Understanding Reflective Distortion in Mirror Installations

Mirrors are an important component to the architectural design of interior and exterior applications for residential, commercial, and industrial settings. Through its reflective qualities, a well-placed mirror can bring light into the living space as well as provide a feeling of enlarging the space around you. However, reflective images from the mirror may exhibit slight distortion, which is a function of the glass used to fabricate the mirror or the result of the mirror installation. This Glass Technical Paper was written to provide you with information and expectations of allowable reflective distortion in annealed flat glass mirrors.

According to ASTM C1503 Standard Specification for Flat Glass Mirrors:

“...limited levels of distortion are inherent in flat glass mirrors and are permitted, provided that the glass used in manufacturing the mirrors conforms to...the allowable distortion limits cited in ASTM C1036 for Q1 or Q2 quality glass.”

When annealed Q1 or Q2 quality glass is used for the production of mirrors, there will be, according to ASTM C1503, an allowable, inherent distortion in mirrors due to the float glass process. Also, the reflectivity of the silver will appear to magnify the naturally occurring distortion present in the glass.

Evaluation of the mirror is to be made by standing one meter from the mirror at an angle of 90 degrees to the face of the mirror, with the mirror mounted vertically. Use daylight or other uniform diffused lighting that simulates daylight.

When evaluating reflected images in any mirror, be aware of the following:

1. Objects with straight lines may appear to exhibit more distortion than objects of random shape.
2. The farther away the mirror is from the viewer or the object reflected, the more distorted the image may look.
3. Distortion of the reflected image may be more pronounced when viewing the mirror at any angle other than “straight on” (90 degrees to the face of the mirror). This apparent increase in the intensity of distortion occurs naturally when viewing an object through glass at an angle.
4. Movement of the observer or the object reflected will also tend to increase the visibility of the distortion present in the mirror.
5. Mirror distortion can also be increased due to poor installation. The most common installation errors are from curvature of the mirror when forced into a mechanical fixture or installing mirrors on an uneven wall.

In addition to visual inspection per ASTM C1503, digital imaging methods can be used to measure optical distortion in mirrors. One digital imaging method is described in ASTM C1652/C1652M Standard Test Method for Measuring...
Optical Distortion in Flat Glass Products Using Digital Photography of Grids. Depending on their design, these devices can be used on-line or off-line. They are non-contact and measure the entire surface of the glass using digital cameras, lighting systems and fixed reflected images. Computer software analyzes the digitized images and displays a surface distortion waviness or quantifies the lens power or optical distortion for the entire glass surface.

There are ways to minimize the visible distortion in reflected images in mirrors:

1. Avoid installing mirrors in a corner or on directly opposing walls because the repeating reflections can dramatically increase the effects of even minimal distortion.

2. Locate the entrance to a room with large wall-mounted mirrors such that the mirrors are installed at 90 degrees to your line of vision as you enter the room. Entering a room at an angle other than 90 degrees can increase the distorted appearance of the reflected image.

3. Leave a space in between mirror panels in order to break up the reflected image.

To summarize, inherent distortion is present in glass used to fabricate flat glass mirrors, and some levels of distortion are permitted and allowable under the ASTM C1503 standard.

References

- ASTM C14.11 Subcommittee is part of ASTM C14 Committee on Glass and Glass Products available at www.astm.org
- ASTM C1503 Standard Specification for Flat Glass Mirrors
- ASTM C1036 Standard Specification for Flat Glass