

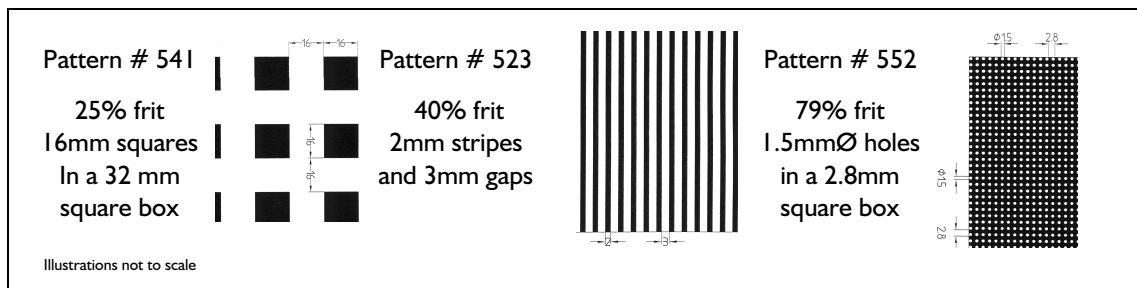
## **Safety aspects of walking on glass – Slip resistance**

When thinking of walking on glass-flooring, end users often express a fear of slippage. Traditional resistance reassurance has been by the means of sand-blast or acid-etched finishes and for low to medium footfall internal use this provides sufficient grip as well as being aesthetically acceptable. These types of finish tend to perform less well in wet conditions, and for external use or for circumstances where the floor is likely to get wet or slippery – kitchens, bathrooms, garages etc, a more robust slip-resistant finish is required.

The Eckelt Glas Saint-Gobain LITEFLOOR range offers, as standard, a ceramic slip-resistant coating to the upper sheet of glass in a variety of [patterns](#) and [colours](#). This ceramic coat contains a hard abrasive material, and is screen-printed onto the top-sheet of glass prior to the heat-strengthening process. During the process the ceramic coat is “cured” and the abrasive frit beds down fusing into the glass giving a permanently fixed finish.

Whilst glass flooring is not specifically included, there is a British Standard (BS 8204: Part 3: 1993 for in-situ floorings: Code of Practice for Polymer Modified Cementitious Wearing Surfaces), which covers slip resistance. Perhaps, more relevant is the United Kingdom Slip Resistance Group (UKSRG) guidelines issue 2, 2000. This makes use of two representative test methods; The Taylor Hobson Surtronic 10 Rtm micro-roughness transducer (the Surtronic 10) to measure surface roughness and the Stanley TRRL Pendulum Coefficient of Dynamic Friction Test (The Pendulum) to measure the coefficient of friction.

We have commissioned testing at the Health and Safety Laboratory, Sheffield to compare an ordinary sand-blasted glass floor finish (100% coverage) with four differently patterned samples of LITEFLOOR top sheet covering levels of “carborundum frit” from 25% to 100% (see Figure A).



**FIGURE A:  
LITEFLOOR frit patterns of samples tested for slip resistance  
at the Health and Safety Laboratory, Sheffield**

The UK Health and Safety Executive Guidelines HSG 156 covers slips and trips, and their Food Sheet No 22 gives a technical update on floor specifications for floors used in wet and slippery conditions. In their information sheet they state that using the Pendulum test technique on a dry or wet surface, values of 36 or more are currently accepted to indicate satisfactory slip resistance. In addition their research has identified the levels of Rtm roughness required to penetrate the squeeze-films caused by liquids with differing viscosities before satisfactory contact can be made with the surface being tested and pendulum friction test results become meaningful. For clean water this value is given as 20<sub>m</sub> but as soon as other contaminants are introduced this value increases. For example to prevent slipping on Milk a minimum roughness value of 45<sub>m</sub> is required.

Results of our testing at the Health and Safety Laboratory in Sheffield are shown in Tables 4 and 5.

**Table 4**  
**Mean pendulum slip-resistance test results for five glass floor finishes.**

<b>TABLE 4</b>	<b>DRY CONDITIONS</b>	<b>WET CONDITIONS</b>
<b>100% SANDBLAST FINISH</b>	<b>79</b>	<b>44</b>
<b>100% ECKELT FRIT</b>	<b>118</b>	<b>100</b>
<b>Pattern #541 – 25% FRIT</b>	<b>118</b>	<b>43</b>
<b>Pattern #523 – 40% FRIT</b>	<b>122</b>	<b>65</b>
<b>Pattern #552 – 79% FRIT</b>	<b>117</b>	<b>87</b>

**Table 5**  
**Mean Surtronic 10 Rtm roughness test results.**

<b>TABLE 5</b>	<b>Rtm (_m)</b>
<b>UNTREATED GLASS</b>	<b>0.2</b>
<b>100% SANDBLAST</b>	<b>15.6</b>
<b>100% ECKELT FRIT</b>	<b>46.3</b>

Whilst the UKSRG guidelines do not recommend that these test results are used to specify a floor, it is clear that the pendulum test shows that the Eckelt frit samples have a significantly higher co-efficient of Friction than the Sandblast sample.

When considering performance in wet conditions, all samples seem to have a pendulum value above 36 in the wet and should show satisfactory slip resistance according to the HSE information sheet. However, when looking at the Rtm roughness results, the 100% sand blast sample does not have enough “roughness” to overcome the squeeze-film of compressed liquid which forms beneath the shoe and prevents solid to solid contact.

As with much good research the results confirmed what we qualitatively already knew – you can slip up on wet sandblasted surfaces but a carborundum frit can overcome this problem. For external applications it is recommended that glass flooring is treated with a carborundum frit system with a minimum 50% coverage.