

3M™ Novec™ 1700 Electronic Surface Coating

Frequently asked questions

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1) General



What concentrations of the product are used?

The 3M™ Novec™ 1700 Electronic Grade Coating product is a ready-to-use solution with a dissolved solid content of 2%. Pure 3M™ Novec™ 7100 solvent can be used to dilute the Novec 1700, or to remove the dried coating. Solutions with higher concentrations

are normally used to top up the concentration of the coating bath.

Can the coating materials be applied manually, e.g. using a spray bottle or a brush?

This is possible in principle, but would quickly lead to non-reproducible results, for which there are several reasons: The Novec 7100 solvent in which the fluoropolymer is dissolved evaporates extremely quickly already at low temperatures (boiling point 61 °C). When a spraying procedure is being used, extremely fine droplets are produced within an extremely short time which then evapo-

rates immediately, even before the polymer has reached the part that is being coated under certain circumstances. In principle, the same thing occurs when brushing: The solvent is finely distributed and evaporates before all of the parts to be coated have been reached by the product. Immersion coating, on the other hand, always ensures that complete wetting and coating of the components takes place in a controlled process, with a more or less uniform coating thickness.

Do critical parts of the components such as plug-in contacts, LED's etc. have to be masked?

No, that is not required in the majority of cases. The coating is thin enough to be penetrated by metal contacts. As far as we know at the moment, there is little or no effect on the visual properties of LEDs.

In the product data sheet an atmospheric lifetime of 4.1 years is indicated. Has the coating disappeared after this time?

This statement only relates to the solvent, and means that the solvent that is evaporated breaks down in the atmosphere in the specified time period. This has nothing to do with the polymer that constitutes the coating on the component.

For which PCB materials is this coating material suitable?

The coating can be used for all known PCB materials. From paper to FR to ceramics, aluminium etc.; no negative influences are known.

What about the viscosity of the coating bath? Does this affect the coating thickness? Is the viscosity dependent upon the temperature in the coating bath?

The Novec 7100 solvent has extremely low viscosity of about 0.4 cSt (at room temperature). The dissolved polymer only has a negligible influence on this. Basically, the viscosity is a function of the temperature, but hardly changes within the process because there is also little temperature variation. The process temperature is within the range of 20°C to 25°C. The viscosity has no influence on the coating thickness.

Is the Novec 1700 product a hazardous material?

No, the product does not require marking as a hazardous product in accordance with the ADR/GGVS and the CLP C&L REACH regulation requirements. It can therefore be transported, stored and used without problems. Details can be found in the safety data sheet.

What must be considered when storing the material?

The material should be stored in closed containers, not in the vicinity of heat sources, and away from concentrated acids and alkalines.

2) The solvent

What influence does the coating bath have on plastics?

An almost countless number of plastics lacquer and colours are used in electronics. Each component is affected by this. Measurements and experience have shown that only a few plastics can absorb small quantities of the solvent over a long period of time. However, because of the short exposure time during the coating procedure, no detectable change to plastics has been observed.

Can the solvent or the polymer that is used, attack the surface of the electrical components?

Paints and lacquers are not attacked. The solvent is considered to be chemically inert, i.e. not reactive. Individual testing should still be carried out.

Does the solvent that is used in the process influence copper wire coating (coiled enamelled wire)?

There have been no cases to date where this would

have occurred. The solvent is chemically active and does not attack hardened surfaces.

3) The coating procedure

Can any component be coated?

The components should be suitable for immersion. These are mainly those components that have been declared as washable parts. Only a small number of components are not suitable for immersion coating.

Do the assemblies have to be cleaned beforehand?

This is recommended but not mandatory. Contamination that is coated may be the starting point for corrosion.

How thick is the dried coating?

The average coating thickness is 500 nm. However, this thickness can vary between about 300 nm and 700 nm. This depends on various factors such as the geometry of the components with a bath concentration of 2% (+/- 0.2%), the presence (or lack) of contamination, etc.

How much can the coat thickness vary?

From 0 to approx. 4µm, depending on the mixing ratio. From approx. 300 nm to 700 nm when using 2% material. The coating thickness varies due to the surface energies of the different materials in an assembly; by the behaviour caused by the position during immersion; by the geometry of the assembly and by the set concentration of solids. The amount of influence can be reduced by fixing the position of the assembly in the immersion frame and controlling the concentration of solids.

How can the coating thickness be influenced?

The coating thickness is directly dependent on the mixing ratio of the fluoropolymer (solid) and the solvent. The supplied material contains 2%. This results in an average coating thickness of 500 nm. The tolerance of the product in the process is between 1.8% and 2.2%. If the value is above or below this, the mixing ratio must be corrected. This is carried out during the process and measured. Any mixing ratio can be set. A higher concentration increases the thickness of the coating, and a lower concentration reduces the thickness.



How is the mixing ratio of the bath monitored?

