



# Technical Data Sheet

US Patent 5877254

## Visgard® 106-94L

Abrasion, Chemical & Scratch Resistant Anti-Fog Coating

### DESCRIPTION

Two part-polyurethane-based thermal cure coating, provides excellent resistance to fogging, scratching, and chemical attack. Visgard consists of cross-linked hydrophilic polymers that cause condensed moisture to spread invisibly rather than forming droplets that appear as fog.

Intended for use on polycarbonate, acrylics, nylon, PVC, PETG, and certain other clear plastics without primers, where limited cure time is applicable. Formulation appropriate for panfed reverse roll, Meyer rod and slot die coating methods.

### FEATURES

- Excellent Abrasion, Chemical, Impact & Scratch Resistance
- Water Washable Anti-Fog Properties
- Exceptional Optical Clarity
- Anti-Reflective (A/R) Compatible

### BENEFITS

- Can be stored at room temperature
- Streamlines manufacturing, enhancing yields and profitability.



Premium Anti-Fog, Abrasion, and Chemical Resistance

### Product Applications

- Polycarbonate Sheet & Film
- Motorcycle Visors & Face Shields
- Protective Goggles & Masks
- Ski Goggles

Designed for roll-to-roll coating, delivers best-in-class abrasion, chemical, impact, and scratch resistances, with exceptional optical clarity. Visgard scratch resistance is equal to many commercial anti-fog scratch finishes. Anti-fog properties are retained after repeated washings and years of use. Many other anti-fog coatings lose their active ingredient or become saturated and fail after only brief exposure to water.



### Substrate Materials

- Acrylic (PMMA)
- Nylon
- Polycarbonate (PC)
- PVC & PETG
- Certain Other Clear Plastics

### Physical Characteristics

	Part A	Part B
Appearance	Clear light (or pale) yellow	Clear to light yellow
Density	0.94 g/cc	1.05 g/cc
Solids Content (TM-100)	28 - 30 %	66 - 68 %
Solvents	Diacetone alcohol Cyclohexane N-Methyl-2-Pyrrolidone 2-Methylbutan-2-ol Xylene	N-butylacetate/ xylene
Viscosity (TM-109)	5 - 25 cps	30 - 300 cps



# Visgard 106-94L

Abrasion Chemical & Scratch Resistant Anti-fog Coating

## 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 cool dry place, Part A will last for one (1) year, Part B for six (6) months from the date of manufacturing.

## PRODUCT SHIPPING & AVAILABILITY

Typical lead-time for shipment of Visgard 106-94L 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.

## Mixing, Filtration & Pot Life

### Mixing Ratio

Mix 10 parts A to 4 parts B, by weight (2.8:1 by volume) and mix at low speed until homogeneous. Be sure all components are fully dissolved. Allow to stand long enough for all bubbles to break.

This will give a clear solution with a low viscosity of 15-20 cps (12-14 sec. Ford 4) containing 40% solids. The coating formulation works best if it is diluted to 27% solids with a mixture of 75% tertiary butanol (TBA) and 25% diacetone alcohol (DAA). Recommended dry coating thickness ranges from 0.4 to 0.5 mils (10 to 15 microns), with the thicker coatings providing the best properties.

### Caution

**Silicone 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. Circulating diacetone alcohol through the pump, hoses and filter is a good way to remove possible contaminants before start-up or change over.**

Pure TBA is a solid of 75°F (24°C) and can be handled more easily by adding 10% DAA. This will liquify solid material and will prevent it from solidifying at temperatures as low as 32°F (0°C). **Do not use normal butyl alcohol, isobutyl alcohol or secondary butyl alcohol. Do not add water, alcohols (other than those recommended), glycol ethers, or other compounds that are reactive toward isocyanates.**

The coating composition will tolerate small amounts of aliphatic and aromatic hydrocarbons, as well as simple ketones and esters. However, these solvents may affect wetting behavior and may attack sensitive plastics. Solvents that contain moisture will cause gelation. If solvent-soluble dyes are to be added, it is important to first evaluate color stability plus the effect on pot life and final coating properties.

