UL 410

STANDARD FOR SAFETY

Slip Resistance of Floor Surface Materials

UL Standard for Safety for Slip Resistance of Floor Surface Materials, UL 410

Third Edition, Dated October 25, 2006

Summary of Topics

This revision of UL 410 dated June 2, 2020 includes the following changes in requirements:

– Adding requirements for Floor Graphic Material (FGM); 1.2, 3.2A, 4.1.1, 4.2.4, Section 4.14A

– Adding James Machine requirements; 4.2.1, 4.11.1, 4.15.1, 4.15.2, 4.16.1, 4.16.3, 4.16.6, 4.16.7

– Adding requirements for use of terrazzo; 4.5.1

– Addition of requirements to follow manufacturer's instructions for buffing for FTM-1 sample preparation; 4.8.2, 4.8.3

– Minor editorial changes; 1.1, 4.3.2

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated January 31, 2020 and April 1, 2020.

No Text on This Page

OCTOBER 25, 2006
(Title Page Reprinted: June 2, 2020)

1

UL 410

Standard for Slip Resistance of Floor Surface Materials

First Edition – December, 1992
Second Edition – August, 1996

Third Edition

October 25, 2006

This UL Standard for Safety consists of the Third Edition including revisions through June 2, 2020.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

No Text on This Page

CONTENTS

INTRODUCTION

PERFORMANCE

MARKING

No Text on This Page

INTRODUCTION

1 Scope

1.1 These requirements cover the testing of floor coating, finishing materials, and surface materials to determine if their minimum average and minimum individual static coefficients of friction meet or exceed the specified requirements with respect to slip resistance only.

1.2 The floor surface materials covered by this standard include floor covering materials (FCM), floor graphic materials (FGM), floor treatment materials (FTM) and walkway construction materials (WCM).

1.3 The methods described involve the preparation and testing of representative floor surfaces to determine their static coefficient of friction.

1.4 The requirements may be applied to other floor surface materials if found appropriate.

1.5 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involves a risk of fire, electric shock, or injury to persons shall be evaluated using the appropriate additional component and end-product requirements as determined necessary to maintain the acceptable level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard cannot be judged to comply with this standard. Where considered appropriate, revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

2 General

2.1 Units of measurement

2.1.1 If a value for measurement is followed by a value in other units in parentheses, the second value may be only approximate. The first stated value is the requirement.

2.2 Instructions

2.2.1 A copy or draft of the application and use instructions intended to accompany each product as produced is to be used as a guide in the testing of the product.

2.2.2 The instructions shall include directions and information as deemed by the manufacturer of the product to be necessary to cover the intended application, maintenance, and use of the product.

3 Glossary

3.1 For the purpose of these requirements the following definitions apply.

3.2 FCM – Floor covering materials made of wood or composite materials.

3.2A FGM – Floor graphic material consisting of adhesive-backed label material.

3.3 FTM-1 – Water-base floor treatment materials.

3.4 FTM-2 – Fillers, sealers, varnishes, and similar floor treatment materials.

3.5 FTM-3 – Detergent materials.

3.6 FTM-4 – Abrasive-grit-bearing floor treatment materials.

3.7 FTM-5 – Floor treatment materials other than water-base.

3.8 FTM-6 – Sweeping compound materials.

3.9 WCM – Walkway construction materials used as floor plates, ramps, and stair treads that are made of natural stone, composite materials, abrasive-grit surface materials, and metal.

3.10 SLIP RESISTANT CHARACTERISTIC – The static coefficient of friction as determined by the Static Friction Test, Section 4.

PERFORMANCE

4 Static Friction Test

4.1 General

4.1.1 The average static coefficient of friction for FTM, FCM, FCM, and WCM products shall be at least 0.50 and individual static coefficients of friction shall be at least 0.45 when tested in accordance with the requirements of this section.

