



Technical Data Sheet

US Patent 5877254

Visgard® 121-35

Abrasion, Chemical & Scratch Resistant Anti-Fog Coating

DESCRIPTION

Visgard 121-35 Coating delivers an unmatched combination of properties for optical applications, incorporating permanent resistance to fogging, scratching and chemical attack.

Suitable for dip and flow application. Coating may be diluted down considerably to produce a thin film application for inexpensive safety eyewear.

The unique combination of properties allows products to be coated once with a single solution rather than coating one side to protect against scratching and the other side for fog resistance. Visgard coatings are elastic and non-brittle polyurethanes that do not degrade the impact strength of molded parts. Visgard will not crack when flexed, and coated parts can be thermoformed to small radius bends without loss of performance.

FEATURES

- Excellent Abrasion, Chemical, and Scratch Resistance
- Permanent, Water Washable Anti-Fog Properties
- Exceptional Optical Clarity
- Thermoformable & Flexible
- Tintable at Room Temperature
- Primer-free adhesion to PC, CR-39, Nylon & Certain Other Clear Plastics

BENEFITS

- Easy to use and highly stable, can be stored at room temperature
- Does not require pre-mixing, providing best-in-class performance in a single application.
- Cost effective, long product service life reduces the need for frequent tank change outs.
- Streamlines manufacturing, enhancing yields and profitability.



Premium Anti-Fog, Abrasion, Chemical & Scratch Resistance

Product Applications

- Medical, Military, Safety & Sports Eyewear
- Face Shields, Goggles, Masks & Visors
- Windows & Mirrors

Visgard 121-35 Anti-Fog coating delivers best-in-class abrasion, chemical and scratch resistance, with exceptional optical clarity.

Visgard **scratch resistance** is equal to many commercial anti-scratch finishes. **Anti-fog** properties are retained after repeated washings and years of use. Most other anti-fog coatings lose their active ingredient or become saturated and fail after washing only once. Visgard consists of cross-linked hydrophilic polymers that cause condensed moisture to spread invisibly rather than forming droplets which appear as fog. **Anti-static** properties are an added benefit; however, the magnitude will vary with humidity.



Substrate Materials

- CR-39®
- Nylon
- Polycarbonate (PC)
- Certain Other Clear Plastics
- Glass with Primer

Physical Characteristics	
Appearance*	Clear light blue
Density	0.98 g/cc
Solids Content (TM-100)	24 - 26 %
Solvents	Diacetone Alcohol
Refractive Index	1.532
Viscosity (TM-109)	20 - 55 cps

*Coating will appear colorless on treated parts, blue is added to enhance brightness.

Coating is supplied ready to use, and does not require premixing. The solution will remain fluid and usable for many months. It will not solidify or increase in viscosity without heat. Designed for dip coating, also suitable for flow coat application.



Visgard 121-35

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Operating Guidelines

TRANSPORTATION & IN-TRANSIT PRODUCT CONDITIONS

Product can be stored in ambient conditions during shipment from FSICT to the customer's site.

STORAGE CONDITIONS

When stored in a tightly sealed container in a cool dry place, Visgard 121-35 coating will remain usable for six (6) months.

PRODUCT SHIPPING & AVAILABILITY

Typical lead-time for shipment of Visgard 121-35 is four (4) weeks from confirmation of a purchase order. FSICT provides several shipping options. Please contact an FSICT representative to determine which option best fits your needs. All orders are shipped F.O.B. Additional shipment charges including customs clearance and fees (if applicable) are the responsibility of the customer.

HEALTH & SAFETY INFORMATION

Before using this product, read and understand the Safety Data Sheet, SDS, which provides information on health, physical, and environmental hazards, handling precautions and first aid recommendations. **For a copy of an SDS, contact an FSICT sales or customer service representative.**

WARRANTY & LIABILITY LIMITATIONS

This document does not constitute any warranty or representation regarding FSICT's product. Please refer to FSICT Standard Terms and Conditions or to your purchase agreement with FSICT for the warranty coverage of FSICT's product.

Handling & Use

For best results use dip withdrawal speeds of 5.0 to 12.0 inches per min. (13 to 30 cm/min.) in a clean-room environment. A solution viscosity range from 10 to 50 cps is desirable; although good coatings can be produced over a much wider viscosity range by adjusting percent solids, dip speed, air dry time and solution temperature.

Target coating thickness to 5 to 6 microns dry. Abrasion resistance and anti-fog performance increase with coating thickness.

Drip tabs are recommended to minimize accumulation at the bottom of each part, although a sufficiently slow withdrawal rate usually prevents visible pooling. Also, parts can be withdrawn and held for 30 to 60 seconds in a position that allows the bottom of each part to barely touch the solution, draining off excess material. It is helpful to tilt parts at an angle of 30 to 45 degrees so any coating accumulation at the bottom runs off to the corners of lenses, safely out of the visual area.

Parts having difficult geometries can be coated at low solids (15%) with fast withdrawal speeds. This applies excess coating which will drain off quickly before drying begins.

