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Standard Consumer Safety Specification for Slip-Resistant Bathing Facilities[1]

This standard is issued under the fixed designation F462; 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.

INTRODUCTION

This consumer safety specification addresses the bathtub and shower accidents that are due in whole or in part to the slipperiness of the bathing surface.

In response to the accident analysis and assignment of causes developed and identified for the U.S. Consumer Product Safety Commission by the Abt Associates, Inc., final report, "A Systematic Program to Reduce the Incidence and Severity of Bathtub and Shower Area Injuries," June 4, 1975,[2] this consumer safety specification provides a means to reduce accidents in bath and shower units caused directly or indirectly by the slipperiness of the bathing surface.[3]

It is not possible to cover, in this consumer safety specification, bath and shower units that are used in a manner for which they were never intended. Furthermore, children do not always act prudently, and the motions of the elderly and infirm are not always under complete control. These problems will be covered in a consumer-education-type publication, designed to describe the hazards of the bathing area, and suggestions concerning bather's conduct to reduce these hazards.

This consumer safety specification is written within the current state of the art of bath and shower technology.

1. Scope

1.1 This consumer safety specification covers the slip resistance of bathtubs and shower structures or combinations, used for bathing or showering, or both, herein referred to as bathing facilities.

1.2 This specification establishes definitions, methods of testing the slip resistance of bathing facilities, and the in-use performance requirements needed to minimize the accidents caused by slipperiness during any reasonable use.

1.3 This consumer safety specification is intended to describe a means to reduce accidents to persons, especially children and the aged, resulting from the use of bathing facilities.

1.4 The following safety hazards caveat pertains only to the test method portion, Section 8, 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:*[4]

D459 Terminology Relating to Soaps and Other Detergents

D799 Specification for Liquid Toilet Soap (Withdrawn 2000)[5]

2.2 *Federal Specification:*[6]

PS-624g Soap, Toilet, Liquid and Paste

3. Terminology

3.1 *Definitions:*

3.1.1 *applique*—a material affixed to the bathing surface or sump of a bathtub or shower for the purpose of increasing its slip resistance.

[1] This specification is under the jurisdiction of ASTM Committee F15 on Consumer Products and is the direct responsibility of Subcommittee F15.03 on Safety Standards for Bathtub and Shower Structures.

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[2] Available from U.S. Consumer Product Safety Commission (CPSC), 4330 East West Hwy., Bethesda, MD 20814, http://www.cpsc.gov.

[3] "Performance Characteristics of Sanitary Plumbing Fixtures," available from U.S. Consumer Product Safety Commission.[2]

[4] 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.

[5] The last approved version of this historical standard is referenced on www.astm.org.

[6] Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, http://www.dodssp.daps.mil.

3.1.2 *bathing*—the act of subjecting all, a substantial part, or a specified part of the body to the action of water in a bathing facility, with or without soap or bath oil, for purposes of health or cleansing.

3.1.3 *bathing facility*—a bathtub, shower structure, or a combination of a bathtub and shower, designed to restrict or contain the flow of water, or both, usually for the bathing use of one adult or one child at a time.

3.1.4 *bathing surface*—the portion of the sump of a bathing facility on which, by either common usage or design, a bather might be expected to step, stand, sit, or come in contact with while bathing or showering.

3.1.5 *bath oil*—a functional (emollient) or nonfunctional (cosmetic) formulation in the form of a liquid (clear or opaque), oil or nonoil, spray, powder, or encapsulated liquid.

3.1.6 *coefficient of friction*—the ratio of the frictional force to the force, usually gravitational, acting perpendicular to the two surfaces in contact. This coefficient is a measure of the relative difficulty with which the surface of one material willslide over a surface adjoining itself, or of another material. The static or starting coefficient of friction is related to the force measured to begin movement of the surfaces relative to each other. The kinetic or sliding coefficient of friction is related to the force measured in sustaining this movement.

