



When is a Defect Not a Defect?

ASTM Glass Standards

For A&D Professionals, Contractors, and Clients

BENDHEIM

“It’s much more difficult to explain expectations around industry standards once the Owner has already seen the glass... and decided it is not acceptable to their personal expectations.”

Anyone can find imperfections in glass if they look close enough and hard enough. Glass is meant to be looked through, not at. Glass is not perfect. It is a fact worth repeating because few things cause more of a headache than glass industry standards – especially when those standards do not align to the client’s expectations.

Primarily regarding visible defects, glass industry standards are set by [ASTM International](#). Frankly, ASTM glass standards cover a wide variety of glass issues and it is not easy to get to the heart of the matter, until the Owner has an issue with the glass, and then it is a bit late.

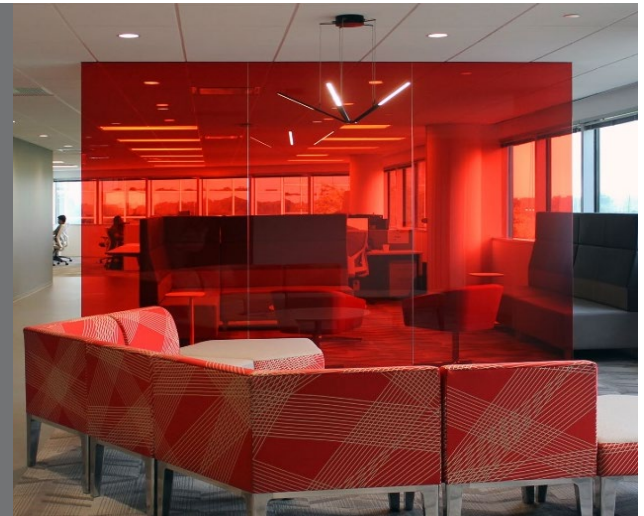
In architecture and construction, expectations are high for everything, and glass is not perfect. The larger the piece of glass, the less perfect it is allowed to be.

The BIG Question: When is a defect not a defect?

The Quick Answer:

1. Stand back 10 feet from the glass.
2. Face the glass straight-on at 90 degrees.
3. View in daylight but not direct sunlight.
4. Inspect the central 80% portion of the glass.

Under these conditions, the ASTM standard is that if you can not see it from 10 feet away – it is not a defect. However, the Bendheim standard is from 5 feet away.



ASTM's Official Standards for Imperfections in Glass

The official ASTM version is quite long and can be tricky to follow. This document is a brief summary of some key parts of the ASTM. Keep in mind there are different types of defects with different inspection rules.

The 10 ft. rule is a good way of educating the Owner that glass standards exist. As with most things, the 10 ft. rule isn't definitive. For example, on sealed units over 35 square feet, the glass is allowed to have three 1" scratches and still be within standards – even if those scratches are visible from 10 ft. However, while the ASTM inspection standard is from 10 ft., Bendheim's inspection standard is from 5 ft.

Ninety percent of ASTM conversations never have to happen. If the client or Owner knows the short version of the inspection, discussed in the early stages, there is greatly reduced risk of an issue.

Here is an email received by Dynamic Architectural Windows & Doors from a client regarding industry standards and client expectations:

"What usually happens is the client sees something – it is within manufacturing standards and not covered – builder replaces glass at their expense.

I have been on a project for Contractor "X" where they spent 15K to replace glass which met standards but was rejected by the customer and it was taken out of what would have been a profit for the job."

This happens too often. **It is much more difficult to explain expectations around industry standards once the Owner has already seen the glass and decided it is not acceptable to their personal expectations.** It is not a simple product issue now, it is an emotionally-charged issue revolving around expectations, reputations, re-scheduling stress, and so on. Those issues are far more difficult to resolve to everyone's satisfaction.

