Standard Operating Procedure

DryWired Liquid NanoTint

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Emergency Phone:	US: 1-800-535-5053, International: 1-352-323-3500
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Created:	07/20/16
Revision:	Original: 07/20/16

Type of SOP: ☒Process ☐Hazardous Chemical ☐ Hazardous Class

Table of Contents

I. PURPOSE

This document provides information on chemical handling, storage, application, disposal and safety techniques required for the use of DryWired Liquid NanoTint.

II. PHYSICAL & CHEMICAL PROPERTIES

Property	Liquid NanoTint
Physical State	Liquid
Color (liquid)	Dark Blue
Color (dried/cured)	Transparent, Blue Tint
Visible Light Transmission (VLT)	**~72%**
Infrared Transmission (IR)	**~5%**
Ultraviolet Transmission (UV)	**< ~0.1%**
Solution Flammability	Flammable
Cured Film Flammability	Non-Flammable
Hardness (ASTMD3363)	4H
Removable Glass Substrates	Yes
Removable Plastic Substrates	No
Warranty (interior coating)	10 years
Dry to touch time	2-3 hours
Cure time	14 days

Table 1. *Physical and chemical properties of Liquid NanoTint*

III. PROTOCOL/PROCEDURE

A. Site Preparation

Site preparation is applicable from a retrofit to manufacturing and everywhere in between. It is recommended to review site preparations before every application. It is recommended that Liquid NanoTint be applied on the interior side of the substrate. This is applicable when the coating is applied on the manufacturing level or as a retrofit. Environmental factors should also be considered whether applying to the interior of a building or in a manufacturing facility.

1. Environmental Conditions

Temperature and humidity should be monitored before and during the application process with a combination thermometer/hygrometer. For retrofits we have recommended a product (Material J). Please refer to Table 2 for ideal environmental conditions. HVAC System Settings: Air conditioning may need to

be turned down/off during the application and drying process due to turbulent air flow that may result in dust and debris being blown onto the wet coating film. This can be turned back on after the film dry-to-touch time has passed. Fans are helpful in drawing air and solvent odors out of the vicinity.

Temperature	41-95°F(5-35°C)
Relative humidity	70% or less

***Table 2**. Ideal Environmental Conditions Application*

2. Safety Considerations

All personnel present during the application process should wear the personal protective equipment (PPE) as specified by the safety data sheet and Section V of this document.

3. Disposal Considerations

Products should be disposed of as specified by the safety data sheet and Section IX of this document. In order to reduce the lingering vapors in occupied rooms remove waste as soon as possible.

B. Retrofitting

When retrofitting, there are a few other factors to consider as opposed to applying the coating at a manufacturing level.

1. Data Logging

To quantitatively determine the reduction in room temperature after Liquid NanoTint has been applied, an automatic **data logger,** such as the Kestrel Drop D2, can be used to measure the room temperature for a period of time before the coating is applied. It is suggested that the data logging begin ***at least*** one week prior to the coating application date. The data logger can gather post application data to identify the difference in room temperature after application versus before application. This is optional, but helpful in identifying and recording effectiveness.

2. Accessibility and Area

The coating area needs to be clear of any obstructions. Items such as window treatments, furniture, and decor should be removed. Consider whether step ladders, staging, lifts, etc., will be needed to reach the area to be coated. The area to be coated needs to be considered. Window with areas over 20ft^2 (2.0m^2) would

need either a 2-person application or, for a single person application, be done in two separate steps creating a seam. If this will be a single person application for large areas, it is recommended the area is coated on two separate days so the first coated area can dry and harden. On glass substrates the coating can be removed and reworked if needed. On plastic substrates the coating cannot be removed or reworked. Take this into consideration when evaluating area to be coated.

C. Materials and Equipment

It is the applicator's responsibility to supply all necessary equipment for application.

1. Chemicals and Application Equipment

Liquid NanoTint is supplied as a 1-kilogram kit. A 200-gram sample kit is available upon request. Table 3 lists the materials provided by DryWired in the 1 kilogram Liquid NanoTint Kit. Table 4 lists recommended materials for application.

