



## **1.0 Scope**

This document defines the methods and criteria for inspecting, accepting, and rejecting glass units. It defines allowable flaws and establishes a common basis for window & sash inspection that exceeds the industry's and major manufacturers' standards. (ASTM C1036 reference standard)

All glass consists of manufacturing flaws, as documented and standardized in the glass industry. Provided these flaws do not exceed the dimensional values defined in this document (Table 1) **and** are not viewable under the defined inspection method & lighting conditions (Section 4.0), **then the glass should not be rejected**. The intent is to create objective quality standards.

## **2.0 Glass Flaws**

Allowable defects are quantified in Table 1. If the flaws detected exceed this criteria, the decision to accept or reject the glass will be based on whether or not the defects are viewable under the inspection conditions defined in Section 4.0.

**Glass Flaws include:** Scratches, Debris, Dirt, Spots, Bubbles, Blemishes, Coating Defects, etc.... Flaws not fully defined by this document must be reviewed by the Plant's Quality Authority for Accept/Reject consideration. This specification should be revised as those issues are encountered. There are Glass Quality Standards that have been created for those facilities producing IG units which cover more issues with respect to fabrication of IG units – however, they will not be addressed in this specification. (See Note 2).

**Tempered Glass:** Tempered glass can exhibit slight optical distortion, even more so when LOWe is involved. This distortion is accentuated when looking off-angle or against a dark background. Relative "waviness" of glass should not be rejected, unless the glass has obvious distortions when viewing under the recommended industry conditions defined in Section 4.0.

**Table 1: Acceptable Limits for Glass Flaws (See Section 4.0 – Inspection Method)**

Defect	Dimension	Up to 6 sq ft.	6 - 35 sq ft.	Over 35 sq ft.
Scratches	1" Max	One defect permitted per unit, unless viewable from 3ft/10ft @ 5 sec (central/perimeter)	Two defects permitted per unit, unless viewable from 3ft/10ft @ 10 sec (central/perimeter)	Three defects permitted per unit, unless viewable from 3ft/10ft @ 20 sec (central/perimeter)
Debris	1/16" Max			
Spots	1/16" Max			
Bubbles	1/16" Max			
Hair/Lint	Use Viewing Criteria			
Scuff/Streak & fingerprints	Use Viewing Criteria			





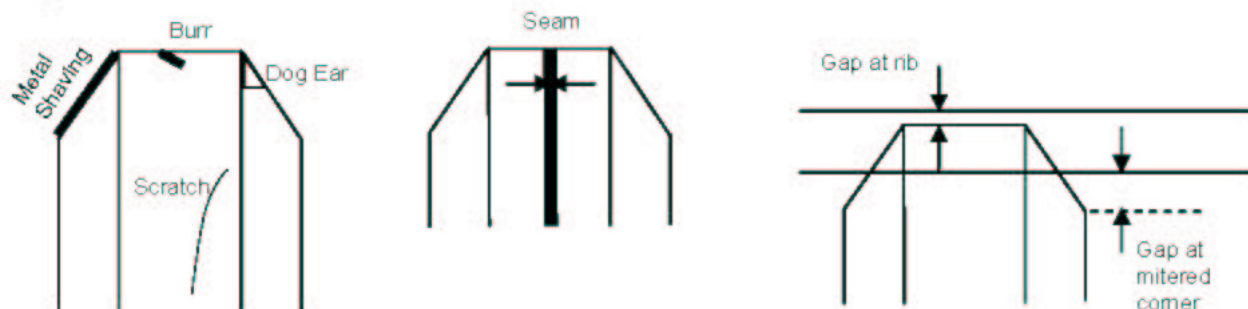
### 3.0 Grid Requirements

Allowable defects are quantified in Table 2 and Drawing 1. If the flaws detected exceed this criteria, the decision to accept or reject the glass will be based on whether or not the defects are viewable under the inspection conditions defined in Section 4.0. Grids should be inspected visually from 3 feet. Grid straightness must meet the conditions specified in Drawing 2. The seam on the grids, by preference, but not required, should always be oriented downwards on horizontal grids, and either left or right (not both) on vertical grids. (see note 1)

