CENSOLUTIONS

The causes of Glass Deflection in Hermetically Sealed I.G. Units.

Glass deflection in a sealed unit may be particularly noticeable during a period of high pressure and cooler weather when the air space inside the unit contracts, distorting the glass panes.

Deflection and its degree is dependant, to varying degrees, on the following factors:-

1. Barometric pressures.
2. Humidity.
3. Ambient temperatures.
4. Cavity width.
5. Aspect ratio.
6. Desiccant selection.
7. Unit construction.
8. Speed of sealant application.
9. Method of application.
10. Seal Quality.

i) **Barometric Pressure and Ambient Temperature:** If units are sealed during a period of low barometric pressure then as the external pressure subsequently rises, the internal pressure will lower (relatively). This will, as the difference increases, lead to a progressively greater inward deflection. Similarly higher than normal ambient temperature during manufacture will effect deflection as the air cools and contracts when ambient temperatures reduces. This contraction continues as the outside temperature reduces during periods of cold weather and is when deflection is at its greatest.

ii) **Humidity:** The higher the relative humidity at the time of manufacture, then the greater the amount of moisture held by the air in the cavity. Once the seal is complete and the desiccant has adsorbed this moisture, then the internal pressure is decreased further.

iii) **Cavity Width and speed of application - Hot melt Sealants:** As the hot melt is applied, then the air space adjacent to the spacer is subsequently warmed, causing the air to expand and force its way out of the unit, until the seal is complete. As the unit cools, the air contracts and the pressure inside the unit decreases. This effect is more pronounced with the wider unit cavities as a greater amount of air will be warmed in a 20mm cavity than a 6mm cavity unit. This is due to two factors: Firstly, the faster the sealing operation the less time there is available for the air space to heat up and secondly a 6mm cavity units' components would act as a greater heat-soak and relatively less air expansion would occur.

iv) **Aspect Ratio:** Large low aspect ratio units (the ratio of width to height being around 1:1) usually exhibit the maximum level of deflection of the glass. High aspect ratio units (i.e. long narrow fan lights) show the least deflection because the small span and the glass rigidity does not permit deflection; in

these cases there is more risk of glass fracture and this risk is increased when decorative components (lead and colour film) are added.

v) **Desiccant selection:** This can have a significant effect on deflection. Certain grades of desiccant (i.e. those not considered low deflection having a high proportion of molecular sieve with a pore size of 4 Angstrom units and over) can desorb nitrogen when subjected to high temperatures during sealing with hot melt sealants. This will (similar to iii above) effectively force air out of the unit cavity and, once the seal is complete, the desiccant will re-adsorb the nitrogen on cooling. This type of desiccant will continue to adsorb nitrogen as the ambient temperature decreases and even creating greater deflection during periods of weather of very low temperature; this deflection with be noted with hot melt and two part sealants. If for technical reasons a non-low deflection desiccant is used the level of fill can have an effect on the degree of deflection; before changing the level of fill advice from your supplier should be sought.

vi) **Unit construction:** We have mentioned the effect of cavity sizes and aspect ratio on deflection. However, the selection of glass and its flexibility must be considered. Should glass of differing thickness be used, then the thinner glass will be more flexible and be therefore prone to even greater deflection than if glass of a similar thickness was used. It may be advisable to position the thicker pane of glass on the exterior, as this will show the least deflection and generally the visual problems of deflection is only noticeable when viewed from outside.

vii) **Method of application:** Units that are made horizontally show a tendency for the top pane of glass to bend as a result of gravity. However, if units are made on rotary tables then the bottom pane (if not correctly supported) will be deflected to even a greater extent than the top, as a result of having to support the total weight of the unit in the central area.

viii) **Incomplete Seal:** If the seal is incomplete, a gap is provided which allows easy passage of air out of the unit cavity. When the unit is exposed to high temperatures the air inside the cavity expands and the increased pressure will force air through the gap. Conversely, when the unit cools and the air contracts the resultant negative pressure may cause the gap in the seal to close up by suction, leaving an overall negative pressure within the unit. In the longer term this can result in the spacer being gradually pulled into the cavity or the fracture of one pane of glass.

Variations in the combination and degree of the above can significantly affect the amount of deflection and although there are methods of reducing some of the causes of deflection, under certain conditions it would be reasonable to expect that equalisation of the units would be beneficial. It should be stressed these comments are theoretical as it has proved difficult in the past to establish test methods to verify the statements made. Should you be experiencing technical problems of this or any other nature, please feel free to contact CENSolutions Ltd for advice.

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