Included Materials in 1 kilogram Kit
A. 1 kg NanoTint Liquid
B. 110g NanoTint Hardener
C. 32oz LNT Glass Primer
D. Roller Applicator Handle
E. High Density Foam Rollers (x4)
F. Metal Tray
G. Glass Mixing Rod
H. Mixing Cups (x6)
I. 1" Masking Tape (12 rolls)

Table 3. *1 kilogram Liquid NanoTint Kit Materials*

Recommended Materials
J. Thermometer / Hygrometer
K. Multi-Purpose Respirator
L. Weighing Scale
M. Glass Scraper
N. Paper Towels
O. Aluminum Foil
P. Lint Free Paper Towels (i.e. KimWipes 15"x17") or microfiber cloth
Q. Disposable Drop Cloths (i.e. Tape and Drape)
R. Powder-Free Nitrile Gloves
S. DryWired Glass Cleaner (for heavily soiled surfaces)

Table 4. *Recommended Materials for Liquid NanoTint Application*

2. Miscellaneous Equipment

a) Accessibility Equipment

Equipment to make the coating area accessible such as ladders or lifts.

b) Ventilation Equipment

Ventilation equipment that will ***not*** push air towards the coating causing particulates to stick to the film is helpful is removing solvent vapors and odors from the coating vicinity. Placing fans, or a similar piece of equipment, in adjacent areas to draw air out the area is recommended.

c) Other Equipment

Sealed buckets to store chemicals can be useful for transportation.

D. Surface Preparation

Surface preparation is the most important part of the coating procedure. It is **extremely important** to follow the steps for surface preparation carefully and remove all contamination so a strong bond between the substrate and the Liquid NanoTint can be formed. This is the key part of the coating process and will greatly affect the final appearance of the product. At this point in the process it is recommended to follow all safety procedures, especially the use of Personal Protective Equipment (PPE).

1. Cleaning and Masking

Wipe down glass and window frame(s) with water or a common household-cleaning product using a paper towel to remove obvious contaminants. For difficult to remove stains, a razor blade scraper can be used but care is needed not to scratch or crack the glass. Scrapers should **never** be used on **plastic substrates.** DryWired Glass Cleaner (Material S) can be used to degrease a surface and remove heavy soiling. Tape and Drape (Material Q) or disposable drop cloths should be utilized to cover flooring, walls, furniture, and other items from cleaning and coating materials. Apply the masking tape (Material I) to the window edges, seals and any other mechanisms that should be protected from being coated.

2. Priming

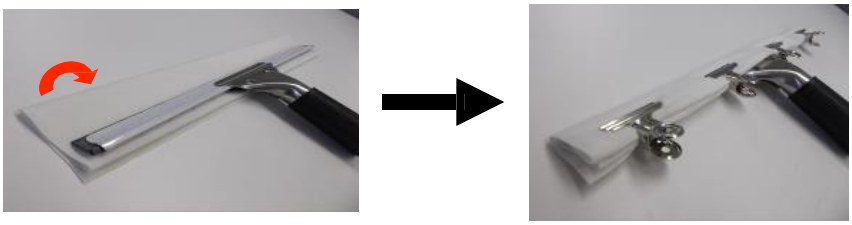
Wet a lint free paper towel such as Kimtech KimWipes or a micro-fiber cloth using the LNT Glass Primer (Material C). Wipe the primer on the surface using a buffing

motion and a good amount of force to remove all remaining contamination. The primer should leave a super-hydrophilic surface for coating. For larger areas, the following procedure should be used to apply the primer

Squeegee:

- Ideal squeegee width ~ around 35cm

-Fold the microfiber cloth multiple times around the squeegee, usually about 4 folds, until the cloth fits snug around the squeegee.



Primer:

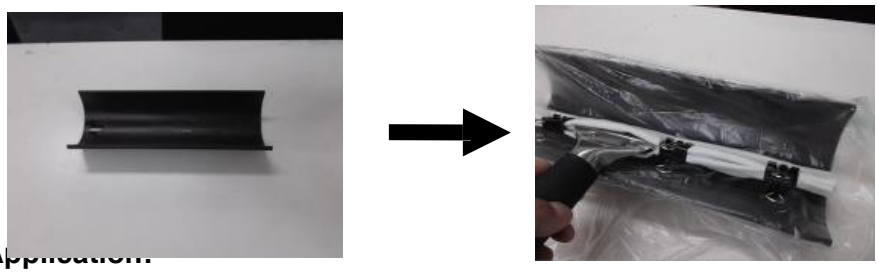
-The masking plastic can be placed over the tray.