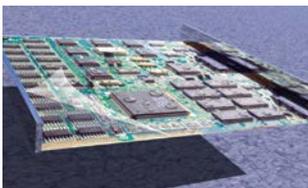
At the moment, the usual method of weighing is normal and functional. Mixing then

also takes place manually. Both the calculation and required dosing quantities are carried out using Excel spreadsheets and are therefore also documented. It is mixed in directly in the bath.

In the future, an optional electronic measuring device will be provided that works on the basis of ultrasound measurement.

Why is it advisable to work with a coating thickness of about 500 nm?

With this value the coating is thick enough to provide reliable protection from moisture and corrosion. However, the coating is then thin enough for metal contacts to penetrate in the majority of cases and provide reliable electrical contacting. This also applies to ZIF contacts. This has to be verified by application individually.



How can the coating thickness be checked?

Measurement can take place with an Interferometer, REM and other methods. Depending on the measuring procedure, only on ideal surfaces or with appropriate sample preparation.

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How does the coating behave at the sharp edges of electronic components?

These edges are also coated. One of the characteristics of the material is the extremely low surface tension, which is why the material does not contract or pull itself back from the edge.



Can fluorescent dyes be added to the fluoropolymer bath, so that the coating can be checked later?

Yes, in principle this is possible, but all tests

have shown that this is not practical. Not enough of

the dye and the fluorescent particles is deposited in the thin coating for a meaningful inspection to be possible. Short-wave UVB light has to be used when carrying out a UV inspection, which is harmful to human beings. Because of the coating process (100% immersion) and the low-viscosity solvent, which penetrates into the finest of structures, 100% surface coating is achieved. Because of this low viscosity and surface tension, no defects occur such as the ones that occur with high-viscosity coatings and the usual application technology. Actually, proof must be provided as to whether coating has taken place or not (e.g. because of erroneous operation or a system fault). The easiest form of proof that shows the modified surface before and after the coating procedure is shown below.



4) Characteristics of the polymer

Are there any instructions for handling the assemblies after coating?

No. The handling after coating is the same as without coating. Surface abrasion must be avoided. For example, if the surface is scratched by a tool, the coating will be damaged. Therefore: Do not transport as bulk material. This may damage the coating.

Can abrasion be caused by air flows containing dust particles?

Fans are often installed in devices. Only dust is normally pulled in. In this case the coating helps because less dust can stick to coated surfaces. Dust can still be retained, particularly if moisture is involved. However, the coating helps to keep the moisture away from the assembly too. Sand or other abrasive particles can damage the coating over time.

What is the ageing behaviour of the coating?
What happens with the coating after 15 years?
What happens to the service life within a temperature range of -40°C - +125°C?

Experience over a period of more than 15 years in use has shown that the material has little or no ageing. Fluorochemical compounds are known to be one of the most stable because of its strong bonding force. This is why fluorinated materials are extremely resistant. The service life of the coating within the range of -40 to +125 is considered to be unlimited. According to the 3M product data sheet, the continuous operation range is designed for -60°C to +175°C.

How does the coating material behave with temperature shocks within the temperature range of -40°C - +125°C?

No effects are known. The material remains plastic.

How much mechanical loading can the coating withstand?

The coating is not resistant to sharp tools or intensive friction. Movement and vibration do not affect the coating.

Has there been any long-term experience on the use of the coating?

The coating has now been successfully in use for more than 15 years. The good protective effect of the polymer compared to non-coated assemblies has been particularly evident in tropical areas.

Is the coating resistant to UV light?

Yes, the coating is UV-stable. It does not become discoloured or brittle.

Is the coating resistant to acids and alkalines?

The material is resistant to weak or diluted acids and alkalines.

Which operating materials is the coating resistant to?

The coating will not be affected by spray or droplets of oil, fuel, brake fluid or cooling water. The use of coated assemblies in these media is not possible.

Which operating materials is the coating not resistant to?

Acetone, strong acids and alkalines, fluorinated liquids.

Does the coating provide protection from electrically conductive soiling?

The coating does not provide protection if metallic or conductive parts accidentally contact a printed circuit board. If solid bridges are formed by electrically conductive particles, the surface resistance may be reduced in the presence of moisture. In the most unfavourable circumstances, arcing may occur. Tests with electrically conductive particles on narrow comb structures have shown that these can be critical.

Have the distances between conductors to be kept the same on coated and not coated boards?

Measurements have shown that the coating has a positive influence on surface insulation. Even in the event of condensation, resistance values are measured that would not be possible without coating. However, it cannot be guaranteed that the safety insulation class will be increased just because the coating has been used. The prescribed minimum distances can therefore not be reduced, despite the coating.

Can the coating be removed again?

Yes, by using Novec 7100 solvent.

Can repairs or soldering be carried out through the coating? How can the original coated surface be restored?

