

Easy to apply. Easy to clean.

Application techniques for easy-clean electronic device surfaces using 3M™ Novec™ Electronic Grade Coatings

Introduction

Touch panel displays and hand-held electronic devices have become part of our everyday lives. Fingerprints, oils, liquids, cosmetics and more, however, can make their surfaces unappealing and difficult to use.

3M™ Novec™ 2202 and 1720 Electronic Grade Coatings are designed to provide easy-clean, smudge resistant performance for glass and glass-like surfaces, helping protect and maintain the appearance of electronic devices. These products are clear, low viscosity, low surface tension solutions of fluorinated silanes diluted in a segregated hydrofluoroether solvent. Easy to apply using spray, dip or other methods, they dry in seconds and should be thermally cured for enhanced durability.

To help explain how to apply Novec coatings for easy clean applications, we have created this quick guide. Figure 1 outlines this simple process.

Figure 1.



Prepare your surface

The surface to be coated must be clean and dry. Plasma cleaning is recommended over aqueous cleaning to eliminate drying steps. Plasma cleaning process conditions for many types of substrates are typically 1 - 5 minutes in a 50:50 mixture of O₂ and Argon (Ar) plasma at 500W.

Alternative cleaning methods include piranha solutions or SC1 mixtures. Typical piranha solutions are 3:1, 4:1 or 8:1 mixtures by volume of concentrated sulfuric acid to 30% hydrogen peroxide. Piranha solutions are oxidizing agents so they will remove organic contaminants from the surface in addition to hydroxylating it. SC1 baths are milder and often composed of 1:2:20 ammonium hydroxide to hydrogen peroxide to water by volume.

When using an aqueous cleaning bath, it is best to obtain a spot-free dried substrate before coating. To clean with spot-free drying, the substrate may need to go into baths of water, isopropyl alcohol (IPA) and 3M™ Novec™ 7100 Engineered Fluid subsequent to the cleaning bath.

It is recommended to coat the glass within one hour of cleaning, regardless of which cleaning method is used.

Note: Follow all applicable precautions and directions. Always practice smart and safe industrial hygiene practices.

Application option 1: spray

The coating coverage will depend on the valve, canister pressure, stroke setting, atomization pressure, gantry (nozzle) speed, area spacing and nozzle height. The operator must determine the exact conditions needed based on their machine's configuration. Coating coverage will be determined by the surface and applicator, as well as the coating chosen and environmental conditions during application.



Spraying of the coating needs to be continuous for quality coverage.

Using an automated spray coating machine is the preferred application method. An atomization spray machine allows the operator to better target thin coating thicknesses than non-atomized spray.

When using air atomization, a clean, dry gas such as nitrogen is recommended. Depending on the configuration of the valve needle, it may be necessary to keep the atomization pressure slightly lower than the canister pressure in order to achieve consistent flow rates.

To help prevent sputtering and uneven spray cones, the fluid canister must be filled with more material than is needed to run the entire spray pattern. This extra coating solution is needed to compensate for tubing lengths and dead volume in the plumbing to the spray nozzle.

There are many commercial automated spray coating machines and nozzles that can be used to apply Novec coatings. Each may use different settings to optimize coating application. 3M uses the following parameters with Novec 2202 and 1720 Electronic Grade Coatings.

Parameter	Recommended Setting
Valve	PVA FCS-300R
Canister pressure	5 to 10 psi
Stroke setting (nozzle opening)	0.0025" to 0.0030"
Atomization pressure	3.5 to 4.5 psi
Gantry (nozzle) speed	50 mm/s
Area spacing (distance nozzle moves between passes)	10 mm
Nozzle height (distance from nozzle to substrate)	5 to 15 cm

To find the settings configuration for your needs, begin by setting a flow rate, then adjust your spray cone, and finally, set the gantry speed, area spacing and nozzle height. When spraying Novec 2202 or 1720 coatings using the FCS-300R valve, the most desirable canister pressure range is

from 5 to 10 psi and a stroke setting of 0.0025" to 0.0035". This should provide a flow rate of approximately 6.3 to 6.8 mL/min. This optimal flow rate can be achieved with several different equipment configurations offered by various spray equipment vendors.