3.1.7 *dam*—a horizontal elevated surface that must be traversed to enter a tub or shower structure, or a combination of both. Relative terms are "rim" for tubs and combination tub/showers, and "threshold" for shower structures.

3.1.8 *friction*—the resisting force that arises when a surface of one substance slides, or tends to slide, against a surface adjoining itself or another substance. Between surfaces of solids in contact there may be two kinds of friction: (*1*) *static friction*—the resistance opposing the force required to start to move one surface on or over another; and (*2*) *dynamic friction*—the resistance opposing the force required to move one surface on or over another at a variable, fixed, or predetermined speed.

3.1.9 *retrofit*—a component used to replace similar worn or expended parts of a manufactured product; a component that is employed to modify a finished product in order to alter its functional character.

3.1.10 *soap*—the product formed by the saponification or neutralization of fats, oils, waxes, rosins, or their acids, with organic or inorganic bases.

3.1.11 *slip resistance*—the property of a bathing surface that acts in opposition to those forces and movements exerted by a bather under all conditions of bathing or showering that can result in uncontrolled sliding; it is directly proportional to the coefficient of friction.

3.1.12 *slipperiness*—the property of a surface that indicates the degree of which uncontrolled sliding (of portions of the body) may occur.

3.1.13 *smooth surface*—a surface that is not textured.

3.1.14 *sump*—the portion of a bathing facility intended for the collection of water, as limited by the height of the dam.

3.1.15 *textured surface*—a bathing surface that contains elevations or depressions, or both, or that incorporates a second material for the purpose of improving the slip resistance of the surface.

3.1.16 *water (pure)*— the liquid that consists of an oxide of hydrogen of the ratio one atom of oxygen to two atoms of hydrogen.

4. Compliance

4.1 No bathing facility shall either by label or other means indicate compliance with this specification unless it conforms to all requirements contained herein.

4.2 No product intended to be used as a slip-resistant retrofit item to a bathing facility shall either by label or other means indicate compliance with this specification unless it conforms to all requirements contained herein.

4.3 If a bathing facility is intended to be retrofitted, treated, etc., to provide slip resistance after installation, there must be an indication, by label or other means, that the unit will not be in compliance unless the surface is treated with the approved material(s) provided, in accordance with manufacturer's installation instructions.

5. Requirements

5.1 The slip-resistant requirements specified herein are designed to reduce the probability of falls due to slipping.

5.2 For any surface that is textured or treated with appliques, the pattern shall be such that a 1½ by 3-in. (38.1 by 76.2-mm) rectangular template placed anywhere on the bathing surface shall cover some textured or treated area.

