

# 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 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 two 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 transparent.

LC Privacy Glass never reaches 100% clarity. 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.

## Limitations of the LC Technology

The obvious objective of LC Privacy Glass is to obtain a maximum level of **privacy** when unpowered, and **clarity** when powered, but there are technical limitations that prevent 100% privacy and clarity. The core LC film is naturally white, and at present it is technically impossible to have such a wide “dynamic range”.

- With a thinner coat of crystals in the film, you might be able to obtain *greater clarity*, but would not 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.

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 greater privacy.

## Achieving An Optimal Balance

Our years of experience have taught us that there is an optimal balance to provide 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 provide enough privacy, while maximizing the amount of optical clarity.

Additionally, we offer our customers many options to further minimize and control the effect of LC haze.

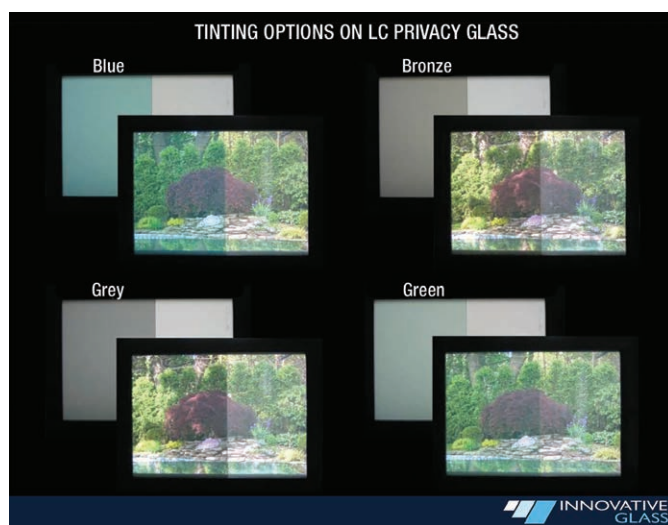
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## Haze: Influenced by the *Tint* of the Glass

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

The haze of the LC Privacy Glass can be further neutralized when manufactured with more heavily tinted glass in colors such as bronze, grey, blue, or other colors, that reduce the amount of incident light reaching the film inside the glass.

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.



**Tinted glass helps neutralize the majority of the white haze, and enhances the view.**

## Haze: Influenced by *Position* of Light Sources

Other factors that amplify the white haze in the transparent state are:

1. Pointing lights directly 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 of a project that includes LC Privacy Glass.

## 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: Influenced by *Balance* of Lighting

The amount of light on either side of an LC Privacy Glass panel is a key factor in the noticeable haze levels when it is in its transparent 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 the lights are off in the room with the LC Privacy Glass. This will create an imbalance in the light causing the haze to 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 on the other, haze will be less visible, but may still be fairly obvious.
3. The best scenario for light “balance” is when the strength of the lighting is virtually the same on both sides of the glass. This will have the best results and the lowest haze visibility.

## Haze: *Viewing Angle* and *Off-Axis* Induced

The haze of LC film in the transparent state varies based on viewing angle. Haze visibility is lowest when 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 Haze After Installation

1. Reduce the amount of direct sunlight in the room.
2. Do not place overhead lights closer than 3' from the glass panel.
3. Do not place floor or can lights too close to the glass panel.
4. Reduce /adjust the lighting level in the room with light dimmers.
5. Apply commercially available tinted window film to the glass on the side of the light source.
6. Add window tints to nearby exterior windows to reduce the amount of sunlight entering the room.
7. Eliminate use of LED, Fluorescent and CFC bulbs.

## Samples and 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, and at various angles and lighting conditions throughout the day. This will help the buyer make an informed choice as to whether or not this 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.