Yes, no pre-treatment is required, you can solder directly through the material. In this case, coating can be carried out afterwards by applying it with a brush in the relevant areas. Alternatively, the entire immersion coating procedure can be repeated. In this case the immersion process should be carried out for at least 60 seconds in order to prevent the build-up of a thicker coating.

5) Systems engineering

Which connections are required?

240V 16A electrical connection. Compressed air at 6 bar if required.

How much current and compressed air is required?

Current: approx. 5 kWh/d; air approx. 60l/h

Is an exhaust required?

No, neither a hood nor an extractor is required or prescribed. This would make the solvent evaporate more quickly and would therefore be counter-productive from a financial point of view. Normal ventilation is sufficient.

Do special safety precautions have to be taken? Does safety clothing have to be worn?

Eye protection is required when filling the system with the liquid. Do not inhale the vapours from the solvent. The room must be well ventilated. Details can be found on the safety data sheet for the product. Safety clothing is not required to operate the system, since you do not come into contact with the liquid. An ESD protection jacket is normally worn, which also protects the clothing if any liquid drips out of the assemblies. The use of gloves are recommended.



Are any special work-piece carriers available for assemblies that are difficult to position? Does the assembly always have to be adapted accordingly

if no harness is being used? Holders are then provided, which are placed in the baskets.

What is the average cycle time?

We allow 30 seconds for immersion and 5 minutes for drying. The time taken to change the basket must also be taken into account. The total cycle time is about 6 minutes.

How long is the drying time?

The drying time depends on how the material penetrates into gaps and small cavities. The drying time on a smooth surface can be about 60 sec. With complicated assemblies the drying time can be up to 300 seconds. Extreme cases are possible because of cavities such as relays, switches, IGBTs etc. and/or ventilation. The drying time must therefore be determined from case to case.

What happens to the drying time if the mixture in the immersion bath changes?

There will only be minor changes to the drying time because of the mixing ratio, unless extremely high solid contents are used. (3%-10%).

Do the assemblies require follow-up treatment?

No, no follow-up treatment is required. Hardening in an oven is not required either.

What happens if the system is disconnected from the power supply? Does the bath have to be emptied to prevent the solvent from evaporating?

The effect of the cooling will continue for quite some time. However, if the power failure occurs over the weekend, the system will heat up and solvent will start to evaporate. A certain amount of vapour will therefore escape. Otherwise the system is sealed if the lids of the tubs are closed and therefore the amount of evaporation is minimal. But the bath should first be recooled before the machine will be reopened. Generally in case of an expected down time for more than 1/2 day, it is advisable to empty the system in advance.

How much solvent evaporates in the sealed system when it is not working?

Evaporation of about 100 ml/d can be expected. In principle, the systems are designed for recovery of almost 100% of the solvent that is used. Losses occur during operation because of system-specific evaporation and mainly because of removal by the assemblies (ladling geometries). Drag out.

How much solvent evaporates in the system during operation?

Losses are generated due to drag out by the assemblies. The amount can only be determined by the operator. Ever longer the drying time within the machine, the lower the drag out losses. Fluid collection in components must be avoided. Positioning the assemblies correctly in the basket should prevent this.

Is the filling height checked automatically?

Yes, by means of direct filling level measurement. This is also required in order to control automatic metering (option), because this depends on how much material is currently in the system.

How high is the maximum permissible processing temperature?

An immersion bath is normally used at room temperature or slightly higher, the drying zone is at approx. 4°C (cold trap). The solvent evaporates at 61°C. The process must operate below this tem-

perature. The bath would boil at 61°C, and the solids would be left behind as a polymer layer.

How often does the system require maintenance?

Apart from regular emptying of the condensation tank (about once per week), occasionally replacing the ventilator filters (depending on the degree of soiling of the air supply) and cleaning the particle filters (when indicated), maintenance is only required annually. This includes checking, cooling water checking and wear checking.

Does the coating bath require regular cleaning?

This is essentially carried out by the filtering. Metal sludge could also build up in the bath. Cleaning is therefore recommended as part of annual maintenance. Then the bath is drained through a filter and then filled up again.

6) Approvals and listings

Is the coating approved by OEMs in the automotive industry?

Yes, it is approved or recommended by many OEMs.



For any future question please contact your local 3M sales representative.



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We reserve the right to alter design to be in conformity with quality improvements, extended application possibilities or for manufacturing reasons.

Is the coating on the GADSL?

We do not know whether it is listed in the Global Automotive Declarable Substance List (GADSL).

Is the coating listed in the IMDS database?

Yes (IMDS = international material data systems, automotive industry)

Is the coating UL listed?

Yes. QMJU2.E319367

Is the Novec 1700 product REACH registered?

Yes, the Novec 1700 solvent is registered. The polymer is exempt from REACH registration, and the individual monomers & building blocks don't require registration in the quantities that are currently imported in.

Is the coating RoHS compliant?

Yes.