

Argon Gas in the Air Space of IG Units

In 1988, Cardinal IG Company developed and patented an evacuation chamber for introducing argon gas into the air space of insulating glass units. Cardinal IG has adapted its evacuation chamber technique for introducing argon gas to operate continuously as part of its automated manufacturing lines.

The introduction of argon gas into the air space of insulating glass units is commonly referred to as “gas filling.” It is universally understood that insulating glass units cannot be 100% filled with any particular gas. In addition, the use of the term “filled” does not mean an IG unit has any particular percentage of argon gas in the air space, although it does indicate that some quantity of argon gas was introduced into the air space during manufacture. Insulating glass unit size, geometry, and addition of internal grilles, etc. negatively influence the effectiveness of the evacuation chamber argon filling process and the resulting percentage of argon in the air space. For example, grilles inside the airspace contain ambient air and the air in the grille likely will reduce the overall initial argon fill percentage by several percentage points.

Cardinal IG is a licensee of IGCC (Insulating Glass Certification Council) and IGMA (Insulating Glass Manufacturers Alliance) under their argon fill certification programs. As such, Cardinal IG is listed in the IGCC/IGMA Certified Products Directory (“CPD”) with the designation “GCIA” for “Gas Content, Initial and After Weathering.” To qualify to be so listed and designated, Cardinal IG submitted certain required IG units to IGCC and IGMA for testing against the requirements. Such test units must be found to meet a tested minimum average initial argon gas content of 90% or greater and a final after weathering (ASTM E 2190 weathering cycle) minimum average gas content of 80% or greater. This testing protocol recognizes that the percentage of argon gas in an organically sealed IG unit, no matter how well made, will decline over time due to numerous factors, including weathering. (See www.igcc.org and www.igmaonline.org for more information)

Since argon is only approximately 1% of the ambient atmosphere, argon will naturally migrate through all organic IG edge seals to the atmosphere. Likewise, the components of the ambient atmosphere (e.g. O₂ and N₂) will naturally migrate into the IG Unit to establish equilibrium, i.e., the same balance of elements as exist in the ambient atmosphere. No organic seal ultimately can prevent the internal atmosphere of an IG unit from becoming the same as the ambient atmosphere over time.

Cardinal IG can affirm that its insulating glass units are constructed similarly to the test units which IGCC and IGMA audited, tested and found to pass the IGCC and IGMA criteria. An accurate method for measuring the percentage of argon gas in the air space of an insulating glass unit is gas chromatography the procedure for which is described in ASTM E 2269. This method and procedure, however, requires the destruction of the IG unit that is tested. Cardinal IG cannot certify or assure any person that any particular IG unit has a specified percentage of argon gas in the air space. Even if it could do so, that percentage would be subject to change as part of an immediate and continuous natural process.

Recognizing it is desirable to manage its IG unit manufacturing processes for the purpose of consistently constructing units in a manner similar to the test units which IGCC and IGMA audited, tested and found to pass the IGCC and IGMA criteria, Cardinal IG has purchased and installed on its automated manufacturing lines certain non-destructive argon measuring equipment using Gasglass® technology from Sparklike, Ltd. This technology has inherent limitations, including limitations on the reliability of its measurements (See www.sparklike.com for more information.). Nonetheless, Cardinal IG believes such technology is currently the best non-destructive argon measuring equipment available in the US for providing information during the manufacturing process about the argon fill percentages of IG units.

Based on the information provided by the non-destructive argon measuring equipment using Gasglass® technology from Sparklike, Ltd., Cardinal IG believes that its IG units measured by such technology have an initial average argon fill level of 90% or greater. Since this is an average of units sampled, some units may have an initial argon fill percentage of less than 90% and some more than 90%. The Gasglas® technology currently cannot accurately measure fill percentages less than 70%.

Cardinal IG has also used the European EN 1279-3 (Long term test method and requirements for gas leakage rate and for gas concentration) to determine the argon/ambient atmosphere exchange rate of tested units. The tests were conducted by an independent laboratory and found the tested units had an argon/ambient atmosphere exchange rate of below 1% of argon per year. Cardinal IG manages its IG unit manufacturing processes for the purpose of consistently constructing units in a manner similar to the units that were tested under the EN 1279-3 standard. However, Cardinal IG cannot certify or assure any person that any particular IG unit will have an argon/ambient atmosphere exchange rate of below 1% of argon per year.

When argon migrates through the organic seal system of IG units, the center of glass winter U-Value will increase (i.e. become poorer). The following are center of glass U-Values (as determined by the LBL Window 5.2 Computer Program) for a 2.2E/11.5/2.2 glass construction with Cardinal CG Company's LoE²-272™, and LoE³-366™ coatings on the #2 surface:

LoE²-272™ and LoE³-366™ coated glass products have different emissivities as indicated above. As can be seen by this data, the increase in U-Value is minimal when the argon fill percentage decreases by 1% per year. For instance, if the initial argon fill percentage is simulated to be 90% because Cardinal IG uses an evacuation chamber method of argon gas filling, the center of glass U-Value would be 0.249 for LoE²-272™ and 0.240 for LoE³-366™. If there is an argon-air exchange of 1% per year, in 20 years the argon level would be at 70% with a resultant argon center of glass U-Value of 0.261 for LoE²-272™ and 0.252 for LoE³-366™. U-factors to the third decimal point have been included because when U-factors of window systems are being calculated for NFRC conformance, the 3rd decimal is used.

% Argon	Center of Glass U-Factor	
	LoE ² -272™ (ε = 0.042)	LoE ³ -366™ (ε = 0.022)
90%	0.249	0.240
85%	0.252	0.243
80%	0.255	0.246
75%	0.258	0.249
70%	0.261	0.252
60%	0.266	0.258
50%	0.272	0.264

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