



Low Contact

### **NEAT<sup>®</sup>** Coated Glass

The second generation of low maintenance glass products has been developed by Cardinal CG Company. The coating on this product is similar to Cardinal's first low maintenance glass coating,  $\text{Lo}\overline{\text{E}}^2$   $\text{Plus}^{\text{\tiny{(B)}}},$  which was introduced to the market in 2003. Similar to the LoE<sup>2</sup> Plus® coating, NEAT<sup>®</sup> coated glass is produced by magnetron sputtering which provides a hydrophilic glass surface once fully activated by UV light. Unlike glass coated with the LoE<sup>2</sup> Plus<sup>®</sup> coating, NEAT<sup>®</sup> coated glass does not have a ZnO (zinc oxide) overcoat which must be removed in the field. The coating on NEAT® glass includes titanium dioxide (TiO2), applied onto the #1 outdoor glass surface, and is a photocatalytic coating. Being photocatalytic means that the coating absorbs UV light which in time leads to decomposition of organic residue on the glass surface.

### FEATURES AND BENEFITS OF NEAT® COATED GLASS **P**RODUCTS:

- NEAT<sup>®</sup> coated glass products include a titanium dioxide (TiO2) functional film coating. The titanium dioxide thickness is less than 100 Angstroms.
- NEAT<sup>®</sup> coated glass products, when activated by UV light, have a surface contact angle below 25°. Having a low contact angle means that water sheets off of the glass surface (called "hydrophilic" in this TSB) instead of beading up. Figs. CG04-01 and CG04-02 show the difference in high contact angle (beading up) and low contact angle (sheeting). The lower the contact angle, the better the sheeting action and less opportunity for water droplets to evaporate on the glass surface and leave airborne pollutants on the glass surface.
- Although to date there are no industry standards on what is considered to be a hydrophobic or a hydrophilic glass surface, at lower contact angels i.e. 25° and below, water sheets. At high contact angles, water beads up (called "hydrophobic" in this TSB).



Fig. CG04-01 Beading up of water



Fig. CG04-02 Sheeting of water





• The coating on NEAT® coated glass becomes active and hydrophilic after the NEAT® coated glass surface receives radiation from UV light. The UV radiation can be from direct or indirect sunlight. Even if first exposure to UV light is on cloudy days or with north facing windows, the coating will still become photoactive and perform; however, more time will be needed for activation than if the coating on the NEAT® glass is exposed to direct sunlight.



Hydrophobic Reaction Uncoated Glass

Fig. CG04-03

• NEAT<sup>®</sup> coated glass products provide a smoother glass surface, compared to pyrolytic photoactive coatings as shown by photomicrographs in Fig. CG04-04.



NEAT<sup>®</sup> Photoactive Coated Glass

• When NEAT<sup>®</sup> coated glass is used on the #1 surface (outdoors) of a window, the window will stay cleaner longer because the NEAT<sup>®</sup> coated glass surface causes water to sheet off of the surface. Uncoated glass surfaces that are hydrophobic permit water to bead up on its surface. The sheeting action allows dirt to rinse from the glass surface rather than dry in highly visible ringlets or water marks. The beading up of water on non-coated glass and sheeting action of water on NEAT<sup>®</sup> coated glass is shown in Fig. CG04-03.



Hydrophilic Reaction



A smoother surface as shown by this NEAT<sup>®</sup> photomicrograph makes the NEAT<sup>®</sup> product easier to clean.



Pyrolytic Photoactive Coated Glass

Fig. CG04-04 Roughness comparison of the NEAT® coated glass surface and a typical pyrolytic photoactive glass surface.



- Due to its photocatalytic properties, the coating on NEAT<sup>®</sup> coated glass cleans itself of many non-mineral deposits i.e. light deposits of silicone vapor, adhesive residue, suction cup marks, fingerprints, organic pollution, pollens, resins, etc.
- The coating on NEAT<sup>®</sup> coated glass performs well in all environments; whether dry, humid, cold or warm.
- The coating on NEAT<sup>®</sup> glass decomposes:

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- Silicone vapor contaminations (one to six weeks depending on cloud cover, sun angle, length of daylight (etc).
- Organic materials (pollens, resins, fingerprints and other organic pollutants). Thick layers may be partially decomposed, loosened and then rinsed away with water.
- The film adhesive residue on PRESERVE® glass units.
- Vapors from many sealants i.e. Dow Corning 1199, GE Silglaze, Novagard, Novaflex, Dow Corning 9-1350 and Dow Corning 3-0117.
- Most organic deposits left on the glass from manufacturing i.e. suction cup marks and marks from glass riding on rollers and belts.

- NEAT<sup>®</sup> coated glass has been tested for over 4,000 hours in a carbon arc ISO test standard and after this test, the contact angle remained at or below 20 degrees.
  4,000 hours in this test is predicted to be equivalent to 13 years of field exposure.
- NEAT<sup>®</sup> coated glass does not:
- Decompose thick contamination i.e. silicone fingerprints, paint, stain etc.
- Stop sealant bleeding after weathering.
- Decompose silicone glazing residue or stop bleeding around the perimeter of a window which can cause moisture picture framing around the perimeter of a window as can be seen in Fig. CG04-04. Windows with a bed of silicone to adhere the sash to the glass on the outdoor #1 glass surface can result in a narrow residue area of higher contact area around the perimeter of the glass. This perimeter area usually extends into the vision area approx. 1" to 3" from the edge of the window.