-Pour primer into the plastic in the tray.

-The cloth will absorb about 10ml to wet the cloth

-The coverage rate is about 10ml/m^2

-Pour for about 1m^2 (10ml) at a time



Application:

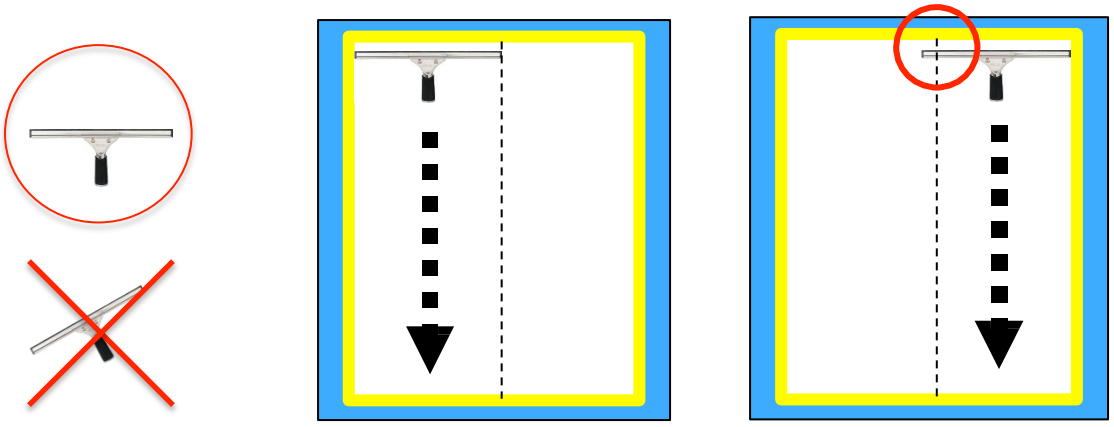
-During application, the squeegee head should be kept horizontal and should move down vertically with one motion from top to bottom.

-Primer should be applied at a slow, steady rate.

-Applying too quickly may leave uncoated areas resulting in a non-uniform finish.

-Let the first pass dry 2 minutes

-Repeat the same process for a second coat of primer



E. Coating Solution Preparation

Liquid NanoTint is a two-part solution. It is important to note, that **after mixing, the coating solution has a pot life of approximately 2 hours.** Consider this information when preparing the solution. It is recommended to prepare the solution directly before the coating application after all prior steps have been completed. When coating large areas or in an assembly line, consider mixing the solution in smaller quantities rather than the total solution needed for the total area to be coated.

1. Calculate

The first step of the solution preparation process is to calculate how much material is needed for the area that will be coated. When calculating total solution weight use 25g of solution per 10 ft^2 (per 1 m^2) of glass. We also recommend adding 10% to your calculated value in order to account for evaporation and the solution that remains in the containers. If applying by roller, account for roller retention by including 35g for each roller to your total weight calculation. This 35g is separate from the calculated value per 10 ft^2 (per 1 m^2). Do not use a roller for more than 2 hours or more than 200ft^2 (20$m^{2)}$ of surface area (otherwise the roller will begin to harden and appearance will be affected).

Example: A window that has an a width of 2 feet and a height of 4 feet has a total of 8 feet squared that needs to be coated. If you need 25 grams of total solution for every 10 square feet, for 8 square feet:

$$\frac{10\ ft^2 glass}{25\ grams\ solution} = \frac{8\ ft^2 glass}{x\ grams\ solution}$$

$$10\ ft^2 glass * \ x grams\ solution = 8\ ft^2 glass * \ 25\ grams\ solution$$

$$x\ grams\ solution = \frac{8\ ft^2 glass * \ 25\ grams\ solution}{10\ ft^2 glass}$$

$$x\ grams\ solution = 20\ grams\ solution$$

Now add 10% to that value:

$$x\ grams\ solution * 1.1\ = \ 1.1x\ grams\ solution$$

$$20\ grams\ solution * 1.1\ = \ 22\ grams\ solution$$

22 grams of material are needed to coat the 8 square feet. Add the 22 grams to the 35 grams of material the roller will absorb, for a total of 57 grams.

