

## FluoroPel 420-F25M

Electrical components are expected to withstand a very wide variety of exposures and conditions. Cytonix FluoroPel 420-F25M is an innovative fluoro-polymer based conformal coating that protects electronic components from chemicals and humidity based corrosion.

Some of the important features of this coating include:

- Eliminate the need for enclosures
- Very thin coating improves weight and design freedom
- Performance degradation is reduced
- Improves work flow due to rapid drying and easy-application
- Prevent damage to electronics caused by water or salt environments
- Water contact angle of 115° and very low vapor permeability at low thickness.
- Coating can be applied by dipping, spraying or syringe dispensing

Third party customer testing has shown that FluoroPel coated circuit boards in phones can get certification for MIL-STD 810G for working under most environmental conditions. Third party customer testing has also shown that FluoroPel coated devices meet the biocompatibility requirements stipulated in ISO 10993 (Biological Evaluation of Medical Devices) and FDA requirements for 510K submissions. Temperature and humidity testing method 507.5 has shown that devices can withstand temperatures up to 140°F in 95% relative humidity. Salt Fog Method 509.5 testing has shown that coated devices withstands exposure to salt fog at 98°F for 120 hours with no loss of functionality. FluoroPel coated devices have also been certified IPX5 or IPX7 waterproof per IEC-60529 by third party testing where the device withstands immersion in 1 meter of water for a period of 30 minutes. FluoroPel coated circuit boards in smartphones can achieve IPX5 standards without the use of mechanical seals and gaskets.



Figure 1. Smartphone coated with FluoroPel working under water passes IPX5 or IPX7 water resistance test

**Table 1. Properties of FluoroPel Solution**

Property	
Name	FluoroPel 420-F25M (10% solids)
Product Code	420-F25M
Chemistry	C6 fluoro-carbon
Color and clarity	Colorless or yellow liquid and Lightly turbid to clear
Odor	Light ether-like odor
Flammability	Non-Flammable
Viscosity	>0.40 cP

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Solubility	FCL52plus, Ethyl-Acetate, MEK, Butyl-Acetate
Shelf Life	6 months in air sealed container
Environmental	Low in toxicity, non-ozone depleting
One Part System	Yes
Application Options	Dipping, spraying, brushing, syringe-dispensing

**Table 2. Properties of FluoroPel films**

Property	
Appearance	Clear, odorless and colorless film
Contact Angle to Water	~115°
Contact Angle to Oil	>55°
Oleophobicity grade	6
Surface Tension	9-12 dynes/cm
Hardness	>2B pencil
Flammability	Non-burning
Tracer	UV tracer for quality control (at request)
Heat stability continuous	150°C
Max heat stability one hour	250°C
Refractive index Surface	~1.34
Toxicity	HMIS Rating Health = 1
Ease of Application	Excellent
Solvent/Chemical Resistance	Excellent after curing
Transparent	Yes
Electric conductivity	Yes (at <0.5 µm film thickness)
Ease of Dry (low BP solvent)	Dries at room temperature in <5 minutes
Low Labor	Yes

**Table 3. FluoroPel film thickness**

Property	
Film thickness at 0.2% polymer	~0.05 µm
Film thickness at 2% polymer	~0.1 µm
Film thickness at 5% polymer	~0.5 µm
Film thickness at 10% polymer	~1.0 µm
Film thickness at 20% polymer	~2.0 µm

**Table 4. Electrical properties of FluoroPel films**

Coating Thickness	Surface Resistance (Ω)	Volume Resistance (Ωm)
0.05 µm film	Conductive	Conductive
0.1 µm film	Conductive	4 X 10 <sup>20</sup>
0.5 µm film	1 X 10 <sup>9</sup>	8 X 10 <sup>20</sup>
1.0 µm film	5 X 10 <sup>11</sup>	ND
2.0 µm film	2 X 10 <sup>14</sup>	ND
>100 µm film	2 X 10 <sup>17</sup>	ND

\*Electrical properties determined on aluminum plates. Measures presented are approximate.

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## Dip Coating Procedure and Application Guide

The environment for the coating process needs to be clean. Dust can negatively affect the coating application process resulting in poor adhesion, voids, and reduction of coating performance.

### A. Masking:

Microphones, speakers, camera lenses may need masking using Duraseal (applied by manual labor).

### B. Cleaning Process:

Device may need to be cleaned using IPA Wipes and/or compressed air to remove dust.

### C. Coating Process:

Dip coat manually or using automated system

- Recommended starting test point immersion speed of 15cm/min
- Recommended starting test point withdrawal speed of 15cm/min
- It is important to control immersion speed to avoid excessive air bubbles. Bubbles can result in voids in the coating.
- Withdrawal speed determines the cosmetic appearance and uniformity of the coating. Slow is good.
- Dry by hanging at room temperature or leaving in basket
- Cure by heating at 60 to 100°C for 10 minutes with 50% relative humidity
- Remove from tray or hook and package

### D. De-masking:

- Remove Duraseal with tweezers

### E. Coating during assembly:

- It may be useful to apply a drop of FluoroPel using a dropper or syringe to exposed connectors and joints made during device assembly. This will assure that water will be effectively repelled for the life of the device.

### F. Safety:

In Case of a Spill: Contain spill. Working from around the edges of the spill inward, cover with bentonite, vermiculite, or commercially available inorganic absorbent material. Clean up residue with acetone or similar solvent. Place in a metal container approved for transportation by appropriate authorities. Seal the container. Dispose of collected material as soon as possible.

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