



# Technical Data Sheet

US Patent 5877254

## Visgard® 112-20

Abrasion, Chemical & Scratch Resistant Anti-Fog Coating

### DESCRIPTION

Visgard 112-20 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 112-20 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*	Light blue to Blue-green
Density	0.94 g/cc
Solids Content (by weight)	30%
Solvents	Tertiary Amyl Alcohol Diacetone Alcohol
Refractive Index	1.532
Viscosity (Brookfield)	30 — 50 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 112-20

Abrasion, Chemical & Scratch Resistant Anti-Fog Coating

## 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 112-20 coating will remain usable for six (6) months.

### PRODUCT SHIPPING & AVAILABILITY

Typical lead-time for shipment of Visgard 112-20 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.

### Handling & Use

For best results use dip withdrawal speeds of 2.0 to 5.0 inches per min. (5 to 13 cm/min.) in a clean-room environment. A solution viscosity range from 20 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. The dilution solvent can be DAA or a 50:50 blend of DAA and isopropyl alcohol (IPA).

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.

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
Flow-coating (15 cm vertical run at 20% solids)				
Top		—	—	4.5
Middle		—	—	7.5
Bottom		—	—	9.0

### 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

Dilution to 25% solids is recommended for dip coating (1000g 112-20 plus 200g DAA). Recommended solvent is Diacetone alcohol (DAA), but isopropanol and Dowanol PM (1-methoxy-2-propanol) can be used if curing ovens have sufficient air flow to exhaust solvent fumes before the curing reaction begins. If dilution is required to the point that coating thickness is reduced, proper thickness may be restored by faster withdrawal speeds, but this may increase the build-up at the bottom of each part. Maintain solids content at 15% or higher.

For flow coating, dilution to 20% solids is recommended (1000g 112-20 + 500g DAA).

The coating composition will tolerate small amounts of aliphatic and aromatic hydrocarbons, as well as simple ketones, esters and lower alcohols. However, these solvents may affect wetting behavior and may attack sensitive plastics. If solvent-soluble dyes are to be added, it is important to first evaluate color stability, plus the effect on viscosity stability and final coating properties (see **Tinting**).



# Visgard 112-20

Abrasion & Chemical Resistant Anti-Fog Coating

## Operating Guidelines (Cont.)

### 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 Coating Technologies Standard Terms and Conditions or to your purchase agreement with FSICT for the warranty coverage of FSICT's product.

### 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 112-20 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.

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.



# Visgard 112-20

Abrasion & Chemical Resistant Anti-Fog Coating

## Contact Information

**FSI Coating Technologies**  
**Corporate Office - N.A.**  
 45 Parker, Suite 100  
 Irvine, California 92618 USA  
 Tel: +1-949-540-1140  
 Fax: +1-949-540-1150  
 technicalsupport@fsicti.com

**SDC Technologies - Americas**  
**Corporate Headquarters**  
 45 Parker, Suite 100  
 Irvine, CA 92618 USA  
 800-272-7681 (Toll Free USA)  
 Tel: +1-714-939-8300  
 technicalsupport.ca@sdctech.com

**SDC Technologies - Europe**  
 Unit 6 John Baker Close  
 Llantarnam Industrial Park  
 Cwmbran, Torfaen  
 NP44 3AX, United Kingdom  
 Tel: +44-1633-627030  
 technicalsupport.eu@sdctech.com

**SDC Technologies - China**  
 No. 1585 Gumei Road  
 Xuhui District  
 Shanghai 200233  
 PR China  
 Tel: +86-21-61995035  
 customercare.cn@sdctech.com

**SDC Technologies Asia Pacific Pte. Ltd.**  
 27 Tuas South Street 1  
 Singapore 638035  
 Tel: +65-6210-6355  
 customercare.ap@sdctech.com

[fsicti.com](http://fsicti.com)

## Operating Guidelines (Cont.)

Typical Properties			
	Visgard® @ 8 mi- crons thick- ness	Visgard® @ 4 mi- crons thick- ness	Most other hard coat/ anti-fogs
Anti-Fog	Pass ASTM F659 and EN168	Pass ASTM F659 and EN166	Fail ASTM F650 and EN166
Taber Abrasion*	10% Δ haze	18% Δ haze	4 to 8% Δ haze
Falling Sand Abra- sion	Diffusion of Light = 1.5	Diffusion of Light = 7	Diffusion of Light = 6 to 28
Bayer Abrasion	5% Δ haze (R=4)	15% Δ haze (R=1.5)	20 to 30% Δ haze (R= 0.6 to 1.0)

\*100 cycles at 500g load with CS10F wheels. Only cyclohexane and soft clean-room wipe is to be used to remove Taber residue from the abraded surfaces of Visgard test plaques. Using another solvent will result in erroneous haze measurements.



Visgard® is a registered trademark of FSI Coating Technologies

CR-39® is a registered trademark of PPG.

©2018 FSI Coating Technologies, Inc. All rights reserved. FSI Coating Technologies is a wholly-owned subsidiary of SDC Technologies, Inc.

**Visgard®**

**fsi**

Coating Technologies

**sdctech**  
Technologies