To mix the 57 grams of ready-to-use material, take the following steps to determine how much Liquid NanoTint solution and how much hardener you will need. Remember, once the solution is mixed you will have two hours to apply the product. **We recommend you clean, mask, prime, and calculate weights prior to measuring and mixing.**

The Liquid NanoTint to hardener mixing ratio is 9:1 by weight, meaning that for every 9 parts of Liquid NanoTint liquid, it needs to be mixed with 1 part hardener.

To calculate the mixing ratios for 52 grams of NanoTint:

NanoTint Hardener:

$$57\ grams\ solution * \frac{1}{10} = 5.7\ grams\ of\ Nanotint\ Hardener$$

NanoTint:

$$57\ grams\ solution * \frac{9}{10} = 51.3\ grams\ of\ NanoTint$$

If we were to make 57 grams of Liquid NanoTint, we would use 51.3 grams of NanoTint Liquid and 5.7 grams of hardener.

2. Measure

Next, using the recommended material (Material L) weighing scale, measure the calculated amounts of NanoTint and Hardener.

- Measure the NanoTint Hardener in one of the provided cups (Materials H).
- Measure the NanoTint liquid solution in a separate cup (Materials H).

3. Mix

- Pour the required amount of NanoTint Hardener into the NanoTint gradually while mixing with the glass rod (Material G). Mix the solution until it appears uniform.

4. Prepare Equipment

Once mixed, cover the measuring cup with aluminum foil immediately to keep contamination from falling in and to slow the hardening process. The coating solution has a pot life of **2 hours**. If the coating solution has not been used within a 2-hour period, measure and mix a new solution. **DO NOT use a coating solution**

that has been mixed over 2 hours prior to application. It is recommended to write the time of mixing on the solution container.

At this point it in necessary to double check all equipment is ready to be used.

For roller preparation, it is recommended to clean the roller with tape to remove any contamination. Cut off the edge of the roller to square the edge. This will allow for a straight edge on the final coating. After the roller has been cut and cleaned, surround the roller in aluminum foil (Material O) or a solvent resistant material that can allow for little evaporation. Pour 35g of the solution in the aluminum foil or like material and allow the roller to soak. The roller should soak for at least two minutes to allow the coating solution to penetrate the roller. This 35g will be held by the roller and should not account for in the solution being used to coat the substrate.

