

## Argon Filling

In 1988, Cardinal IG Company developed and patented a state-of-the-art process for argon filling of insulating glass units. Recognizing the need to determine the specific argon fill levels in IG units, Cardinal also developed a non-destructive, very accurate device for measuring argon concentration levels. This laboratory instrument is based on Raman Spectroscopy and is not applicable for use in manufacturing. Cardinal has installed on-line argon measuring equipment using Gasglass technology from Sparklike, Ltd.

The insulating glass unit size, geometry, and addition of internal grilles, etc. influences the effectiveness of the argon filling process. For instance, grilles inside the airspace contain air and the air in the grille, if not completely removed, will reduce the overall initial argon percent fill level. With 10 years of argon filling testing and manufacturing experience, Cardinal believes that its IG units will have an initial average argon fill level of 90% or greater.

Since argon is approximately 1% of the atmosphere, there is a driving force for the argon to permeate through all IG edge seals to the ambient atmosphere. Likewise, there is a similar driving force for air (O<sub>2</sub> and N<sub>2</sub>) to permeate into the IG unit. Since there are no US industry standards for argon fill levels or for argon/air exchange rates, Cardinal has used the European DIN Standard 52 293 (Testing the Tightness of Gas-Filled Insulating Glazing Units) to determine our gas fill level and the argon/air exchange

rate. This independent test has confirmed that our typical product, as designed, exceeds 90% argon fill level with argon/air exchange rates below 1% per year.

When argon permeates through the seal system of insulating glass units, the center-of-glass winter U-factor will be increased (poorer). Following are center-of-glass U-factors (as determined by the LBL Window 5.2 Computer Program) for a 2.2E/11.5/2.2 glass construction with Cardinal's LoE<sup>2</sup>® coating on the #2 surface:

% Argon	Winter U-factor
100%	0.24
97%	0.25
90%	0.25
80%	0.26
70%	0.26
60%	0.27
50%	0.27

As can be seen by this data, the increase in U-factor is minimal when argon levels are decreased by 1% per year. For instance, if an initial argon fill were at 90%, the center-of-glass U-factor would be 0.25. 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-factor of 0.26.

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