Fig. CG04-05 - Silicone glazing residue causing picture framing

Sill section of window showing water beading up due to silicone glazing sealant residue on glass.



• NEAT<sup>®</sup> coated glass can be tempered.

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- NEAT<sup>®</sup> coated glass does not alter the color or performance of the glass.
- Recertification for NFRC testing of NEAT<sup>®</sup> coated glass used in windows is not required because the coating on the NEAT<sup>®</sup> glass does not affect:
- Outdoor or Indoor reflections and visible transmittance
- Solar heat gain co-efficient
- U-Factor
- Color

This can be seen in the LoĒ<sup>2</sup>-272<sup>™</sup> comparison chart below. Other LoĒ coatings will also have no change in performance with NEAT<sup>®</sup>.

IGU Description	Vis. Trans.	Vis Refl. Ext	Solar Ext. Refl	SHGC	U Value	UV Fading	UV Trans.	Color
LoDz-272™	72%	11%	36%	0.41	0.25	34%	16%	Neutral
Neat <sup>®</sup> w/LoDz-272™ on #2	72%	12%	37%	0.41	0.25	34%	16%	Neutral

### IGU Performance NEAT<sup>®</sup> with LoE<sup>2</sup>-272<sup>™</sup>

- Glass construction 3E/11.5/3 with 90% argon fill level (3 mm glass, 11.5 mm airspace and Lo $\overline{E}^2$  on the #2 glass surface)
- Data is for center of glass

## Processing NEAT<sup>®</sup> Coated Glasses

When fabricating IG units with NEAT<sup>®</sup> coated glass, Cardinal recommends that the pH of the wash water be as neutral as possible and not be below 5.5.

 $\mathsf{NEAT}^{\circledast}$  coated glass should be placed in the IG unit washer with the  $\mathsf{NEAT}^{\circledast}$  coated glass surface down and

the  $Lo\overline{E}^2$  coated glass surface should be up and away from the rollers in the washer.

When glazing, care should be taken to avoid direct sealant contact to the NEAT<sup>®</sup> coated glass surface except as required in the glazing area.

For grilles that are adhered to the #1 glass surface with a PSA glazing tape (as shown in Fig. CG04-06), the grille tape manufacturer should be contacted for recommendations on adhering grilles to the NEAT<sup>®</sup> coated glass surface.



Fig. CG04-06 – Grilles adhered to NEAT® coated glass.



# Protection and Cleaning of NEAT<sup>®</sup> Coated Glass

When NEAT<sup>®</sup> coated glass is installed in a window in the field, normal glass protection should occur to reduce the opportunity for building materials (i.e., stucco, paints, stains, etc.) used at the job site from contacting the glass surfaces. Thick deposits or layers of these materials will not be removed by the photocatalytic action of the coating on NEAT<sup>®</sup> coated glass. Usually contractors use plastic sheeting or polymer films to protect the glass from standard construction materials.

No special cleaning requirements are necessary to clean NEAT<sup>®</sup> coated glass. Standard cleaning solutions such as a soap solution with clean water or standard window cleaning products can be used. As with standard glass products, if a squeegee is used to clean the glass, the squeegee should not have any metal edges exposed as the metal edges could scratch the coating or glass itself.

As with non-coated standard glass products; metal blades should not be used as they will scratch NEAT<sup>®</sup> coated glass just as they will scratch any glass product. Clean NEAT<sup>®</sup> coated glass on a regular schedule as needed. In most applications this will be needed less frequently than without NEAT<sup>®</sup> coated glass, however, in areas where rainfall does not reach the surface, NEAT<sup>®</sup> coated glass cannot rinse clean.

Hard water deposits are visible (less visible than on uncoated glass) and are reduced after contact with rain or washing. Automatic sprinklers should be adjusted to prevent sprinkler water contact.

When first installed, it will take time for the coating on NEAT<sup>®</sup> coated glass to become fully active. Based on weather patterns and the amount of UV available for activation of the coating on NEAT<sup>®</sup> coated glass, the attached U.S. maps show the approximate times for full activation of the coating on South and North exposures in the Spring/Fall and Autumn/Winter yearly cycles.





### FULL ACTIVATION - Activation without screens or overlays

Factors that can affect NEAT® coated glass performances are:

- Screens
- Elevations/orientations
- Vegetation
- Volatile Organic Compounds (VOC's)

Accelerated UV and condensation exposure testing indicate that sheeting and photo activity of NEAT<sup>®</sup> coated glass should continue after 15 years of exposure.

## NEAT<sup>®</sup> and PRESERVE<sup>®</sup> Coated Products

Cardinal's PRESERVE<sup>®</sup> glass products include a protective film used on the exposed glass surfaces of IG units. Cardinal IG Company owns several patents relevant to PRESERVE<sup>®</sup> glass products. (see TSB IG16). NEAT<sup>®</sup> coated glass is compatible with the protective film used on Cardinal's PRESERVE<sup>®</sup> glass products. The protective film protects the PRESERVE<sup>®</sup> glass surfaces during shipping, window fabrication, handling and installation and from debris to which the glass is exposed on the jobsite. Use of the protective film will not significantly increase the UV light activation time of the coating on NEAT® coated glass.

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