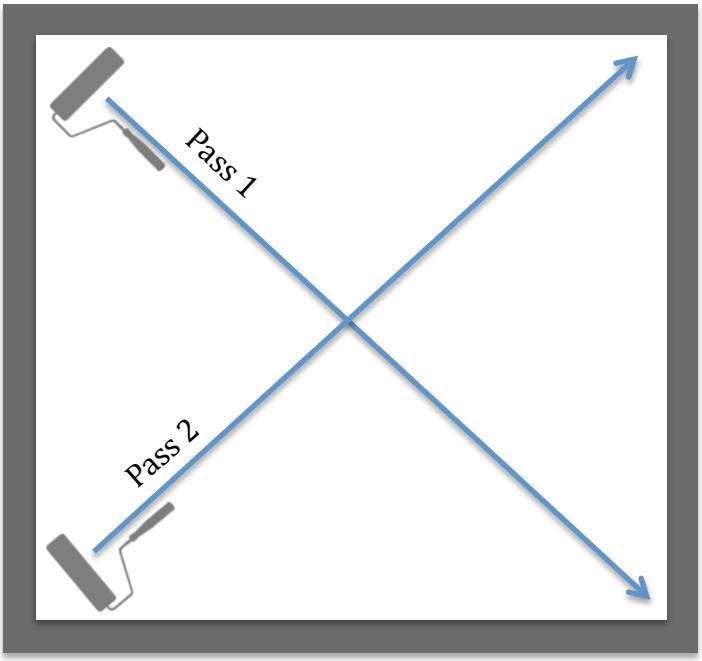
F. Application

1. Roller Application

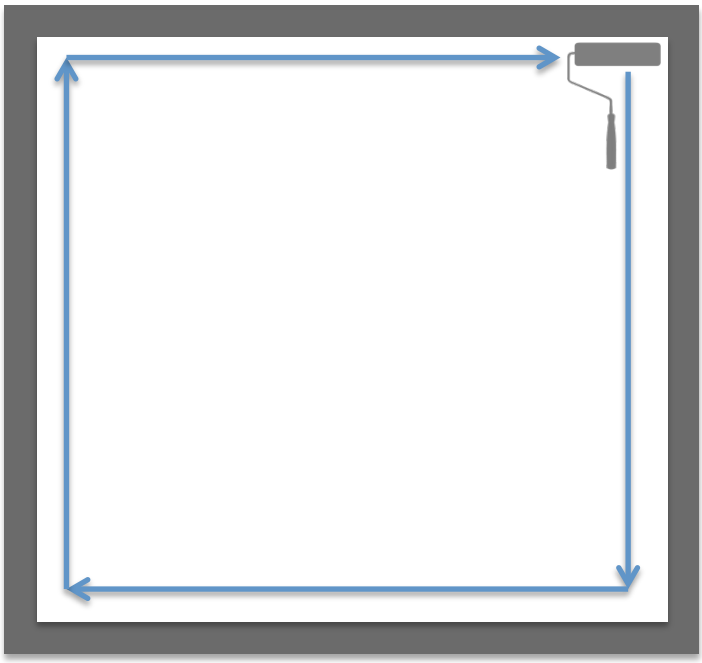
The roller can absorb up to an additional 65g of NanoTint solution in addition to the 35g used to saturate the roller – **this comes to a total of 100 grams maximum capacity absorbed by the roller**. For windows or sections that require more than 65g of NanoTint, more Nanotint must be ready to be added to the roller. In this case, assistance from another individual is helpful to pour out additional solution since application time is limited. Hold the roller at an even pressure to avoid dripping and streaking during the initial coverage of the coating area. Not enough pressure will result in a very thin coating. Too much pressure will result in drips and streaking. However, during the course of a roll if the amount of the coating solution reduces, DO NOT STOP, but instead start to apply more pressure to the roller to get the solution out of the roller. Dip the roller in solution as needed. The first roll may drip if the roller is oversaturated with the coating solution- it is important to roll over this area immediately so the drips do not cause lines or streaking in the coating. Stopping in the center of a stroke can leave a streak in the coating. Sections should be kept to a manageable area so that the coating application process can be completed in approximately **3-5 minutes total**. Hotter and dryer environments result in faster hardening.

For the most uniform coating, following the recommended coating pattern:

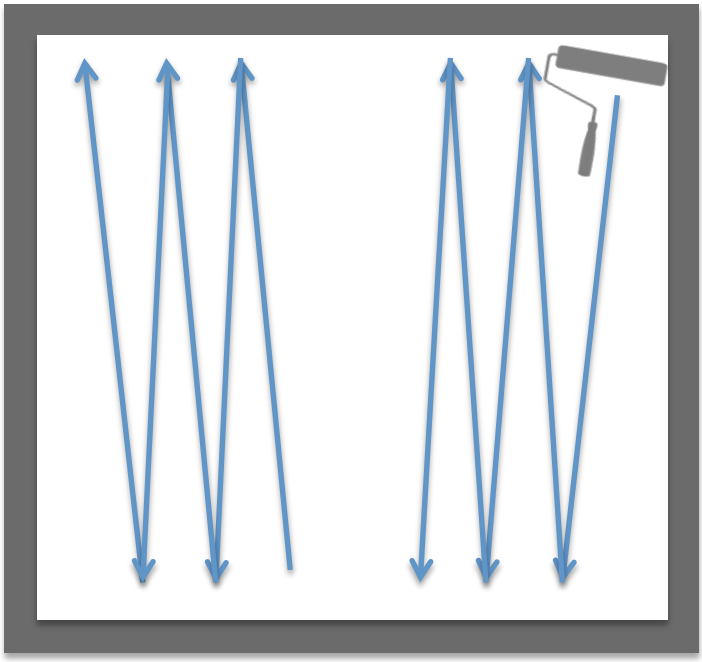
Pass 1: Start from the top left corner to the bottom right corner.
Pass 2: Start from the bottom left corner to the top right corner.