Understanding the Standards

ASTM International is the basis for understanding glass and coating quality, allowable defects, and visual inspection criteria. ASTM has many different specifications and classifications depending on the type of glass being analyzed or quality controlled. Some examples of quality criteria are:

1. [ASTM C1036](#) – Standard Specification for Flat Glass
2. [ASTM C1048](#) – Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass
3. [ASTM C1172](#) – Standard Specification for Laminated Architectural Flat Glass

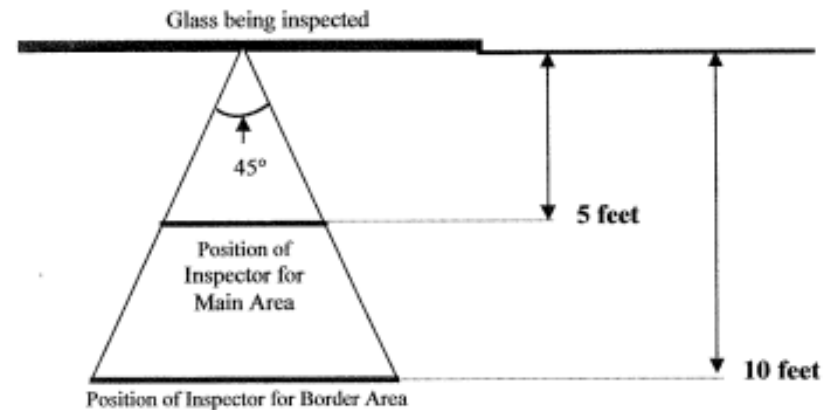
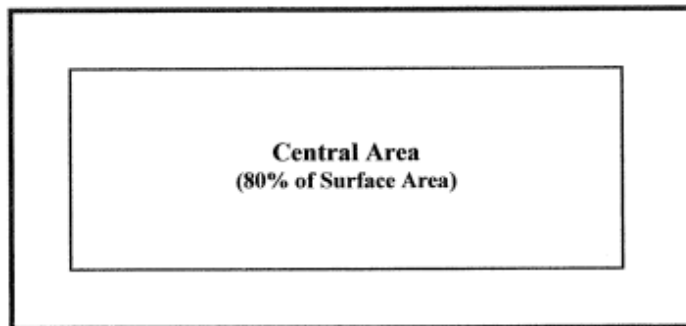
Before pointing out defects and imperfections, understanding ASTM inspection criteria is very important. It outlines things such as inspection distance, lighting requirements, inspections times, etc.



Examples of Visual Inspection Criteria

- Glass shall be inspected in the central area in transmission at a distance of 5 feet from the observer, and in reflection at a distance of 10 ft. from the observer. Bendheim's inspection standard is always from 5 ft.
- Glass shall be inspected in the border area in transmission and reflection at a distance of 10 ft. from the observer.
- Glass must be inspected using a viewing angle of 90 degrees from the glass with suitable background light (daylight without direct sunlight or a range of 500 – 1000 foot-lamberts.) If a lighting box is used as a light source, the diffusing plate shall be parallel to and at a distance of 10 feet from the glass.
- Inspection should not exceed viewing of more than 5 seconds for lites up to 6 sq. ft., 10 seconds for lites up to 35 sq. ft., and 20 seconds for lites larger than 35 sq. ft., either in transmission or reflection.
- If defects are visible beyond what is allowable as listed by sizes (in sq. ft.) using the inspection criteria, the glass may be rejected.

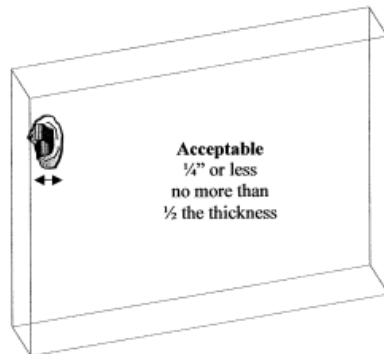
Visual Inspection Criteria Visual Aid:



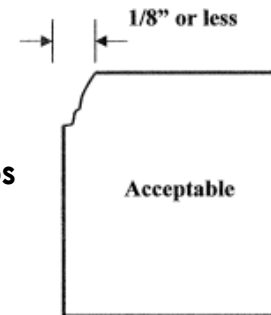
Allowable Defects

Defect	Allowable When	Max. Allowed on Lites up to 6 Square Feet	Max. Allowed on Lites 6 to 35 Square Feet	Max. Allowed on Lites Over 35 Square Feet
Scratches	Size is 1" or less	1	2	3
Debris, Dirt, Spots	Size is 1/16" or less	1	2	3
Seeds, Bubbles, Knots, Stones	Size is 1/16" or less	1	2	3
For visible defects described above: no more than 1 total defect is allowed per lite up to 6 square feet; no more than 2 total defects are allowed per lites 6 to 35 square feet; no more than 3 total defects are allowed per lite up over 35 square feet				
Shells	Located no more than 1/4" from the edge and less than 1/2 the thickness of the lite	1 per side	1 per side	1 per side
Chips	Located no more than 1/8" from the edge	1 per side	1 per side	1 per side

Glass Shells

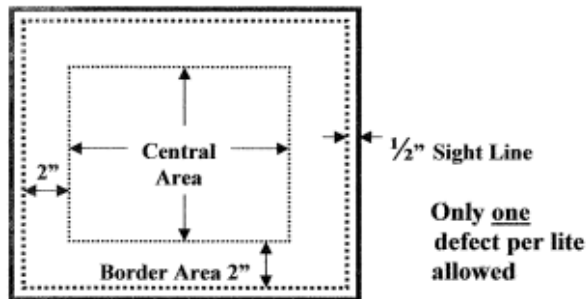


Glass Chips

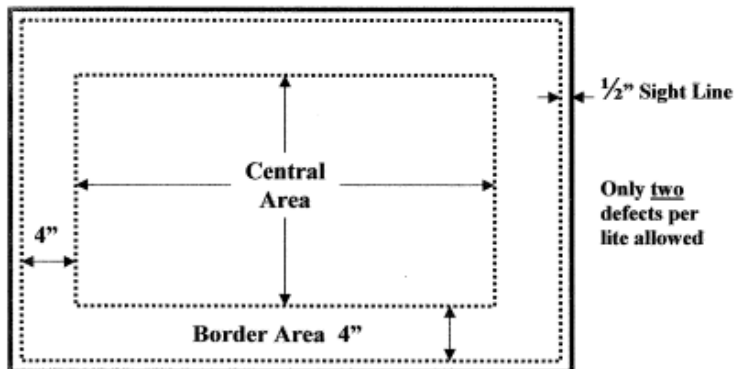


Allowable Defects Visual Aid

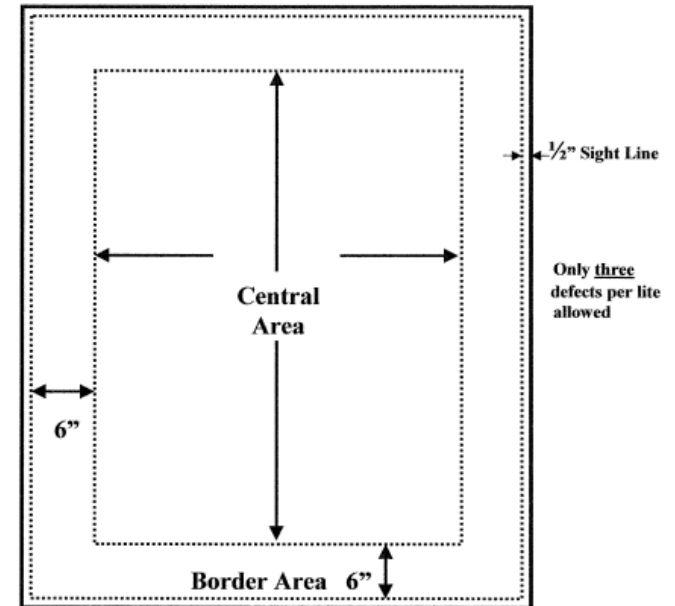
Lites up to 6 square feet



Lites 6 to 35 square feet



Lites greater than 35 square feet



- For lites up to 6 square feet, the border area is comprised of 2 1/2" from each edge of the lite. All other area is the central area.
- For lites 6 to 35 square feet, the border area is comprised of 4 1/2" from each edge of the lite. All other area is the central area.
- For lites over 35 square feet, the border area is comprised of 6 1/2" from each edge of the lite. All other area is the central area.

Summary and analysis of ASTM Glass Standards
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