### Suggested Starting Formulations

Visgard Part A	100 parts
Visgard Part B	40 parts
Tertiary Butyl Alcohol	28 parts
Diacetone Alcohol	42 parts
Solids Content	27%
Viscosity	16 cps

### Filtration

Solutions should be filtered through a 0.2 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 41-50°F (5-10°C) in a sealed container. Circulate DAA through system and drain before replacing with Visgard if shut-down will extend more than 24 hrs. If shutdown will be overnight only, continue pumping but do not allow Visgard to flow in contact with atmosphere. Do not allow Visgard to stand in a warm pump chamber as this may cause gelation.

### Pot Life

**IMPORTANT NOTE: The pot life of Visgard solutions depends on the environment, specifically the level of humidity in mixing and application areas.** At 22°C (72°F) and 35% relative humidity (RH), the pot life will range from 36 to 48 hours. Adding freshly mixed solution to "old" materials extends the working life.

**Caution:** When the pot life of mixed solutions has been reached, the material will thicken and gel. **This can be stopped by adding a mixture of methanol and toluene (1:1) when the solution viscosity becomes noticeably high.** Avoid using Visgard where humidity is 70% or higher. Under these conditions the pot life may be as short as 12 hours and gels may limit usefulness. If Visgard solutions are chilled, be sure that humidity in the coating area is low enough to prevent moisture condensation in and around tanks, coated rollers and film substrates.



# Visgard 106-94L

Abrasion Chemical & Scratch Resistant Anti-fog Coating

## Applications, Curing & Performance

### 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.

### TRADEMARKS

Fantastik® is a registered trademark of S. C. Johnson & Son, Inc.

Formula 409® is a registered trademark of The Clorox Company.

Lexan® is a registered trademark of the SABIC.

Scotch Brite® is a registered trademark of the 3M Corporation.

TopJob® is a registered trademark of Proctor and Gamble Company.

Visgard® is a registered trademark of FSI Coating Technologies, Inc.

### Shelf Life

The unmixed components of Part A remains stable for one year, and the Part B for six months. Do not use if either material contains lumps or insoluble precipitate. **Do not open containers in a humid area.** Store in a cool, dry place, away from sources of ignition.

### Applications & Cure Requirements

Cure requirements range from about 30 seconds at 300°F (150°C) to 2 min. or more at 220°F (104°C). After curing, the coating will feel rubbery and it will take an impression from any uneven surface it contacts. For this reason it is important to laminate a hard, smooth and glossing masking before winding. High gloss oriented polyester film (PET) or polyethylene-polyester co extruded film such as Scapa Tables 1/2 laminating film #26/D8 is recommended. Oriented polypropylene film may affect anti-fog properties. Adhesive backed or co-extruded polyethylene masking films are also not recommended. Any masking other than those recommended may be thoroughly tested before commercial use.

### Substrates

The preferred substrates are polycarbonate and biaxial oriented polyester films. Excellent wetting flow and adhesion are usually obtained without the use of primers or additives. Acrylics, PVC, PETG, cellulose, metalized plastics, and some nylons also be coated without primers. PVC and cellulosic plastics may contain plasticizers that can be extracted by the solvents in Visgard and may be problematic.

If a substrate cannot tolerate sufficient heat to cure Visgard, then masking films may not remove cleanly, or may leave haze or spots. Some temperature sensitive films have been treated by laminating temporarily to a more heat resistant film such as PET.

Visgard coated thin PET films are available from FSICT and can be used to "coat" a material via permanent lamination. The use of Visgard for application to film and sheet products is restricted. Please contact FSICT for details.

### Clean-Up

Wash equipment with Isopropanol, diacetone alcohol or methyl ethyl ketone before the coating cures. Fully cured coatings may be difficult to remove. **Add 10% isopropyl or alcohol to any leftover Visgard to prevent gelation so waste can be properly disposed.**

### TECHNICAL MEMO

#### VSIGARD PERFORMANCE PROPERTIES

### Clarity

Visgard coatings are exceptionally clear. While the specification limit is 1% haze, actual values are usually less than 0.5%. Often the coating will fill in fine scratches and actually improve the clarity of molded parts.

