MINIFIBERS, INC.

SHORT STUFF® in 1K Cementitious Flexible Waterproofing Membranes

Purpose

The purpose of this technical bulletin is to show the impact of SHORT STUFF® high-density polyethylene (HDPE) in a 1K Cementitious Flexible Waterproofing Membrane. All data was collected versus a control formula without SHORT STUFF® to define the performance properties of each system.

Executive Summary

The incorporation of SHORT STUFF® ESS5F into the 1K Cementitious Flexible Waterproofing Membrane improves the water resistance properties of the coating, increasing the hydrophobicity and reducing water absorption, while maintaining a good balance of application properties and tensile strength. Both the control and the formula with SHORT STUFF® ESS5F passed the crack bridging requirements at various temperatures.

Summary of the Project

In this study, we evaluated SHORT STUFF® ESS5F, which is the smallest grade, to ensure a smooth and homogeneous applied product. The properties of SHORT STUFF® ESS5F are described in *Table 1* below.

Table 1. *Properties of SHORT STUFF®*

	SHORT STUFF® ESS5F
*Treated for improved dispersion in aqueous systems	NO
Fiber Length (mm)	~0.1
Diameter (µm)	5
Superficial Area (m^2/gm)	12
Melting point	~135°C / ~275°F
Moisture content (%)	<2.0
Specific gravity	0.96

Each formula was evaluated for water demand, fresh mortar properties (in-house evaluation), tensile strength EN 1542, crack bridging EN 14891 at +23°C / +40°C / -5°C, and water pressure resistance EN 14891.

Sample Preparation

Each 1K Cementitious Flexible Waterproofing Membrane formulation was prepared separately, the formulations are shown in *Table 2* below.

Table 2. *Formulations 1K Cementitious Flexible Waterproofing Membrane*

	FXM-2630-2 Control	FXM-2630-w/ ESS5F
Cement Portland I	19%	
Quartz Sand	42.75%	42.25%
Barite	7%	
HDPE	--	SHORT STUFF® ESS5F
% SS	--	0.5%
% Low CE	0.25%	
Defoamer	1%	
Redispersable powder (VA/E)	30%	

Results

Workability and appearance: The amount of water demand has a direct correlation to workability. The formula containing SHORT STUFF®ESS5F had a slightly higher water demand due to no cellulose ether being present. Both formulas met the standards for water demand, with 24 and 25%, respectively. The results for water demand and workability are shown in *Figure 1* and *Table 3* as follows below.

Figure 1. *Percent Water Demand*

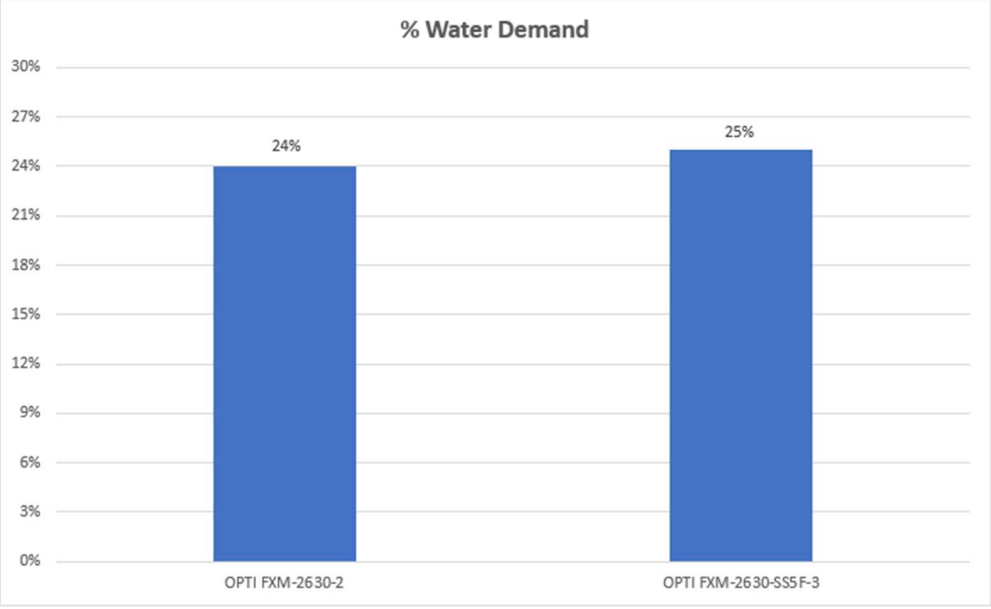
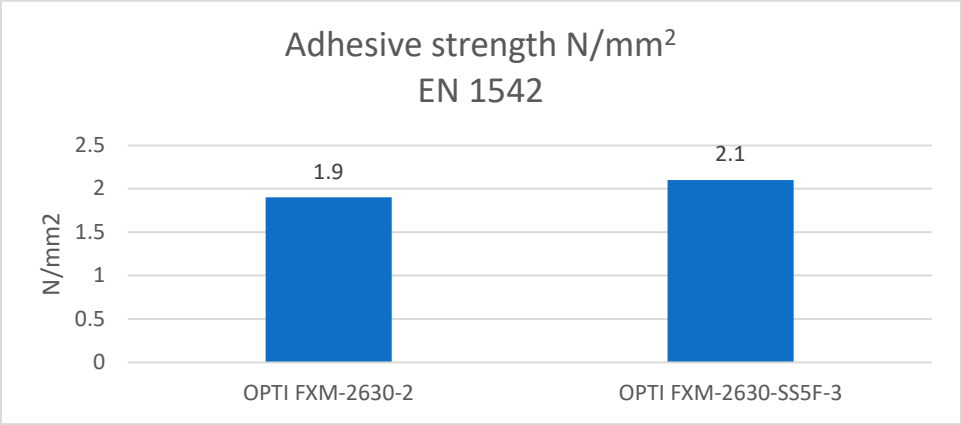


