
Application Note LC-101

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HOW TO MINIMIZE AND CONTROL HAZE IN LC PRIVACY GLASS INSTALLATIONS



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Introduction:

This Application Note discusses the ways to minimize and control the cloudiness or “White Haze” in LC Privacy Glass in the clear / transparent state using best known practices of design, engineering, and specification. “Haze” is user-influenced by choice of tints of glass, direct and indirect artificial lighting, types of lighting, general exposure to sunlight, and viewing angle.

Overview of the LC Technology

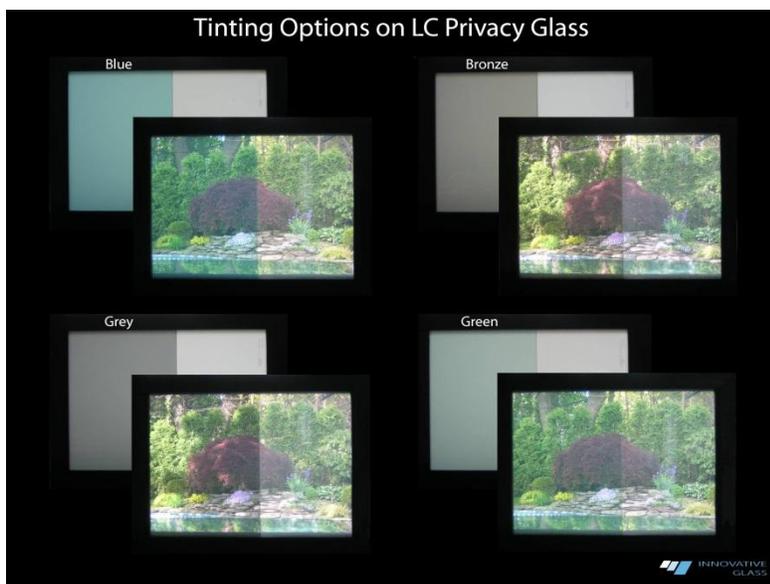
LC Privacy Glass is produced by laminating 2 pieces of glass over an electrically switchable LC Privacy Film. This film contains a mixture of Liquid Crystals and white polymers which diffuse and scatter the light when in the Unpowered / default / privacy mode. When electricity is applied to the film, the Liquid Crystal particles align and allow light and vision to pass through to the opposite side, thereby making it clear / transparent.

LC Privacy Glass never reaches 100% clear. There is always a certain amount of resultant “white haze” or cloudiness when in the “On” state. This varies by manufacturer, manufacturing processes and materials, and the environment it is viewed in.

Haze: Influenced by the Tint of the Glass

The naturally white haze is filtered out and masked to a *certain degree* when viewed through ordinary glass. This is because ordinary glass has a green tint to it, which comes from the iron content in the glass.

The haze of the LC Privacy film can be further masked when manufactured with *greater* tinted glass, like bronze, grey, blue, or other colors, which reduce the amount of incident light reaching the film.



Adding a tint to the glass masks the majority of the objectionable white haze, and enhances the view.

On the other hand, you will see more apparent haze if you use low-iron or Starphire glass, which has a much lower iron content, and therefore no green tint at all. Low iron / Starphire glass might be suitable for ordinary glass walls, jewelry showcases, storefronts, and showers, but it is generally not recommended for LC Privacy Glass applications unless the lighting conditions are ideal.

Haze - Influenced by “Position” of Light Sources

Other factors that amplify the white haze in the “clear” state are:

1. Pointing lights at the glass.
2. Wall washing the glass with overhead or floor can lights.
3. Placing ceiling lights or hi-hat lights too close to the surface of the glass.
4. Having too much sunlight hitting the glass.

Light position and placement should be carefully considered as part of the planning on a project that includes LC Privacy Glass.

Haze - Influenced by “Balance” of Lighting

The amount of light on either side of the LC Privacy Glass is a driving force in the noticeable haze levels when the glass is in its “clear” state. Here are some guidelines to follow when considering the “balance” of light on each side of the glass.

1. The worst case scenario is when light is present on only one side of the glass. For example a hallway is lit, but in the room which has the LC Privacy Glass the lights are off. This will create an imbalance in the light and the haze will be most evident.
2. When the lights are on in both areas, but the strength of the light is greater on one side of the glass than the other, less visible haze will be better, but it will still be fairly obvious.
3. The best scenario for the light “balance” is when each side of the glass has virtually the same strength of lighting. This is a truly balanced install and the best results would be expected in terms of the visible haze.

Haze - Influenced by “Type” of Light

Recently we have seen that LED lights and CFC (Compact Fluorescent) lights can display “halo” like effects on the glass, as well as “strobing” and “flickering” of the glass. The angle of the glass to the light fixture itself will make the “halo” appear. This type of lighting is not recommended and should be tested with the LC Privacy Glass.

Haze – Viewing Angle and “Off-Axis” Induced

The haze of LC film in the clear / transparent state varies based on viewing angle. The least amount of haze is when you are viewing straight through the glass, at a 90 ° Angle. The haze increases when viewing at a more oblique angle of 160 °. The greater or wider the viewing angle, the more you will see the haze. Designers should carefully consider the placement of interior walls in multi-angular installations.

Solutions to minimize the haze after the installation:

1. Reduce the amount of direct sunlight in the room.
2. Do not place overhead lights closer than 3 feet of the wall.
3. Do not place floor or can lights too close to the wall.
4. Reduce the lighting level in the room by using light dimmers.
5. Add commercially available tinted window film to the glass on the size of the lights.
6. Add window tints to the Exterior windows to reduce the amount of sunlight in the room.
7. Eliminate use of LED, Fluorescents and CFC bulbs.

Limitations of the LC Technology:

Unfortunately, there are technical limitations which limit the dynamic range, and prevent full privacy and 100% clarity. The core LC film is naturally white. Although the goal is to obtain 100% Privacy and 100% clarity, it is presently technically impossible to have such a wide “dynamic range”.

- If you put less crystals or a thinner coat of crystals in the film, you might be able to obtain greater clarity, but you would not be able to get the desired privacy.
- In contrast, a thicker coat of crystals might make the film *more private*, but then the *clarity in the clear state goes down*.

The obvious objective of LC Privacy Glass is to obtain a satisfactory level of privacy when unpowered, and as clear as possible when powered.

There are a few different manufacturers of LC film in this industry. Some provide a higher level of Clarity, but at the expense of Privacy. And some offer a lower level of clarity, which gives them exceptional Privacy.

Our years of experience have taught us that there is an *optimal balance* to give the best of both worlds. We therefore custom-blend our own formulation to satisfy even the most discriminating clients - with the widest dynamic range, to offer enough Privacy, and maximize the amount of optical Clarity.

Samples & On-Site Evaluations:

Because of these conditions and anomalies when using LC Privacy Glass, we recommend and urge all potential buyers to request a sample of our LC Privacy Glass and view it under the final or anticipated environmental conditions. Then view it straight ON, at an off angle, and under various lighting conditions through the day. This will help the buyer make an informed choice as to whether or not the product is right for them.

We pride ourselves on having the finest LC Privacy Glass on the market, with the widest dynamic range, best color, lowest haze, and an optimized balance of Privacy and Clarity.