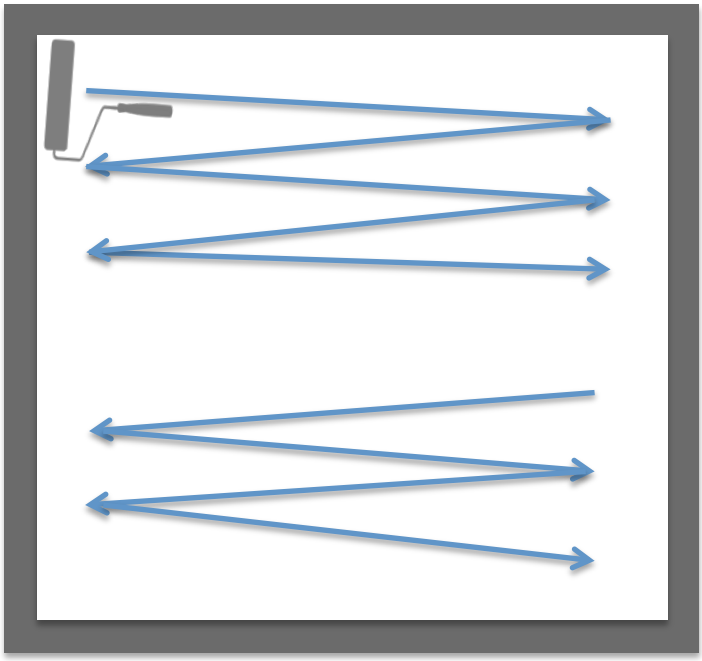
Pass 3,4,5,6: Perimeter.



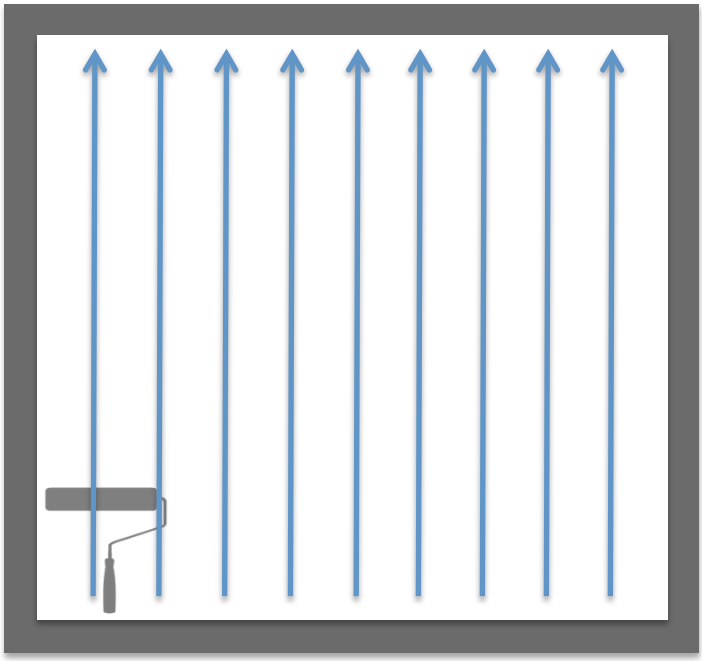
The next passes will be a vertical motion from the top to the bottom of the area, then from the bottom to the top of the area repeatedly in a “V” pattern while slightly overlapping each roll. Avoid sliding the roller.



Repeat the previous “V” pattern, this time horizontally.



The final passes should be vertical. Starting from the bottom and applying light pressure, roll up to the top of the area and gently lift the roller. Repeat this light rolling from bottom to the top while slightly overlapping each pass. Apply the lightest pressure to ensure good uniformity and complete coverage.



If any parts of the coating are noticeably thick (these sections may appear slightly blue) rub them lightly, buffing them into the surface with very light pressure. If an adjustment needs to be made before the coating has dried, eliminate the contaminant with a small section of a KimWipe or micro-fiber cloth, and touch up the area with more coating. Small contaminants or tiny pieces of dust can be removed with tweezers.