The atomization pressure, gantry speed and area spacing should now be adjusted to ensure ample coating coverage. With the given flow rate and valve, the atomization pressure should be set at 3.5 to 4.5 psi, the gantry speed at 50 mm/s and area spacing of 10 mm.

The operator will need to find the proper distance between the nozzle and the substrate so that the atomized coating solution applies to the substrate slightly wet and the solvent evaporates almost immediately upon contact with the substrate. A good nozzle height is 10 to 13 cm, however, nozzle heights from 5 to 15 cm might be necessary depending on the other parameter settings that are chosen. Set the nozzle height so that subsequent spray passes overlap by 50 percent in order to ensure complete and uniform coating coverage.

To help protect workers and product quality, it is critical that the spraying process is controlled and properly ventilated. Consult the operating guide and local safety regulations for ventilation and personal protective equipment (PPE) requirements to follow during the spray coating process. Please see 3M's Safety Data Sheet (SDS) for more specifics of safety, storage and handling. It is the responsibility of the user to use appropriate safety and health practices.

When the spray coating is complete, it is recommended to flush equipment with 3M™ Novec™ 7200 Engineered Fluid to maintain cleanliness.

Application option 2: dip

The substrate should be removed at a constant rate. A removal rate of 30 centimeters (12 inches) per minute is suggested. The faster the substrate is removed, the more coating will remain on the surface. However, the post-cure coating film is a monolayer and excess coating will not result in a thicker coating or provide extra protection. Excess material will need to be removed in post-cure cleaning steps. Parts should be allowed to dry before any additional processing.

Cure the coated parts

Coated substrates should be cured for optimal performance and durability:

Novec Coating	Recommended Curing Temperature	Recommended Curing Time
2202	185°C	60 minutes
1720	135°C	15 minutes

Upon removal from the oven, the substrates will be hot and must be handled with appropriate precautions. After curing, allow the substrate to cool completely before moving to the next step. If the coating is not cured properly, its performance will be affected.

If other curing temperatures and timing cycles are needed to fit into your production process, please contact a 3M Technical Representative for other options.

Post-cure cleaning (optional)

After coating and curing, the surface of the substrates should have initial static contact angles for water greater than 110 degrees. Low initial static contact angles can be indicative of excess coating on the surface that is unbound to the substrate. If the initial contact angle is less than 110 degrees, a post-cure cleaning step may be necessary. To remove excess coating, the surface can be rinsed with Novec

7200 fluid and gently wiped with a soft, low linting cloth until dry.

Safety, handling & storage

To make sure your coating solutions perform as designed, it is important that they are handled and stored appropriately. Please follow the “Safety, Handling and Storage” information on the 3M Technical Data Sheets and Safety Data Sheets for these products.

To avoid thermal decomposition, the liquid coating solution should not be heated above 150°C (302°F) and the dried fluorochemical polymer film should not be heated above 250°C (482°F).

Please note that we do not recommend open, manual spraying of the material. Use of automated equipment that is enclosed and vented is highly suggested.

Before using 3M products, please read the current product Safety Data Sheet (SDS), which is available through your 3M sales or technical service representative or at 3M.com/electronics, and the precautionary statement on the product package. Follow all applicable precautions and directions. Always practice smart and safe industrial hygiene practices.

For additional information

To request additional product or process information, please contact 3M Customer Service at one of the numbers below or visit 3M.com/Novec. For other 3M global offices or information on other 3M products for electronics, please visit our website at 3M.com/electronics.

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3M™ Novec™ Engineered Fluids • 3M™ Novec™ Aerosol Cleaners • 3M™ Novec™ 1230 Fire Protection Fluid • 3M™ Novec™ Electronic Grade Coatings • 3M™ Novec™ Electronic Surfactants • 3M™ Novec™ Dielectric Fluids

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