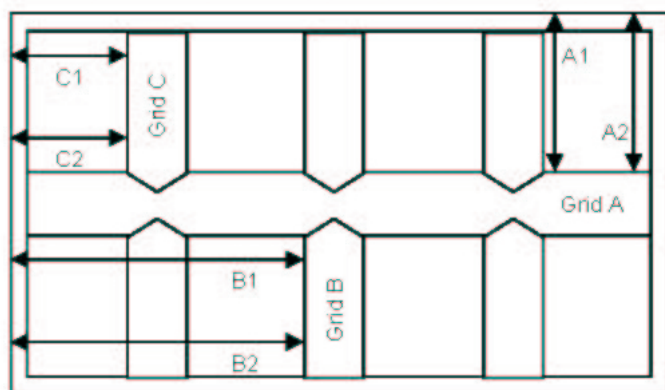
**Table 2: Acceptable Limits for Grid Flaws (See Section 4.0 – Inspection Method)**

Burrs/Shavings	1/32" x 1/16" max
Fold-Overs/Dog Ears	1/32" x 1/32" max
Dent (diameter) & Crease (length)	1/8" max
Paint Chips / Marks / Spots	1/32" max
Scratches (width > 0.008")	1/4" long max
Scratches (hairline < 0.008")	1" long max
End gaps (At Spacer connection)	1/8" width max
End Gaps (At Grid connection)	1/16" width max
Smudges/Fingerprints	1/4" width max

**Drawing 1: Grid Flaws**



**Drawing 2: Grid Straightness Requirements**



Note: Measurements should be from the edge of the glass to the edge of each grid.

The maximum difference between the two measurements (e.g. C2-C1, A2-A1), must be:  
 +/- 1/32" - For grids 4 inches long or less  
 +/- 1/16" - For grids greater than 4 inches in length  
 +/- 1/8" - Alignment grids between top and bottom sashes and muller windows.  
 (see Note 4)

Glass units should be inspected visually against the specified grid inspection boards @ glass drop.





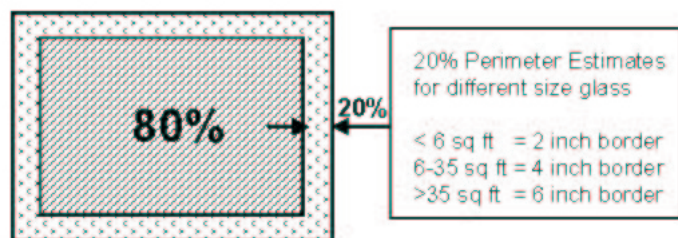
#### **4.0 Inspection Method**

Glass shall be inspected according to Table 3 & Drawing 4

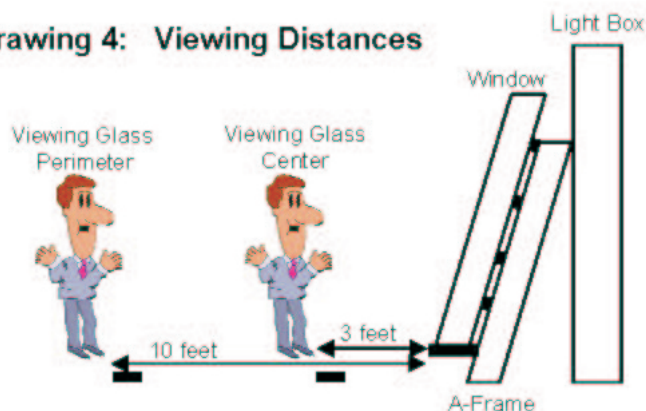
- Glass measuring up to approximately 6 sq ft (total window area) should be inspected for a maximum of 5 seconds.
- Glass measuring between approximately 6 sq ft and approximately 35 sq ft should be inspected for a maximum of 10 seconds. Most windows will fall within this range.
- Glass measuring greater than 35 sq ft should be inspected for a maximum of 20 seconds.

