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## **Manufacturer Opinion Statement Regarding Tempered Mirrors**

### ***MANUFACTURER'S OPINION - SUMMARY:***

We often see project specifications that require the use of tempered mirrors. Gilded Mirrors does not feel that using tempered glass as the base substrate material for a tempered mirror will meet the applicable ASTM standard that defines a high-quality mirror. As such, Gilded Mirrors does not manufacture nor support the use of tempered mirrors in applications where a high-quality mirror will be utilized (e.g., frameless or framed vanity mirror, bi-fold mirror panel, cabinet mirror, residential common area mirror, furniture dresser mirror). The commonly accepted mirror industry solution to meet both the related safety building glazing code and to provide a high-quality mirror (per ASTM definition) is to apply a safety-tape backing to the mirror. Safety-tape backing is available in both Category 1 and Category 2 strength, thus offering the ability to meet either building safety code typically defined within project specifications.

### ***MANUFACTURER'S OPINION - DETAILED SUPPORT:***

The tempering process adversely changes the optical quality of glass, which causes distortion in the reflected image of a mirror. Defects that occur during the tempering heating and cooling process are easily viewed within the mirror's reflected image and degrade the quality of the mirror.

There are three important ASTM standards applicable to this opinion:

- **ASTM C 1036 - Standard Specification for Flat Glass.** This standard defines the flat glass that is used in various architectural glazing products, which includes the manufacturing of mirrors. This is a common ASTM standard typically required by most project specifications. This ASTM standard defines various types of glass by Type, Class, Quality, Form, and Finish. High quality mirrors are to be manufactured using Type I, Class I, and Quality 1 or 2 flat glass. This defined level of flat glass is typically referred to as "mirror quality glazing", which represents a very high quality of flat glass.
- **ASTM C 1503 - Standard Specification for Silvered Flat Glass Mirror.** This standard defines the requirements for silvered annealed monolithic clear and tinted flat glass mirrors up to 6mm thick (i.e., typical indoor residential mirrors). This is a common ASTM standard typically required by most project specifications. This ASTM standard requires the use of flat glass as defined as Type I, Class I, Quality 1 or 2 per ASTM C 1036 (or "mirror quality glazing"). Additionally, this Standard addresses acceptable reflectance, blemishes, chips, dimensional tolerances, distortion, and testing methods. All Gilded Mirrors meet this Standard, and by default meet ASTM C 1036.

- ASTM C 1048 - Standard Specification for Heat-Treated Flat Glass -- Kind HS, Kind FT Coated and Uncoated Glass. This standard addresses the requirements for flat heat-strengthened (HS) and flat fully tempered (FT) coated and uncoated glass used in general building construction. Within this specification, there are several applicable sections of note:
  1. Section 5.2 Kind FT (fully tempered) Intended Use references common uses of tempered glass (particularly where required by safety building code) which includes passage doors, shower enclosures, fixed glass in walking surface proximity, table tops, countertops, showcase enclosures, etc -- it's important to note that mirrors are not stated as an intended use.
  2. Section 7.4.1 Distortion states that the tempering process will cause reflected images to be distorted.
  3. Section 8.1.1.2 Strength Requirements for Kind FT (fully tempered) Glass states it will meet ANSI Z97.1 and CPSC Standard 16 CFR1201 -- both are common requirements found within project specifications for mirrors.
  4. Section 10.1 Glass Quality and Finish states that tempered glass will meet Quality levels 2-6 of ASTM C 1036. Note this list does NOT include Quality level 1 and 2, which are required for ASTM C 1503 mirrors.

Per details contained within the three above-noted ASTM standards, there is an inherent conflict in meeting all three ASTM standards. That is, it's unlikely that tempered flat glass will meet ASTM C 1036 Type I, Class I, Quality 1 or 2 standard, which is required to produce a mirror that will meet ASTM C 1503. It is our opinion that many project specification authors often use the same glass requirement for mirrors as for shower enclosure glass, which should not be the case. This can also be seen when the mirror glass specification requires the use of low-iron glass -- which may be advantageous for shower enclosure glass utilization, it would not offer any benefit to mirror glass utilization and has a much higher product cost.

The solution to meeting the building safety code and to provide a high-quality mirror (as defined in ASTM C 1503) is to apply a high quality safety-tape backing. Safety-tape backing (or film backing) is available in both Category 1 and Category 2 strength (typically specified within the project specifications). Gilded Mirrors uses a high-quality safety-tape backing manufactured by 3M. Our safety-tape backing will meet the ANSI Z97.1, HUD, and CPSC's Standard 16 CFR1201 standards for safety building codes. With this solution, not only is the high quality of the mirror maintained and it will meet the safety building codes, it is less expensive than utilizing tempered glass.