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Standard Consumer Safety Specification for Slip-Resistant Bathing Facilities¹

This standard is issued under the fixed designation F 462; 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 approval. 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

D 459 Terminology Relating to Soaps and Other Detergents,

D 799 Specification for Liquid Toilet Soap

2.2 *Federal Specification:*⁵

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.

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

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 the Consumer Product Safety Commission, Washington, DC 20207.

³ “Performance Characteristics of Sanitary Plumbing Fixtures,” available from the Consumer Product Safety Commission, Washington, DC 20207.

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

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 will slide 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.

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 tester⁶ 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.

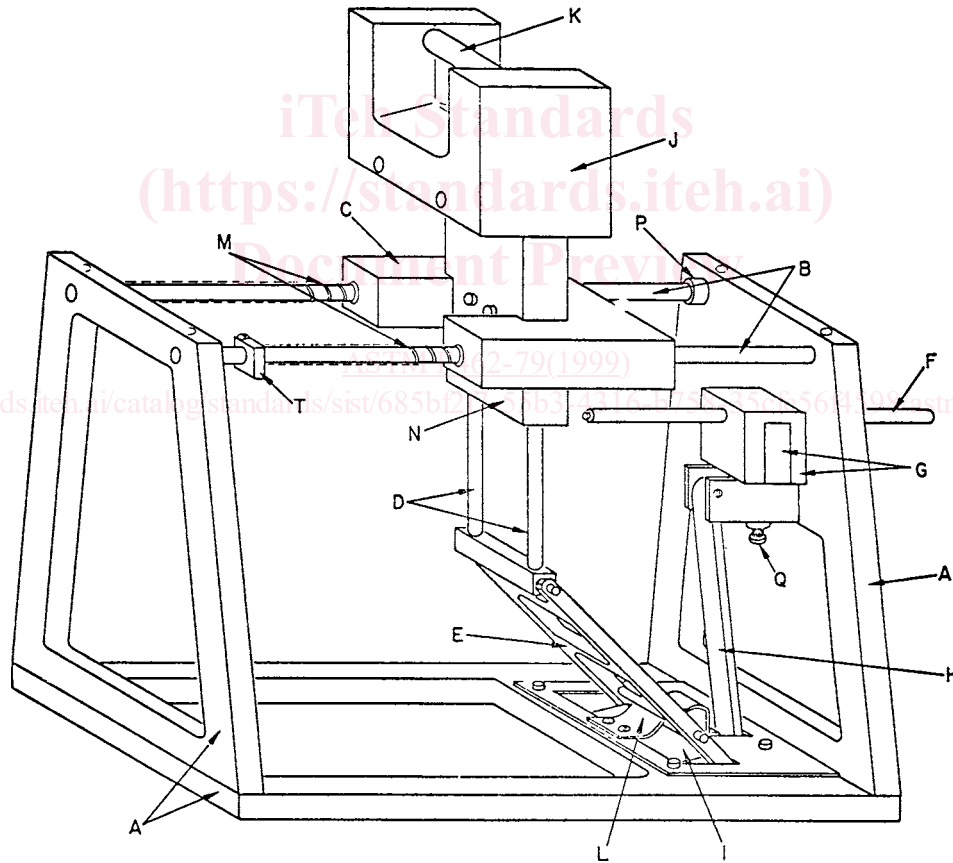
6.1.2 At the start of a test, the carriage is brought forward to a stop position such that the articulated shaft is not vertical but set at a slight angle towards the back of the tester. (This is accomplished by either introducing an initial position stop at the front of the carriage or by using the 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 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

⁶ “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.



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| 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