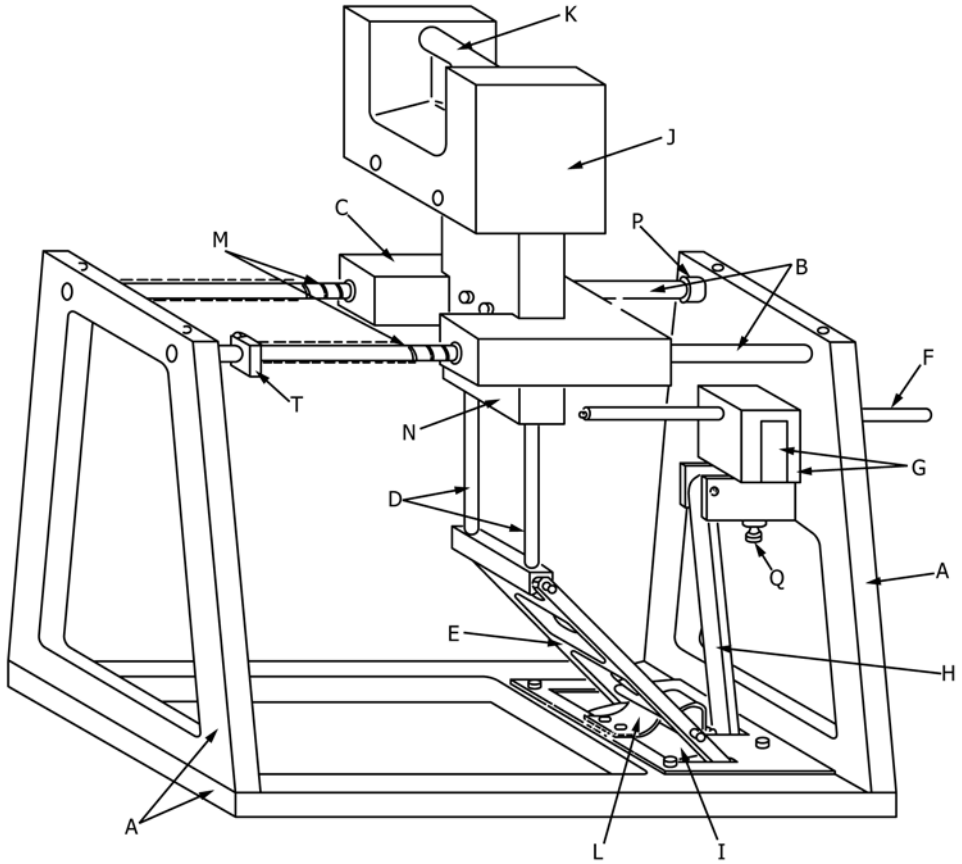
5.3 The slip resistance of the bathing surface shall remain at or above the level required by this specification during the life of the manufacturer's guarantee, using cleaning methods recommended by the manufacturer.

NOTE 1—It is emphasized that this specification was written within the state of the art existing in early 1976. It is intended that a section dealing with durability will replace 5.3 at the time of the next revision of this specification.

5.4 Any nonintegral slip-resistant material applied to a sump or bathing surface shall be removable without harm to the bathing surface.

5.5 All slip-resistant surfaces shall withstand, without marked deterioration, the action of normal bathing soaps, bath oils, body oils, and dirt normally encountered in bathing and showering.

5.6 *Characteristics of the Slip-Resistant Surface*—This consumer safety specification provides for nine pairs of measurements (see 9.1.1) distributed over that portion of the bathing surface upon which measurements can be made as a basis for determining compliance. These measurements are assumed characteristic of the entire bathing surface. In order to make this assumption valid, the entire bathing surface is required to have the same characteristics as the region chosen for slip-resistance measurements. Conformance with this requirement is determined by visual inspection and consideration of the quality control methods applied to the manufacturing process.



A	Main frame	K	Handle
B	Travel bars	L	Retainer plate
C	Carriage	M	Control springs
D	Vertical shaft	N	Adjustable attraction screw for magnet
E	Articulated strut	O	Sensor facing clip (not shown)
F	Recording shaft with magnet	P	Initial position stop
G	Recorder clamp	Q	Trigger adjustment screw
H	Trigger	R	Adjustable trigger stop (not shown)
I	Sensor shoe	S	Indicator tube for recording shaft (not shown)
J	Weight	T	Adjustable collar

FIG. 1 NIST-Brungraber Tester

6. Instructions for the Operation of the NIST-Brungraber Portable Slip-Resistance Tester

6.1 *Principles of Operation:*

6.1.1 The NIST-Brungraber portable slip-resistance tester[7] is designed to measure the static coefficient of friction between a representative foot surface and a surface for walking or standing under true field conditions (see Fig. 1). It does this by applying a predetermined vertical force (the weight) through vertical shafts and an articulated shaft to the sensor shoe.

