

Floor Safety Technical Data

A floor finish constitutes just one of many parameters that determine the safety of a walkway surface. A pedestrian's walking gait, health and agility are contributing factors as well as the construction of the shoes, including composition of the sole and heel and presence of residues on them.

Maintenance of the floor, especially in terms of residues of soil or foreign material that may be present on the surface, is also highly important. Making sure floor finishes have adequate slip resistance is one of the most important and long-standing commitments of the floor finish industry.

Slip Resistance

Making sure floor finishes have adequate slip resistance has been and continues to be one of the most important and long-standing commitments of the floor finish industry. A James Machine is used to measure slip resistance as per the American Society of Testing and Materials (ASTM) standard D-2047. The Consumer Specialties Products Association (CSPA – formerly CSMA), recognized by the floor care industry, also specifies this test procedure.

Coefficient of Friction

Walking is an enormously complex activity involving many muscles, bones and nerves, as well as kinesthetic sensory information that must be blended, graded and coordinated by the brain to transport the body from one point to another.

Studies published in 1953 by the Federal Construction Council show that the horizontal component of walking is the force that must be overcome by friction between the shoe material and the walkway surface, if the process is to be accomplished without slipping and possibly falling.

The ratio of forces required to move one surface over the other under a given vertical force (e.g., the total mass of the pedestrian) is called the "coefficient of friction." When the coefficient of friction is measured from a rest position it is called "static" and when measured while the surfaces are in relative motion it is called "dynamic." Both measurements define different aspects of the same parameter, i.e. the resistance between two surfaces that are in contact with each other to slide past one another.

Measuring Slip Resistance

Development of reliable test methods for evaluating the slip resistance of floor polishes have been a primary concern to the polish industry. In 1964, the Polishes and Floor Maintenance Division of CSPA established a permanent subcommittee to investigate methods for measuring slip resistance. Of the methods investigated, only the James Machine, which measures the static coefficient of friction, was found to consistently and reliably simulate the sequence of events which occurs when a person actually walks on the floor surface. The method, developed in the 1940s by Sidney James of Underwriters Laboratories Inc. has survived more than 50 years of scientific demands for reliability and reproducibility and is now the only universally accepted industry practice or measuring coefficient of friction.

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The James Machine

The James Machine test incorporates an 80-pound weight that is applied through a strut to a clean leather "shoe" placed on a panel to which a floor polish has been applied. The panel and the shoe together are moved horizontally so that the weight develops a horizontal force at the shoe/polish interface. The strut is pivoted at both ends. The distance the panel moves before slippage occurs is accurately measured and recorded on a chart that is calibrated to read static coefficient of friction based on the linear distance the panel moves prior to slippage.

The developer of the James Machine established the coefficient of friction figure of 0.5 as the minimum in deciding whether the finish could bear the UL seal of approval in terms of slip resistance. In 1953, the Federal Trade Commission recommended the standard of 0.5 in its floor rules and in 1970 CSPA adopted the 0.5 figure as the point which determines whether a product should be classified as slip resistant, anti-slip, or some other similar term. It is the only method, outside of the subjective and purely qualitative tentative CSMA method: "Comparative Determination, Slip Resistant Floor Polishes," commonly referred to as "The Paper Under Foot Method" (CSPA Bulletin 245-70), that continues to be officially approved by CSPA. The James Machine method was subsequently approved by the American Society of Testing and Materials (ASTM) as the basis for Standard Test Method D-2047. As is the case with CSPA, the James Machine is currently the only official ASTM method for measuring static coefficient of friction of polished floors.

A paper given at the 1971 CSPA Mid-Year Meeting presented a detailed mathematical analysis of the static coefficient of friction as measured by the James Machine and its relation to a person's walking stride. The authors showed that people would not slip if they walked on a floor having a coefficient of friction as low as 0.3 to 0.45, depending on the individuals. On this basis, the James Machine value of 0.5 provides a factor of safety.

Slip Resistant Finishes

According to industry standards, any finish possessing a static coefficient of friction of 0.5 or greater by this method is considered to be slip resistant. All Ecolab Professional Products' floor finishes fall into this category.

If the static coefficient of friction (which lies between 0.0 and 1.0) approaches 1.0, tacky floors result. Feet may start to "grab" onto the finish which could also be a dangerous situation. As a result, Ecolab Professional Products' floor finishes are designed to fall in the 0.5 – 0.7 slip resistance range.

The use of spray buff products are designed to temporarily soften the surface of the finish. Then the buffing/burnishing action of the pad increases gloss levels. All components of the spray buff product evaporate. The use of spray buff solutions will, in no way, decrease the coefficient of friction.