If Visgard solutions are chilled; care must be exercised to ensure that the temperature of coated parts is not below the dew point temperature in the coating area. Otherwise, moisture may condense causing flow abnormalities and possibly precipitating dissolved polymers.

Viscosity will not change significantly over time, but percent solids should be monitored periodically and adjusted to maintain suitable viscosity (see "Dilution" and solids content). Humidity levels above 65% may cause a light haze to form on the Visgard coated surface immediately after cure. This will dissipate within 1 to 2 hours at lower humidity and performance properties will be completely normal. The haze can also be removed with a dry cloth.

Caution

Silicon hard coatings are incompatible with Visgard and will impair anti-fog performance even at low concentrations. Be sure all equipment is thoroughly clean and free from other coating residues before evaluating Visgard in production systems. A peristaltic pump is best for initial tests because there is no actual contact of Visgard with the pump chamber or mechanical parts. Visgard is incompatible with PVC tubing due to plasticizer extraction. Use only LDPE or PU tubing. Circulating diacetone alcohol (DAA) through the pump, hoses and filter for 8-12 hours is a good way to remove possible contaminants before start-up or change over.

Dilution

Visgard 121-35 is ready to use as is. No dilution is required. Make-up solvent is 1-methoxy-2-propanol to maintain solids.

Filtration

Solutions should be filtered through a 0.5 micron filter cartridge for several hours before coating operations begin and continuously throughout the coating process. When operations stop, drain Visgard from system and store at 20-30°C (68-86°F) in a sealed container. Circulate DAA through system and drain before replacing with Visgard if shutdown will extend more than 24 hrs. If shutdown will be overnight only, continue pumping but do not allow Visgard to flow in contact with humid air. All connections must be air-tight and the system designed to prevent turbulent flow, which can cause bubbles.

Cure

Best cure is obtained by heating one hour at 125°C (257°F). Check actual surface temperature with temperature indicating labels. **Visgard 121-35 will not cure hard at temperatures below 110°C (230°F) and the under cured coating will feel tacky with poor abrasion resistance.** Under-cured coatings can be hardened by baking again at the proper temperature as long as this is done within a 2 to 3 day window. Severe over-curing may cause discoloration. A surface haze may develop under high ambient humidity, or if cure time is extended. This will disappear on standing for several hours at lower humidity.

Molded parts which contain high levels of stress are susceptible to solvent attack. Stress crazing can affect optical clarity and can also reduce impact strength so it is essential that molded parts be tested fully before they are offered for commercial use.

Coating Thickness (microns) vs. Percent Solids

Dip-coating withdrawal rate		@30% solids	@25% solids	@20% solids
mm/sec.	in./min.			
.085	2.0	9	6	3
2.1	5.0	12	8	5
4.2	9.9	14	10	6.5



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Visgard® is a registered trademark of
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Operating Guidelines (Cont.)

Cure (Cont.)

If stress crazing is severe, stress can be reduced by annealing the parts for two (2) hours at 130°C (266°F) before coating. After annealing, let the parts gradually cool to room temperature before coating. The coating can also be diluted with alcohols, such as isopropanol or tertiary butanol, as described above. Coated parts can also be pre-dried 15 min. at 100°C to flash off solvents, followed by normal cure cycles.

Coatings may be pre-cured 10 min. at 100 - 110°C (212 - 230°F) to reduce surface tackiness, followed by full cure, but this is not necessary. Pre-cured coatings can be stripped for re-coating, if necessary, by immersing parts in DAA or Dowanol PM. Fully cured coatings are very difficult to remove.

Chemical Resistance

Visgard coatings will resist exposure to most alcohols, ethers and aliphatic hydrocarbons, including gasoline and jet fuel. They will also withstand commercial glass and lens cleaners, even those containing ammonia. Avoid exposing to strong acids. Visgard is not intended to resist aggressive solvents such as methyl ethyl ketone and toluene.

Shelf Life

Six (6) months from date of shipment if stored in tightly sealed containers in a cool, dry place - longer if refrigerated. Keep away from sources of ignition. Consult SDS for shipping, disposal and health hazard information.

Packaging Coated Parts

Use high density polyethylene (HDPE) bags rather than low density bags, preferably sealed to exclude moisture. Do not package in an area where humidity is above 70%.

Tinting

Cured Visgard coatings will accept commercial ophthalmic dyes at room temperature without sacrificing anti-fog properties. Usually only 1 to 5 min. dip time is required, and gradient tints are easily produced by controlled withdrawal. Adding 5% methyl or ethyl alcohol to the aqueous dye bath promotes uniform dyeing. It is important to test the colorfastness of each individual color, as well as the effect on ultimate coating properties. Very deep hues (<40% visible light transmission) are more likely to reduce scratch resistance and anti-fog performance.



Clean-Up

Wash equipment with isopropanol, diacetone alcohol or methyl ethyl ketone before the coating cures. Fully cured coatings may be difficult to remove. Dispose of waste in accordance with Federal, state and local regulations.