6.1.2 At the start of a test, the carriage is brought forward to a stop position such that the articulated shaft is not vertical but set at a slight angle towards the back of the tester. (This is accomplished by either introducing an initial position stop at the front of the carriage or by using the tester in an "uphill" mode on a surface inclined to an angle of at least 1°.) This established an unbalanced lateral force against the carriage. At the instant that the handle is released and the vertical load is applied, the carriage begins to move back along the travel bars, inducing an increasing lateral load on the shoe as the angle between the articulated shaft and the vertical shaft increases. The tangent of this angle at the moment that slip occurs is directly related to the static coefficient of friction. This angle is measured by the recording shaft, which is magnetized and drawn along by attachment of the attraction plate as the carriage moves backwards. When slip occurs, the sensor shoe hits the trigger so that the recorder clamp grips the recording shaft, retaining the shaft in the position assumed at the time of slip. The measurement of slip resistance is read opposite a notch in the indicator tube at the front of the recorder clamp from a linear-graduated scale imprinted along the length of the

[7] "A New Portable Tester for the Evaluation of the Slip Resistance of Walking Surfaces," *NIST Technical Note 953,* National Institute of Standards and Technology, Washington, DC 20207.

recorder shaft. This value can be directly translated to the static coefficient of friction by use of the calibration chart or table supplied with the tester.

6.1.3 The motion of the carriage is controlled by the springs. The retaining plate keeps the shoe in position while the tester is being lifted and moved to a new test location.

6.1.4 When evaluating surfaces with low values of coefficient of friction, such as soapy bathing surfaces, the initial position stop (a short section of plastic tubing that is on the front end of one of the travel rods) should be removed. This permits the tester to start in the position corresponding to a zero value of coefficient of friction and requires that the carriage be given a slight initial push immediately after the handle is released, unless the test is conducted "uphill" on a surface inclined to at least 1°. For best results and to reduce operator error as much as possible, tests on bathing surfaces should be conducted in the "uphill" mode whenever possible, since in this mode the tester is self-actuating.

6.1.5 Tests on soapy surfaces should never be conducted in the "downhill" position as this will cause a premature forward motion of the shoe and the tester will not function. Also, when conducting tests on soapy surfaces, the tester should be restrained from slipping by holding firmly with the hand that is not being used to operate it.

6.2 *Operation of the Tester*—For a detailed step-by-step procedure on the NIST-Brungraber Tester, refer to Annex A1.

6.3 *Calibration of Tester:*

6.3.1 The scale on the NIST-Brungraber Tester is graduated in tenths of an inch (or 2.5 mm). The value read from this scale can be used directly in comparing the relative slip resistance of materials, or the corresponding value of static coefficient of friction can be determined from a calibration chart or table supplied with the tester.

6.3.2 Calibration of the NIST-Brungraber Tester is effected by comparison with standard weights or standard springs that are applied in such a manner as to provide a precisely controlled, simulated friction force. Calibration with weights is done by installing a low-friction pulley at the rear of the tester, replacing the sensor shoe with a low-friction linear ball bearing,[8] and placing the tester on a carefully leveled sheet of plate glass. A string and bridle arrangement attached to the shoe, passing over the pulley and aligned horizontally, permits the simulation of a well-defined friction force by attaching standard weights to the string. The weight on the string (the drag force of the linear ball bearings is negligibly small, but has been determined and included) divided by the total of the weights on the articulated shaft, including the weight of the shaft, shoe, sensor, etc., is the simulated coefficient of friction. This is compared with readings from the tester for a series of different loads on the string. The results are presented in the form of a calibration chart or table. Calibration with standard springs is carried out in essentially the same manner, except that the well-defined friction force is established with a selection of calibrated springs that are stretched between the low-friction linear ball bearing shoe and the rear of the tester frame.

6.3.3 The two existing models of the NIST-Brungraber Tester have been calibrated repeatedly, in the horizontal position as well as tilted laterally as much as 4°. The results to date indicate that the calibration is essentially the same for both testers and is not affected by lateral tilts of up to 4°.

6.3.4 The testers have also been calibrated after being modified or adjusted to permit the evaluation of sloping surfaces. When testing surfaces that slope upwards in the direction of test, adjust the collars for the control springs to prevent excessive speed of travel of the tester carriage. For surfaces inclined up to as much as 4°, if the tester is adjusted as described to permit full travel of the carriage without an excessive jolt at the end of travel, satisfactory calibrations are obtained.