Table 3. *Workability and application properties of 1K Cementitious Flexible Waterproofing Membrane*

	FXM-2630-2 Control	FXM-2630-ESS5F
Mixing properties	spontaneous wetting	spontaneous wetting
	low mixing resistance	low mixing resistance
Consistency during mixing	Smooth Stable	Smooth Stable
Workability	easy to apply	easy to apply
	low workability resistance	low workability resistance
	good application	good application
Workability after 60 min	Smooth	Smooth
	Tears a little	Tears a little
	Good Application	Good Application

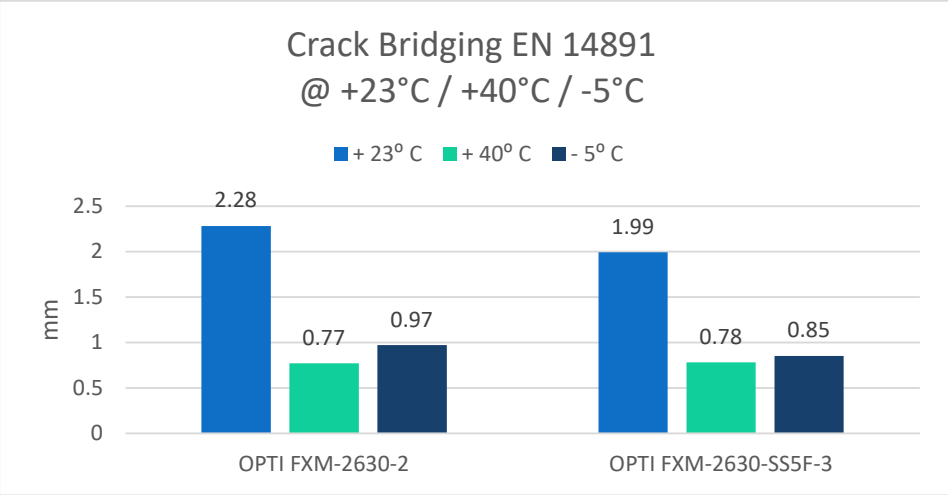
Tensile Strength: We followed European Standard EN 1542 by pull-off, the products were applied on a concrete substrate and a layer thickness of 2 x 2 mm, the required strength is ≥0.5 N/mm^2. The addition of SHORT STUFF®ESS5F slightly increased the tensile strength of the product as shown in *Figure 2*, both formulations showed fracture type B, meaning rupture within the mortar layer.

Figure 2. *The tensile strength of 1K Cementitious Flexible Waterproofing Membrane*



Crack Bridging: We followed EN 14891 at 23°C, 40°C, and -5°C, the required distance for all temperatures is ≥0.75 mm. As observed, both formulations passed the test at low and elevated temperatures as observed in *Figure 3* below.

Figure 3. *Crack bridging of 1K Cementitious Flexible Waterproofing Membrane*



Water Pressure: We followed EN 14891 where the test samples are based on a permeable concrete substrate sealed on all faces apart from the test surface areas, and then covered with the liquid flexible membrane where the water pressure is applied. Before starting the waterproofing test, the specimens are weighed and placed under pressurized conditions for 7 days, and then the specimen is removed from the water pressure, blotted dry, and weighed immediately to record the increase in weight, then the specimen is broken to observe if there was any water penetration. To pass the test the samples must have ≤ 20 g of weight increase and no penetration.

The addition of SHORT STUFF®ESS5F decreases the water absorption of the coating, therefore improving the waterproofing properties of the applied product. Both formulations passed the required standard as shown in *Table 3* below.

Table 3. *Water Pressure Resistance of 1K Cementitious Flexible Waterproofing Membranes*

	Control FXM-2630-2	**FXM-2630-w/ ESS5F**
Evaluation (Pass / Fail)	PASS	PASS
Weight increase of the specimen (g)	7.2	**5.8**
Penetration after 7 days by 1.5 bar, (mm)	0	0

Water absorption on the surface: The test was conducted using a Rilem tube to compare surface porosity. The addition of SHORT STUFF®ESS5F improves the water repellency of the product in comparison with the control formula, as observed in *Table 4* below. All coatings must have ≤ 1 mL or less of water absorbency to meet the standard.

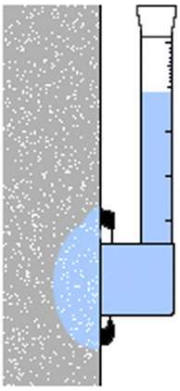


Table 4. *Water absorption of 1K Cementitious Flexible Waterproofing Membranes*

	Control FXM-2630-2	**FXM-2630-w/ ESS5F**
Evaluation	PASS	PASS
Rilem tube @ 20 min (mL)	0.2	**0**

Conclusions

The introduction of SHORT STUFF®ESS5F in *1K Cementitious Flexible Waterproofing Membranes* improves the waterproofing properties of the product, making it more hydrophobic which improves water repellency and decreases water absorption.

The workability over time shows less stickiness and is smoother to apply when SHORT STUFF®ESS5F is added to the formula.

The crack bridging requirement according to EN14891 is ≤ 0.75 mm and both formulations passed at each tested temperature.

All test samples are water pressure resistant according to EN14891, but with SHORT STUFF®ESS5F added there was an improvement in water penetration, making it more hydrophobic and improving the water repellency versus the control formula.

Recommendations

SHORT STUFF®ESS5F is recommended in all 1K Cementitious Flexible Waterproofing Membranes to improve the hydrophobicity and water repellency, reduce water absorption, and to improve application and workability.