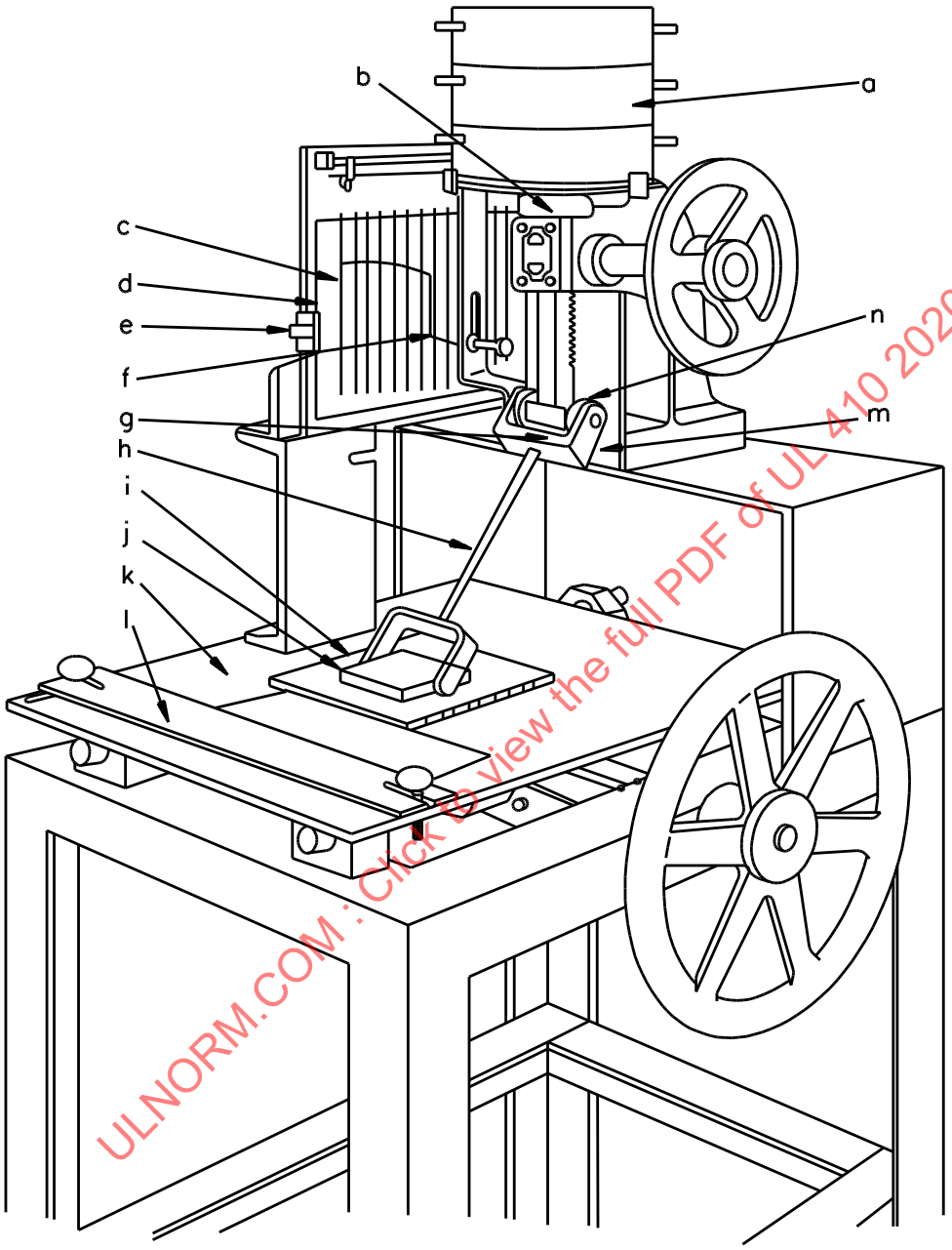
4.2 Apparatus

4.2.1 A James Machine, which tests the static friction of a surface, is employed for this test. The James Machine (see Figure 4.1) consists of a stand having a bridge on which is mounted a platform (t) and weights (a). The weights are supported by a rack and pinion member, hereafter referred to as the "ram." The ram, platform, and weights total 80-mass pounds (36.3 kg).