7. Test Specimens

7.1 *Description*—The test specimen shall consist of the bathing surface.

7.2 *Leveling*—Bathing facilities are normally tested in the installed condition. After leveling, the bathing surfaces will have the same slopes encountered under normal bathing conditions and test measurements taken on these slopes are more indicative of the slip situation existing during bathing.

7.3 *Marking for Slip-Resistance Measurements:*

7.3.1 *Determining the Measurement Area*— The measurement area is that portion of the bathing surface which can be measured by the 1½ by 3-in. (38.1 by 76.2-mm) sensor of the NIST-Brungraber Tester after the bathing facility has been leveled. Establish the measurement area experimentally by placing the tester at all possible locations around the perimeter of the bathing surface and marking the portions of the surface that can be reached by the sensor when the tester is used in the "uphill" mode. As an example of how the measurement area can be established, the following instructions apply to the standard 5-ft (1.5-m) tub.

7.3.1.1 Place the NIST-Brungraber Tester in the bathtub as close as possible to the drain end, with the sensor end towards the rear (uphill) and the side of the tester as close as possible to the far side of the tub. Note and mark the location of the sensor. Call this location Point 1.

7.3.1.2 Move the tester along the far wall and as close to the rear wall as possible. Note and mark the location of the sensor. Call this location Point 2.

7.3.1.3 In a similar manner, locate Points 3 and 4. Then connect Points 1, 2, 3, and 4. This establishes the measurement area. (See Fig. 2 for an illustration of a tub with testers in positions 1, 2, 3, and 4 and Fig. 3 for the measurement area and measurement zones.)

7.3.2 *Establishing the Measurement Zones:*

7.3.2.1 Divide the measurement area into nine approximately equal areas. These are measurement zones.

7.3.2.2 Suitably identify these zones using any convenient system that does not affect the slip resistance of the surface and number them as shown in Fig. 3.

[8] A unit available from Turnomat, Inc., Rochester, NY or equivalent, has been found satisfactory for this purpose.

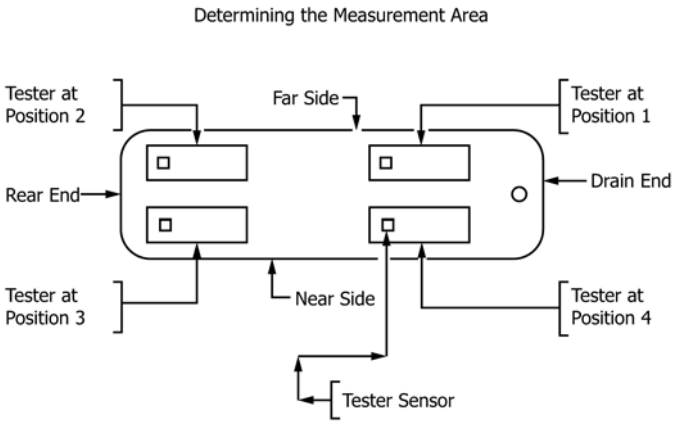
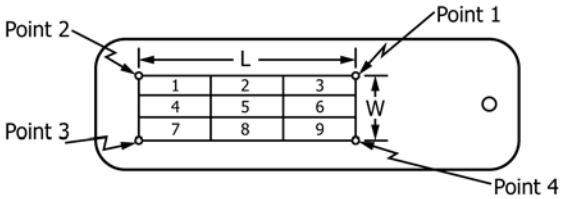


FIG. 2 Tub with Testers in Positions 1, 2, 3, and 4



Measurement Area = Area L × W
Measurement Zones = Areas Marked 1 through 9

FIG. 3 Measurement Area and Measurement Zones

8. Test Method

8.1 This method is designed to determine the slip resistance of a bathing surface by measuring its static coefficient of friction with an NIST-Brungraber Tester.

8.2 *Preparation for Testing*—Prepare the reference or bathing surface for testing as follows:

8.2.1 Thoroughly clean and rinse the surface with alcohol or other cleaning agents so that there is no residue left on the surface.