Each glass unit has a defined central viewing area and perimeter viewing area. The distance at which defects are inspected is to be 3 ft when looking at the central 80% of the window. The distance at which defects are inspected is to be 10 ft when looking at the perimeter 20% (see Drawing 3). For example, a flaw that exceeds the dimensional criteria in Table 1 is rejected if it is then viewable from 3 feet, and found within the central 80% (under the time prescribed in Section 4.0) and rejected if viewable from 10 feet if located within the perimeter 20% (under the time prescribed in Section 4.0).

**Drawing 3: Glass – Central & Perimeter Viewing Areas**



**Drawing 4: Viewing Distances**



Inspection of the glass perimeter @ 10 feet should only be necessary if perimeter defects are viewable @ 3 feet to determine if glass should be rejected. If no defects are viewable at 3 feet (central & perimeter), then the glass should be approved. If flaws are viewable in the glass perimeter at 3 feet, but not viewable from 10 feet, then the glass should be approved.

**Table 3: Glass Inspection Method**

Up to 6 sq ft.	6 - 35 sq ft.	Over 35 sq ft.
5 seconds @ 3 feet (central area) and, if necessary, @ 10 feet (perimeter area)	10 seconds @ 3 feet (central area) and, if necessary, @ 10 feet (perimeter area)	20 seconds @ 3 feet (central area) and, if necessary, @ 10 feet (perimeter area)





### **5.0 Light Boxes, Grid Boards, & Inspection Frames**

Light boxes have been designed to maximize the ability to view & detect glass flaws.

Glass is NOT intended to be inspected under close-up scrutiny or held under direct sunlight, as these conditions will almost always reveal tiny glass flaws, that would otherwise be considered acceptable within industry standards.

Grid Boards will be used to inspect grid alignment. This will occur at the glass drop, the final A-frame, or a combination of both.

A-Frame modifications have been made to maximize the amount of unobstructed viewing through the glass into the light boxes.

### **6.0 Spacer Issues**

Glass spacer or butyl should not be visible in sight line of sash, except for Super Spacer units, which can have 1/16" visible around perimeter and up to 1/8" at the 4<sup>th</sup> corner.

Matrix and Butyl blemishes in the Matrix on spacers are not cause for IG rejection provided the blemish is outside the sightline. However, action should be taken with the Process Control plan to minimize and monitor such properties. Breaks in the matrix shall be reviewed by the Production & Quality Authority for acceptance, but are not preferred.

### **7.0 Glass Dropping – Glass Inspection**

It is expected that the glass drop operator provide an initial inspection for the glass/grid qualities defined in this document. Glass can be rejected at this point in the process.

It is further expected that the glass drop operator inspect for glass properties otherwise not visible once assembled into the sash. These include, but are not limited to:

- Glass is free of defects and imperfections (good seal with no voids)
- Glass is dropped in preferred orientation (4<sup>th</sup> corner up) (see Note 3)
- LowE – SunClean - Laminated orientation is correct,
- IG set on the bottom setting blocks

Note 1: Grids are constructed with continuous sections and branches. It is preferred that the continuous sections run horizontally in a grid pattern, although not a requirement or pass/fail criteria.

Note 2: This specification does NOT apply to the inspection of vinyl or metal components of the windows...and is limited to the context of glass inspection.

Note 3: Specific orientation with respect to the 4<sup>th</sup> corner is NOT required for pass/fail criteria of a window, and is only a default preference.

Note 4: Due to the grid being physically offset from fixed to vent when installed into a window frame (*fixed units to the back of the frame and vent units to the front of the frame*) This creates a Parallax of grid/glass and can cause perceived grid alignment issues, especially on eyebrows and bay bow units – even when within specification.

Note 5: Grids ideally should be flat with in the plane of the IG, but larger patterns and certain styles of grid inherently can bow inward/outward of the glass...the requirement is that the grid NOT be in contact with the glass. Certain situations require the use of grid bumpers to prevent that.

General Note: While these specifications are written to define pass/fail criteria, it should also be noted that visual inspection is not a guarantee for 100% compliance to every element defined. Subjective abilities will vary operator to operator, day to day --- but consistent effort is intended.