Exception: As an alternative to the manually-operated model James Machine, a motorized James Machine may be employed that has the same operating characteristics as the manual machine as determined by an ASTM Precision and Bias Evaluation.

Figure 4.1

The James Machine



a–Weights
b–Cushion
c–Chart
d–Chart Board
e–Spring Clip
f–Recording Pencil
g–Set Screw
h–Strut
i–Specimen
j–Shoe
k–Test Table
l–Retaining Bar
m–Back Plate
n–Ball Bearing Rollers

SM405

Courtesy of ASTM

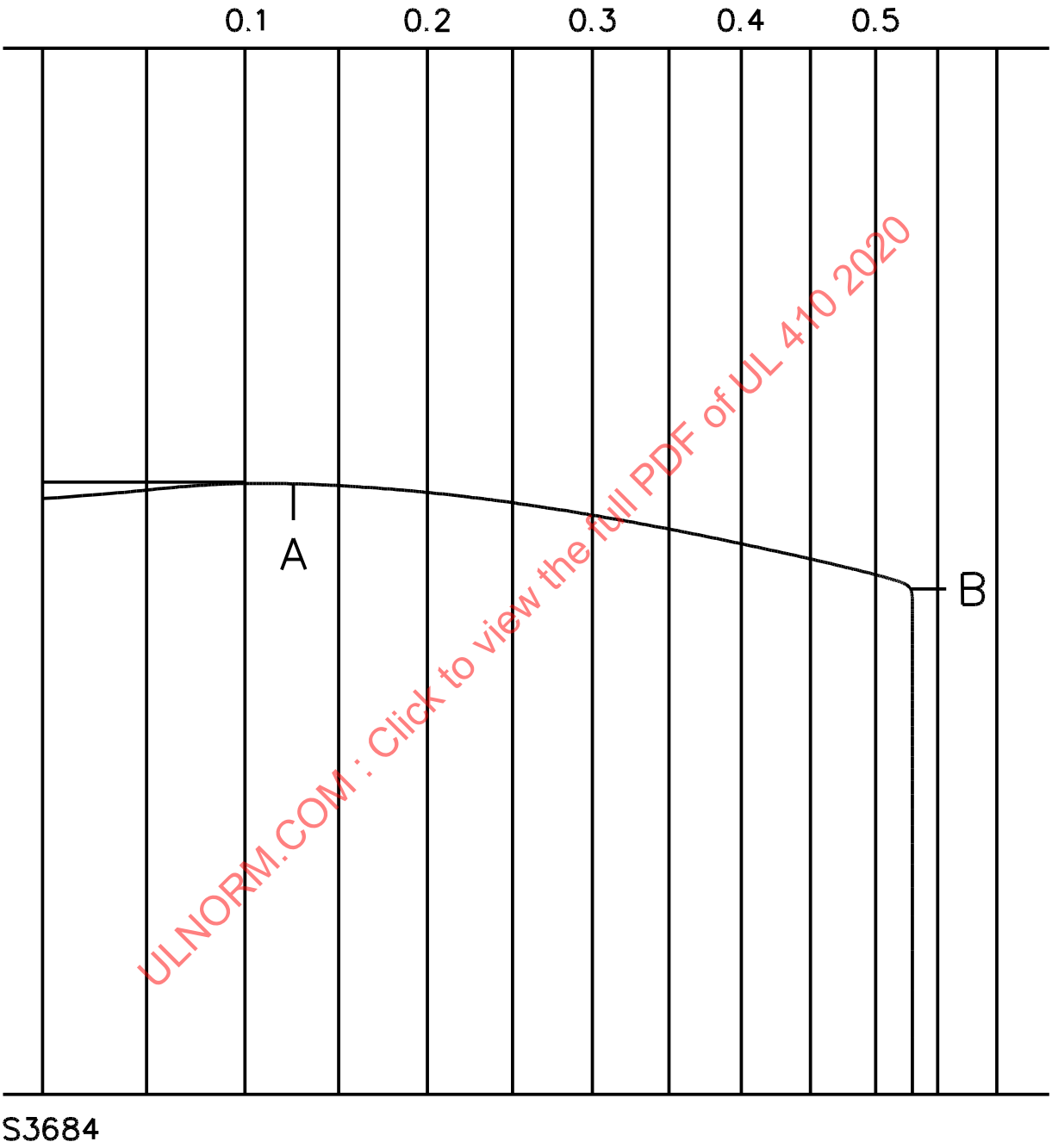
4.2.2 At the lower end of the ram, there is a crossarm with ball-bearing rollers (n) in contact with the vertical plate of the ram support. A strut (h), with forked ends, has an upper fork which is hinged to the ends of the ram crossarm by means of ball-bearings. The lower fork (g) has short pins to engage the shoe holder (j). The shoe holder is a 3 inch (76.2 mm) square flat block of steel. The strut is 10 inches (254 mm) long, from the center of the upper hinges to the center of the shoe pins.