8.2.2 Support the tub or shower base so that the spatial orientation of the bathing surface will be as if the unit were properly installed in a bathroom.

8.2.3 Plug the drain and introduce sufficient liquid soap solution, as specified in 8.3, to cover all areas to be tested to a depth of at least ½ in. (12.7 mm) and not more than 1½ in. (38.1 mm).

8.2.4 Take static coefficient of friction readings at nine specified locations as described in 9.1.

8.2.5 If specimens cut from a bathing surface or float glass are to be tested, clean them in accordance with 8.2.1, and support them so that the surface to be tested is at an angle of at least 1° and not more than 3° from the horizontal.

8.3 *Soap Solution:*

8.3.1 The soap solution shall consist of one part of liquid soap complying with Fed. Spec. P-S-624g, or Specification D799, mixed with four parts of distilled or deionized water. The liquid soap shall be made from 100 % coconut oil fatty acids, saponified with potassium hydroxide and brought to the correct pH value by the addition of acetic acid; 0.010 to 0.015 % of EDTA (ethylenediaminotetraacetic acid) shall be added as a chelating agent. Since the soap is 15 % active, the resulting solution is 3 % active.[9] Use the soap solution at normal room temperature, 70± 5°F (21.1 ± 2.8°C).

8.3.2 When not actually in use for testing, store the soap solution in a clean, closed container. If the soap solution displays any "curd" or other material floating in it, or deposited from it, discard it and replace with a fresh solution.

8.4 *Reference Surface*—To help maintain continuity within one user's tests and consistency among all users of this procedure, each user shall have a reference surface consisting of a 12 by 30 by ¼-in. (304.8 by 762 by 6.35-mm) thick piece of plate or float glass. Prepare the reference surface in accordance with 8.2.4 and verify the readings by taking six measurements as follows:

8.4.1 At the beginning and end of any series of tests.

8.4.2 Any time the soap solution is replaced by a fresh sample.

8.4.3 At the beginning and end of any day of tests, if a series extends for more than one day.

8.5 *Test Sensor*—The test sensor shall be made of medical grade silicone rubber.[10] Cast a 1½ by 3 in. (38.1 by 76.2 mm), having a thickness of 3⁄16 ± 1⁄16 in. (4.8 ± 1.6 mm), following the instructions supplied by the manufacturer. Attach the section, as cast, either directly to the shoe of the tester or to a detachable clip which in turn can be attached to the shoe of the tester by means of a suitable adhesive.[11] The sensor needs no special care, such as presoaking or storing in a soaked condition. It is only necessary that the sensor's test surface be kept clean and that it be inspected for mechanical damage from time to time. If the test surface evidences any mechanical damage, roughness, or missing areas, replace the sensor.

8.6 *Recording of Data*—Record and retain the following data to evidence compliance with this specification:

8.6.1 The 18 results of the NIST-Brungraber Tester,

8.6.2 Angle of inclination of the tester at each of the nine locations tested, both transverse and parallel to the direction of the test,

8.6.3 Temperature of the room in which the tests were conducted,

8.6.4 Temperature of the soap solution at the time the tests were conducted, and

8.6.5 Results of the NIST-Brungraber Tester on the reference surface.

9. Measurements and Interpretation of Results

9.1 *Number Required:*

9.1.1 *Measurements*—Eighteen measurements, two in each of the measurement zones, are required to establish the slip

[9] The Dermi-Klene Co., 306 Oak Place, Brea, CA 92621, will supply soap to these specifications in lots of at least three cases of 12 gal per case. To assure compliance with the above requirements, the order should identify the soap as 8520-00-228-0598-C.

[10] Silastic 382, available from Dow-Corning Corp., Midland, MI, or equivalent, has been found suitable for this purpose.

