Capillary Tubes & Breather Tubes

Capillary Tube vs. Breather Tubes

Capillary tubes and breather tubes are used in insulating glass units to equalize the pressure between the sealed panes. The main reason for the use of capillary or breather tubes is for installation of windows at high altitudes. When a sealed insulating glass unit is constructed at low altitudes and then installed at higher altitudes (such as Denver) the resulting increase in altitude causes the glass panes to bow out, having a pillow shape appearance. The glass bows out because the sealed pressure at the time of assembly is greater than the pressure incurred at the higher elevation. If the pressure change is large, the insulating glass panes can fracture and/or the sealant holding the glass panes can rupture causing premature seal failure.

Breather tubes are defined as large aluminum tubes with a typical inside diameter of approximately 0.125 inches and a typical length of 3 to 6 inches. Breather tubes are intended to be sealed after pressure equalization at the installed altitude. Breather tubes are only intended to be open during shipment to the job site. Cardinal IG does not recommend the use of breather tubes in their IG units.

Capillary tubes are small stainless steel or aluminum tubes with a typical inside diameter of 0.010 to 0.020 inches, and a typical length of 12 inches. Capillary tubes are typically left open in the field, which allows the IG unit to equalize initially and maintain a generally flat appearance over time. Cardinal IG uses only capillary tubes in high altitude applications.

Capillary Tube Function

Many theories and misconceptions have emerged on how capillary tubes work. Such theories as “an open capillary tube has a small enough diameter to only allow air to diffuse and not a water molecule” are not accurate. The diameter of the capillary tube is significantly larger (over a million times) than the diameter of a water molecule. Testing conducted by outside laboratories has shown moisture diffusion through the tube is a function of the tube diameter and tube length, as well as humidity level and pressure changes. The results from testing have shown that with a small capillary tube diameter and sufficient tube length that the moisture diffusion through the tube is minimal.

In addition to diffusion, moisture is transported into the unit by the pressure changes caused by daily and seasonal temperature changes (“breathing” of the unit). In some unit constructions (primarily smaller IG units), this mode of transport can allow significant amounts of moisture into the airspace. Capillary-tubed units are designed for the purpose of relieving pressure associated with high altitudes, that is, mountainous areas typically with low humidity. Installation of a capillary-tubed unit in any other environment may significantly reduce the longevity of the unit. Because of the reduction in unit longevity, Cardinal IG recommends only installing capillary tubes in high altitude applications, and minimizing the use of capillary tubes whenever possible.

Equalization Rate

The rate of pressure equalization for a large IG unit through a capillary tube can be slow. The rate of equalization is dependent upon temperature, barometric pressure, altitude, IG unit dimension, glass thickness, airspace width, and the type of insulating glass spacer. Typically, the majority of pressure equalization will occur within 48 hours. However, it is unlikely the glass deflection will return to a perfect neutral or parallel position. As the unit

equalizes in pressure, the pressure difference becomes less, and therefore the rate of pressure equalization is reduced.

In addition, if tempered or heat strengthened glass is used, additional bowing can be present from the tempering process. Bowing of the glass from tempering can be significant, with as much as a 1/16th of an inch per foot of glass. This bow will remain regardless of whether the unit has pressure equalized.

With the increase in popularity of the simulated divided lite (internal muntin bars), positive glass deflections can be magnified. As indicated above, most of the equalization of the unit will occur within 48 hours, but it's likely that some deflection will remain. This remaining deflection could be objectionable, especially if the unit is constructed with internal muntin bars. The internal bars act as a gauge, by showing the gap between the glass and the bar.

Summary Points

- Cardinal IG does not use large diameter breather tubes in their IG units and will not honor the warranty of units with breather tubes.
- Due to the possibility of unacceptably decreased longevity, Cardinal IG does not suggest the use of capillary tubes in units not installed in high altitude areas and recommends minimizing the use of capillary tubes whenever possible.
- Cardinal does not sell high altitude argon filled units. Argon will easily diffuse through a capillary tube, and currently there are no dependable methods to seal off a capillary tube.
- When a capillary tube is used, the majority of the glass deflection will be alleviated within 48 hours; however, complete equalization of the airspace (no glass deflection) may not occur because of constant changes in atmospheric conditions.
- Windows constructed with tempered or safety-glazing glass can have a permanent bow due to the tempering process. There is no current solution for this problem, and the homeowner should be made aware that windows with internal bars and safety glazing glass could have an objectionable gap between the bars and glass after a capillary tube has been installed.
- IG units having capillary tubes installed by Cardinal IG are covered by warranty, when used in high altitude applications. For this warranty, all capillary tube materials (tubes, covers, silicone, picks) must be purchased from Cardinal IG and the Cardinal IG installation procedure must be properly executed. Failure to utilize Cardinal IG supplied materials or properly execute the installation procedure will void this warranty. See Cardinal IG's Limited Warranty statement for additional information or contact your Cardinal IG representative for more information.

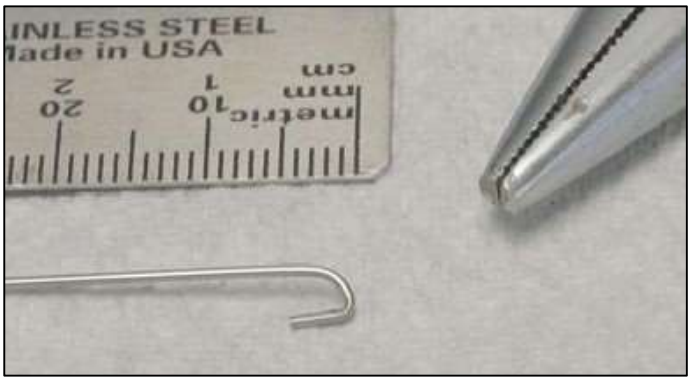

Fig1 A capillary tube prior to insertion into the spacer

Fig 2 An installed capillary tube, colored red for photo only

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