4.2.3 The table is mounted so it can be moved horizontally in a straight line and at right angles to the bridge supporting the ram. It is actuated by a rack-and-pinion arrangement, controlled and operated by the lower hand wheel (r). A vertical record sheet holder (d) is supported on an upright attached to the table so as to move with the table. A pencil (f) attached to the ram bears against the record sheet (c) and serves to record the results of the static friction test. See Figure 4.2 for a typical test record sheet.

Figure 4.2

Typical Test Record Sheet For One Static Friction Test

Static Coefficient Of Friction



A Strut movement

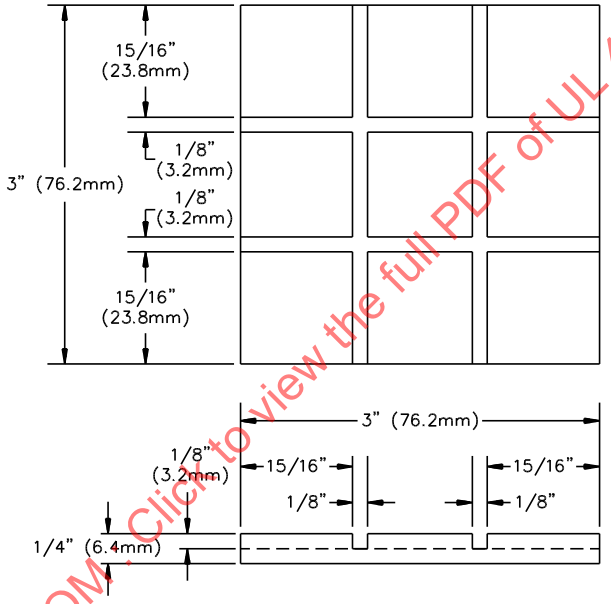
B The value of the static coefficient of friction is read at the point where there is a critical slippage of the shoe, evident by the sharp break in the line. For some cases, the use of a template of the strut movement with no shoe movement may be necessary to determine exactly where the shoe slippage starts.

4.2.4 For FTM, FGM, and FCM products, the test shoe is to be of leather conforming to Federal Specification for Leather, Cattlehide, Vegetable Tanned and Chrome Retanned, Impregnated, and Soles, KK-L-165C approximately 1/4 inch (6.4 mm) in thickness. The shoe surface is to be without deep grooves, scratches, or other visible defects; natural or otherwise. It is to be securely glued to the shoe holder of the James Machine.