[11] Scotch-Weld Structural Adhesive made by 3M, St. Paul, MN, or silastic medical adhesive silicone Type A made by Dow Corning have been found to be satisfactory for this purpose.

resistance of a bathing surface. The two measurements in each zone are taken without moving the NIST-Brungraber Tester.

9.1.2 *Compliance-Determining Measurements*—The lowest average static coefficient of friction in any of the nine measurement zones (average of the two readings) shall be the basis for determining compliance with this specification.

9.2 *Required Level of Performance*— The required level of performance for compliance with this specification shall be a static coefficient of friction no less than 0.04, as determined in 9.1.2.

ANNEX

(Mandatory Information)

A1. STEP-BY-STEP OPERATION OF THE NIST-BRUNGRABER SLIP-RESISTANCE TESTER

A1.1 Perform the following procedure:

A1.1.1 Carefully remove the tester from its case, inspecting it for any loose or damaged parts.

A1.1.2 Using a clean cloth or paper napkin, thoroughly wipe all parts of the main, horizontal travel bars that come in contact with the linear ball bushings in the carriage.

A1.1.3 Select a sensor clip having a suitable facing material and attach it to the bottom of the sensor shoe, making certain that the vertical extension in the clip extends up through the hole in the base plate and lies behind the trigger. Also be certain that the clip is pushed back with respect to the shoe as far as it will go, so that the vertical extension on the clip is thoroughly engaged in the single notch at the front of the shoe.

A1.1.4 Remove the recording shaft from the case and wipe it thoroughly with a clean cloth or paper napkin.

A1.1.5 Insert the magnetic end of the recording shaft through the indicator tube at the front of the tester, pushing the rod back until the magnet engages the head of the adjustable carbon steel bolt attached to the carriage. While inserting the shaft, be certain that the trigger-clutch assembly is thoroughly released by pushing the sensor shoe as far towards the rear of the tester as it will go. If the shaft fails to slide in easily, it may be necessary to back off the adjustment screw in the upper end of the trigger. This is done by first releasing the knurled locknut on it.

A1.1.6 Adjust the trigger mechanism by first putting the tester on a level surface, with the sensor shoe to the rear of its possible travel and with the carriage fully forward, with the initial stop (the short piece of flexible plastic tubing) removed. Then adjust the trigger so that the 0.05-in. (1.3-mm) thick spacer, supplied with the tester, can be easily placed between the trigger and the vertical extension on the front of the sensor clip. Set the trigger stop so that there is a 0.05-in. gap between the stop and the front of the trigger, with the trigger again at the front of its travel. At no time during these adjustments should the trigger be pushed hard enough to bend it. The 0.05-in. gap between the trigger and the stop permits some elastic bending of the trigger during the operation of the tester, but the trigger should be free of bending stress while being adjusted.

A1.1.7 With the carriage fully forward and the magnet on the recording shaft engaged with the attraction screw in the carriage, check the zero reading. If the zero line on the recording shaft does not lie opposite the notches in the indicator tube, bring them into alignment by releasing the thumb nut on the attraction screw in the carriage and adjusting it as needed. Before attempting to adjust the zero position of the recording shaft, first check the indicator tube to be sure it is tightly secured in front of the tester and is so positioned that the recording shaft may be easily read from the top of the tester.

A1.1.8 Check the free movement of the recording shaft by holding the sensor shoe in its rearward position and moving the carriage, by hand, throughout its travel. The recording shaft must travel freely, without breaking the magnetic attachment to the attraction screw in the carriage. If the shaft does not move freely, check the shaft for straightness. If the shaft has been bent, it may be possible to carefully straighten it; if not, it must be replaced. During this operation, the sensor shoe can be held in its rearward position either by hand or by temporarily adjusting the trigger stop such that all movement of the trigger is prevented.

A1.1.9 With the tester on a level surface and the sensor shoe again held in its rearward position, adjust the spring-control collar(s) so that the carriage will move freely throughout its entire travel, using the initial-position stop to initiate the travel. That is, the collar should be adjusted such that the carriage, while dragging the recording shaft, will just move to the end of its travel (the weight fully descended) without causing an excessive bump at the end of the travel.