If areas appear to be repelling the coating and showing poor adhesion, this is the result of a hydrophobic area on the glass – the following steps should be taken:

- Remove coating from area with a KimWipe or micro-fiber cloth.
- Re-apply primer using KimWipe or micro-fiber cloth in a circular motion, buffing it in to remove the hydrophobic patch causing adhesion problems.
- Proceed to use the roller to re-apply Nanotint and blend in the area with the rest.

Use the primer solution to remove the coating in areas where it is not desired.

2. Other Application Methods

a) Flow/Spin Coat

Flow and spin coating methods have been used at the manufacturing level to coat glass before it is put into a final assembly. This method needs to be tested by the manufacturer. Different surface areas and

shapes affect the amount of material and method that is best fit for application. Contact DryWired for more information.

b) Spray Application

Spray application is not recommended.

3. Dry

Dry-to-touch time is approximately 2 hours. **The masking materials can be removed an hour after application and must be removed before the 2 hour dry-to-touch time.** Removing the masking materials too soon risks smearing the coating. Leaving the masking on too long risks bonding the coating to the tape, resulting in rough edges. If there is not adequate ventilation, it is recommended to leave the area unoccupied until the solvent vapors have noticeably dissipated.

4. Cure

Full cure takes 14 days. Once the coating has fully cured, desired physical properties will be achieved.

5. Clean Up

Properly dispose of all waste (masking materials, paper towels, used rollers, etc.), as well as any unused chemicals according to local, federal, and national regulations. Mixed chemicals that were not used in the 2 hour period must be properly disposed of. Ensure proper chemical storage of any unmixed chemicals.

IV. PERSONAL PROTECTIVE EQUIPMENT (PPE)

A. Liquid NanoTint Coating Solution

Eye/face protection: Face shield or safety glasses. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).
Skin protection: Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands after removal of gloves. It is recommended to check with the manufacturer of the gloves to ensure the gloves are fit for use with this material.

Respiratory protection: Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).
Body Protection: Complete suit to protect against chemicals, flame retardant antistatic protective clothing. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

B. Hardener

Eye/face protection: Face shield or safety glasses. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).
Skin protection: Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands thoroughly.
Body Protection: Complete suit protecting against chemicals. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.
Respiratory protection: Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).
Control of environmental exposure: Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

C. LNT Glass Primer

Eye/face protection: Face shield or safety glasses. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).
Skin protection: Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.
Full contact: Material: butyl-rubber, Minimum layer thickness: 0.3 mm, Break through time: 480 min
Splash contact: Material: Nitrile rubber, Minimum layer thickness: 0.4 mm, Break through time: 31 min
Body Protection: Complete suit to protect against chemicals, flame retardant antistatic protective clothing. The type of protective equipment must be selected according to concentration/amount of the dangerous substance at the workplace.

Respiratory protection: Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

V. EXPOSURE CONTROL / LIMITS

A. Liquid NanoTint Coating Solution

Component	CAS No.	Value	Control Parameters	Basis
Propylene glycol monomethyl ether acetate	108-65-6	TWA	50.0 ppm	USA. Workplace Environmental Exposure Levels (WEEL)
n-Butyl acetate	123-86-4	TWA	150 ppm	USA. ACHIS TLV
		Remarks: Upper Respiratory Tract irritation, Eye irritation		
		STEL	200 ppm	USA. ACHIS TLV
		Remarks: Upper Respiratory Tract irritation, Eye irritation		
		TWA	150 ppm, 710 mg/m^3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	150 ppm, 710 mg/m^3	USA. NIOSH Recommended Exposure Limits
		ST	200 ppm, 950 mg/m^3	USA. NIOSH Recommended Exposure Limits
Butylglycol acetate	112-07-2	TWA	20.0 ppm	USA. ACHIS TLV
		Remarks: Hemolysis, Confirmed animal carcinogen with unknown relevance to humans		
		TWA	5.0 ppm, 33.0 mg/m^3	USA. NIOSH Recommended Exposure Limits

Table 3. Liquid NanoTint coating solution components with exposure controls

B. Hardener

Component	CAS No.	Value	Control Parameters	Basis
Hexamethylene diisocyanate	822-06-0	TWA	0.0050 ppm	USA. ACHIS TLV
		Remarks: Upper Respiratory Tract irritation, Respiratory sensitization		
		TWA	0.0050 ppm, 0.035 mg/m3	USA. NIOSH Recommended Exposure Limits
		Remarks: 10 minute ceiling value.		
		C	0.02 ppm, 0.14 mg/m3	USA. NIOSH Recommended Exposure Limits
		Remarks: 10 minute ceiling value.		