### Scratch Resistance

Rubbing lightly with #0000 steel wool will leave only a few light scratches on the Visgard surface. Occasionally, fine scratches will appear but will heal when warmed slightly or when moistened, or after simply standing at room temperature for 15 to 30 minutes. Pencil hardness is 8H (on acrylic).

The following data were obtained using a Taber abraser with CS10F wheel and 500g load, according to ASTM D1044:

	100 Cycles	500 Cycles
Uncoated Polycarbonate (PC)	28% (approx.) Δ haze	86% (approx.) Δ haze
Visgard coated PC, 15 microns	5.6% Δ haze	25.5% Δ haze
Visgard coated PC, 8 microns	7.6% Δ haze	43.3% Δ haze

Falling sand abrasion was performed according to ASTM D968 using 3kg standard Ottawa Sand :

Uncoated Polycarbonate (PC)	35% (approx.) Δ haze
Visgard coated PC, 13 microns	1.49% Δ haze
Visgard coated PC, 8 microns	1.72% Δ haze



# Visgard 106-94L

Abrasion Chemical & Scratch 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 7, Avondale Industrial Estate  
Pontrhydryn, Cwmbran  
NP44 1UG, Great Britain  
Tel: +44-1633-627030  
technicalsupport.eu@sdctech.com

**SDC Technologies - China**  
No. 1585 Gumei Road  
Xuhui District  
Shanghai 200233  
PR China Tel: +86-21-61517768  
customer-care.cn@sdctech.com

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

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

©2019 FSI Coating Technologies, Inc.  
All rights reserved. FSI Coating Technologies is a wholly-owned subsidiary of SDC Technologies, Inc.

106-94L\_180926

## Performance Properties

Visgard is superior to all other formable hard coats in Taber abrasion tests and comparable to most non-formable hard coats on flexible substrates. In the falling sand test, Visgard outperforms all other hard coats tested. Bayer abrasion tests yield ratios range from 2.5 at 6 µm coating thickness to over 10 at 15 µm thickness.

### Anti-Fog

Anti-Fog Test #1 - The test surface is immersed in distilled or deionized water for 1 hr. and allowed to dry for at least 1 hour. It is then placed face down over a container of warm water (122°F/50°C) so as to completely cover the opening. Visgard coatings may exhibit a ring of condensation as the coating hydrates, but will remain clear indefinitely thereafter. The test is complete when sufficient moisture has condensed to form large water drops.

Anti-Fog Test #2 - The test surface is immersed in distilled or deionized water for 24 hours, removed and allow to dry for at least 1 hr. The sample is then cooled in a refrigerator to approximately 40°F (4°C) and withdrawn to test chamber containing ambient air at 70°F (21°C) and 70% to 80% relative humidity. Materials coated with Visgard will remain free of fog indefinitely.

Untreated plastics or glass will fog within seconds. Inferior anti-fog coatings may fog immediately, or remain clear for a short time until they become saturated. Visgard passes ASTM and DIN tests for resistance to fogging.

### Chemical Resistance

Visgard coating is unaffected by brief exposure to:

Acetone	Ethanol	Glycol ethers/esters	Methanol
Ammonium hydroxide	Ethyl acetate	Hexane	Methyl ethyl ketone
Diacetone alcohol	Gasoline	Isopropanol	Toluene



### Weathering

The Visgard coating does not crack, peel or discolor from exposure to sunlight. The coating does not, however absorb enough UV light to protect sensitive plastics from yellowing.

### Maintenance & Care

Properly cured Visgard coatings will usually outlast the coated item. Resistance to cleaning solvents and detergents is excellent. While grease and oils will contaminate the surface and impair anti-fog effectiveness, these can be removed with a strong grease cutting detergent such as Fantastik® or Formula 409®. Coated articles should be cleaned regularly to prevent accumulation of oily deposits. Consult the Material Safety Data Sheet for further handling precautions.