A1.1.10 With the tester fully adjusted, the proper sensor in place, and the initial stop (the short piece of flexible plastic tubing) installed at the front of one of the main travel bars, conduct a test by picking up the tester by the handle, placing it on the area of the floor or bathing surface to be evaluated, and releasing the handle. Read the value of the resulting NIST-Brungraber number from the recording shaft at the index formed by the pair of notches in the indicator tube. Then convert the NIST-Brungraber number to an equivalent value of static coefficient of friction by means of the calibration chart or curve that is supplied with the tester. When picking up the tester, take care to see that the clutch is released, permitting free movement of the recording shaft before the recording shaft is forced forward to its initial position. This can most easily be

done by inducing a slightly rearward force on the handle during the initial part of the picking-up operation. This assures that the sensor shoe is lifted free of the floor or bathing surface, thereby permitting it to return to its initial position, releasing the trigger and clutch, before the recording shaft is pushed by the carriage back to the initial position.

A1.1.11 By repeating the procedure in A1.1.10, additional readings can be taken at the same or newly selected spots on the walking or bathing surface. When taking repeat tests at the same identical spot, hold the tester in place with one hand, and operate it with the other. In this case, exercise special care to be sure to apply a rearward bias to the handle when first lifting it to assure that the recording shaft is free to be returned to its starting position.

A1.1.12 It should be noted that with the initial-position stop in place, readings of less than 0.5, which correspond to a static coefficient of friction of about 0.03, cannot be taken. However, such values of coefficient of friction are quite low and would represent an extremely hazardous condition for most walking or bathing surfaces. In fact, the operator of the tester would have to exercise great care to prevent self injury. In the event the presence of water or other contaminant on the surface makes it so slippery that the tester registers a value equal to the initial setting of the tester, indicating that the recording shaft did not travel at all, a repeat test should be performed with the initial-stop removed. In this case, the tester is not self-starting, and it will be necessary to impart a slight rearward push to the handle as soon as the sensor comes in contact with the floor or bathing surface. It is important that there be no delay between the contact of the sensor with the floor or bathing surface and the start of the carriage movement, since it is under those circumstances (the presence of water or other liquid contaminants) that a time delay will permit the squeezing-out of the contaminant, which may promote adhesion of the sensor to the floor or bathing surface and result in an unrealistically high indication of the slip resistance of the walking surface.

A1.2 When evaluating extremely slippery surfaces such as bathtubs or shower bases in the presence of soapy water, certain modifications must be made to the previous instructions for the operation of the NIST-Brungraber Tester, which are for dry, level floors.

A1.2.1 To promote free and complete drainage, most bathtub and shower base surfaces have a built-in slope towards the drain, of about 1½ to 2°. By taking advantage of this slope and operating the NIST-Brungraber Tester "uphill," it can be adjusted so that it is self-starting without the use of the initial-position stop. This permits the measurement of low values of coefficient of friction, less than 0.03, while still retaining the desirable self-starting feature that reduces operator error. Thus, wherever possible, bathtub and shower surfaces should be tested "uphill" at a 1 to 2° slope and the tester should be adjusted and calibrated for this mode of operation.

A1.2.2 Follow the instructions in A1.1.1 – A1.1.8 for use of the tester on slippery surfaces. For adjustment of the spring control collar(s), the adjustment should be carried out with the tester inclined "uphill" at the approximate angle it is to be used and with the initial-position stop removed. For the actual operation of the tester, remove the initial-position stop and conduct the test in the "uphill" direction. If it is too difficult to incline the surface and it must be tested in the level position, satisfactory results can be obtained by carefully following the instructions in A1.1.12. However, the tester shall then be adjusted and calibrated for use on a level surface. When evaluating such surfaces as bathtubs or shower bases, particular care should be used to hold the tester in place with one hand while operating it with the other, since movement of the tester during the conduction of a test will result in a false reading.