Table 4. Liquid NanoTint Hardener components with exposure controls

C. LNT Glass Primer

Component	CAS No.	Value	Control Parameters	Basis
Methanol	67-56-1	TLV-TWA	500.0 ppm	ACGIH(2005) (Exposure limits / biological exposure indices.

Table 5. LNT Glass Primer components with exposure controls

VI. FIRST AID MEASURES

A. Liquid NanoTint Coating Solution

Inhalation: Supply fresh air; If not breathing, give artificial respiration. Consult a physician.
Skin Contact: Wash off with soap and plenty of water. Consult a physician.
Eye Contact: Flush eyes with large amounts of water for fifteen minutes. Separate eyelids with fingers. If irritation persists, seek medical attention.
If Swallowed: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician. Take victim immediately to hospital.

B. Hardener

Inhalation: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.
Skin Contact: Wash off with soap and plenty of water. Consult a physician.
Eye Contact: Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.
If Swallowed: Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician. Take victim immediately to hospital.

C. LNT Glass Primer

Eye Contact: Without rubbing the eyes, flush with large quantities of water for 15 minutes, including the inside of the eyelids; promptly seek medical attention.
Skin Contact: Wash with soap and flush with large amounts of water. Obtain medical attention. If the product permeates ones clothes, wash contaminated clothing and clean shoes before reuse.
If Swallowed: If swallowed, call a physician immediately. Only induce vomiting at the instruction of a physician. Never give anything by mouth to an unconscious person. Take victim immediately to hospital.

VII. HANDLING AND STORAGE

A. Liquid NanoTint Coating Solution

1. Handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Avoid inhalation of vapor or mist. Provide appropriate exhaust ventilation at places where dust is formed. Use explosion-proof equipment. Keep away from sources of ignition. Take measures to prevent the build up of electrostatic charge.

2. Storage

Keep container tightly closed in a dry and well-ventilated place. Do not store in direct sunlight. Do not allow to solution to freeze. Containers, which are opened, must be carefully resealed and kept upright to prevent leakage. Storage class (TRGS 510): Flammable liquids.

B. Hardener

1. Handling

Avoid contact with skin and eyes. Avoid inhalation of vapor or mist.

2. Storage

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

C. LNT Glass Primer

1. Handling

Do not expose to any flame because of the combustibility of the material and the ease with which it combines with air to form a volatile gas. Handle with caution because vapor concentration at room temperature may be sufficient to ignite. Wear appropriate protective clothing to keep away from skin, mucous membranes and the eyes. Minimize exposure to released vapors or concentrations encountered while working with the material. Manage static electricity; use appropriate conductive materials in clothes and shoes. After working with material, thoroughly wash hands and eyes and change clothes.

2. Storage

Seal after use and avoid locations which might freeze or that have directly sunlight or that might be close to a source of heat. Keep container in well-ventilated area. All electrical equipment near the storage area should have spark and ignition control protective measures.

VIII. DISPOSAL CONSIDERATIONS

A. Liquid NanoTint Coating Solution

1. Disposal Methods

Should be taken to an authorized industrial waste handler. Do not allow resin to reach water supply.

2. Uncleaned Packaging

Dispose of as unused product according to official regulations.

B. Hardener

1. Disposal Methods

Contact a licensed professional waste disposal service to dispose of this material.

2. Uncleaned Packaging

Recommendation: Dispose of as unused product according to official regulations.

C. LNT Glass Primer

1. Disposal Methods

Contact a licensed professional waste disposal service to dispose of this material.

2. Uncleaned Packaging

Recommendation: Dispose of as unused product according to official regulations.