4.2.5 A simulated corrugated leather shoe is to be used on WCM products. The test shoe is to have two equally spaced grooves 1/8 by 1/8 by 3 inches (3.2 by 3.2 by 76.2 mm) in each direction; 90 degrees apart. See Figure 4.3. The corrugated leather test shoe is to be securely glued to the steel shoe holder of the James Machine.

Figure 4.3

Corrugated Leather Test Shoe



Radius of edges and corners: Approximately 1/64 inch (0.4mm)
Tolerance: ±1/64 inch (±0.4mm)
Leather: Prime Sylva, No. 12 Iron

S3685

4.3 Test panels for FTM-1, FTM-3, FTM-6

4.3.1 A vinyl composition test panel is to be used. A floor treatment material intended for use on only one type of flooring is to be tested on a panel of that flooring material.

4.3.2 A vinyl composition test panel is to be ASTM Official Vinyl Composition Tile (OVCT) as specified in the Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine, ASTM D 2047.

4.3.3 A test panel is to be smooth, clean, and dry and is to have no surface irregularities in the test area.

4.4 Test panels for FTM-2

4.4.1 An FTM-2 material (s) is to be tested on a panel of each flooring material specified by the manufacturer's instructions.

Exception: If a test is conducted on terrazzo, the test on concrete may be waived.

4.4.2 A wood flooring panel is to be hardwood (oak) flooring of a size to permit four tests (approximately 9 inches square). Its surface is to be belt sanded with 1/2 (60) grit aluminum oxide paper, then with 3/0 (120) grit paper, and then dusted. A terrazzo panel is to be 9 by 9 inches (229 by 229 mm) of any convenient thickness.

4.4.3 A test panel is to be smooth and clean and is to have no surface irregularities in the test area.

4.5 Test panels for FTM-4

4.5.1 An FTM-4 material(s) is to be tested on panels of wood, concrete, and steel. A 9 by 9 inch (229 by 229 mm) slab of smooth-finished concrete of any convenient thickness is to be used for concrete flooring. A 9 by 9 inch (229 by 229 mm) smooth steel panel is to be used for steel decking. The wood flooring panel is to be as specified in 4.4.2.

Exception: If a test is conducted on terrazzo, the test on concrete may be waived.

4.6 Test panels for FTM-5

4.6.1 An FTM-5 material(s) is to be tested on a panel of wood or terrazzo flooring in accordance with 4.4.2 and 4.4.3.

4.7 Test panels for FCM, WCM

4.7.1 Representative test panels of the material are to be used.

4.8 Sample preparation for FTM-1

4.8.1 The test material is to be flooded over the surface of the test panel. The panel is to be held at an angle of approximately 45 degrees and allowed to drain for 10 seconds. It is then to be left to dry in a vertical position for 2 hours in a temperature-controlled room that is approximately 23° C ±2° C (73° F ±3.6°F) and 50 ±4 percent relative humidity. A second coat is then to be applied in the same manner from the reverse direction and the panel again allowed to dry in the vertical position for not less than 12 hours, but not more than 24 hours.

4.8.2 If the product label includes buffing, burnishing, spray buffing, or words of similar intent as part of the application or maintenance instructions, a second tile is to be prepared as in 4.8.1 with spray buff products applied just prior to buffing.

4.8.3 Prior to conducting the static friction test, the tile shall be buffed with a beige pad on a machine having a minimum speed of 1000 rpm. Any dilution shall be in accordance with the manufacturer's instructions.

4.9 Sample preparation for FTM-2

4.9.1 The test material is to be smoothed on the test panel with a cheesecloth swab, or with a brush. The material is to be applied with the grain of a wood panel. Excess fluid is to be swabbed to prevent wrinkles or bubbles.

4.9.2 The test panel is to be placed on a level surface to dry. The drying time is to be not less than 12 hours and is to be extended until the test panel is dry to the touch. Varnishes are to be dried in accordance with manufacturer's instructions in a temperature-controlled room as described in 4.8.1. If the instructions