....large)

Ease of rinsing time to rinse product out of swatch under controlled conditions (water pressure and temperature)
(record time or count_____)

9.4 Wet Hair Characteristics—The hair swatch should be towel dried to remove excess water. Using a standard comb, hold hair swatch at the top in one hand, with opposite hand comb from the top of the hair swatch down to the end of the swatch. Evaluate for ease of detangling and force to comb. Hold wet hair swatch loosely in a closed fist, rub hair between thumb and index finger in a downward motion. Evaluate for wet feel/slipperiness and residue.

Ease of detangling	ease of removing the tangles from the hair swatch (not easy/difficult.....easy)
Force to comb	force applied to the comb to move it through the hair swatch. Apply and measure only the minimum and necessary force. (none.....high)
Wet feel/Slipperiness	presence or absence of resistance when moving the fingers down the hair between the thumb and forefinger (drag.....slip)
Residue (greasy/oily/waxy/Silicone)	total amount of all residues left on hair (tactile sensation). The individual types of residues may be identified and quantified. (none.....high)

9.5 Dry Hair Characteristics—Dry swatch in a standard, controlled manner (for example, hanging in a hood dryer or using a hand-held blow dryer). The same drying procedure should be used by each evaluator. Hold the dry swatch at the top in one hand. With the opposite hand hold the comb by the end. Comb the hair swatch starting at the top and moving down. Evaluate for ease of detangling and force to comb. Hold dry swatch loosely in a closed fist, rub hair between thumb and index finger in a downward motion. Evaluate for dry feel/slipperiness, residue and pliability. Continue to comb in a vigorous manner. Evaluate for static. (For static evaluation, specify either the number of strokes or amount of time to comb.)

Ease of detangling	(same as for wet hair characteristics)
Force to comb	(same as for wet hair characteristics) However, the hair is evaluated in sections (for example, middle section, ends).
Dry feel/slipperiness	(same as for wet hair characteristics)
Residue	(same as for wet hair characteristics)
Pliability	measure of the force required to bend the hair, not stiff or rigid (low.....high)
Static	degree that the individual hair shafts repel each other (none.....high)

10. Evaluation of Half and Whole Heads/Subject Selection

10.1 Due to the large amount of variation from subject to subject, a minimum of 20 subjects is usually required. This is highly dependent on the study objective, the number of evaluators, and other practical constraints.

10.2 Subjects may be recruited from within a company or from the local community.

10.3 Subjects, those individuals who will serve as sample carriers, should be selected based on the objective of the test or target population of the product (for example, age, gender, hair type), or both.

10.4 Based on the objective of the study inclusion or exclusion, or both, criteria may be selected from the suggested