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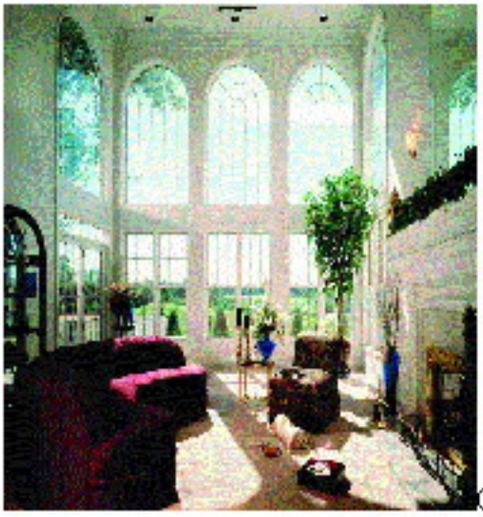
Filling the Bill?

The Real Cost of Gas Filling

by Joe Almasy



Once again, the filling of insulating glass units (IGUs) with an inert gas has become one of our industry's hot topics. As window and door fabricators work to keep up with the R/U values of their competitors' products and contemplate the recent litigation threats posed by various consumer advocate groups, the long-term performance of gas-filled IGUs has stepped to the front of many discussions.

Manufacturing companies need to analyze their views on the direction gas filling will take and whether or not their current methods will produce IGUs that will meet future standards. Every IGU system on the market today is capable of producing a quality unit. However, if a fenestration product's performance is based on a specific concentration of inert gas in an IGU's airspace and the product is warranted, the manufacturer should ask:

- Are the specifications of our existing design adequate for gas retention?
- Do we use fabrication procedures and materials that produce high-quality units?
- Do we produce the best unit possible with the system we have in place?
- Do our methods match the recommendations of our suppliers?
- Do we employ a reliable fill method?
- Do we have the necessary quality control (QC) procedures in place?
- Are we contemplating the ramifications of future industry standards?
- Should we become active in the industry organizations that determine testing requirements?

 Do we use industry-approved glazing guidelines?

Attention to Detail

The IG process employed must produce units with specific physical properties. Therefore, attention to detail is required if the expectations are to produce a unit with the highest quality capable from the components being used. Durable, gas-filled IGUs must utilize a sealant with low gas and moisture vapor transmission properties, a reliable method of gas filling, quality workmanship and, preferably, a continuous spacer system.

"To have an edge seal that ensures gas retention requires a very well made seal—not only in materials, but also in workmanship," said Marcel Bally, sales and marketing director for Bystronic Inc. of Hauppauge, N.Y. "There should be no gaps in the primary seal or the secondary seal."

Numerous companies have invested in high-end gas-filling processes that cost more than $100,000. Manufacturers are also showing increased interest in testing methods. In fact, Randi Ernst, president of FDR Design Inc. of Buffalo, Minn., has reported worldwide sales of more than 100 GasGlass devices—more than half of which were sold in North America. Sparklike Ltd. of Helsinki, Finland, manufactures the GasGlass, which is imported by FDR for U.S. sales.

"The GasGlass is an accurate, easy-to-use, portable and non-destructive method of testing IGUs for fill level," said Ernst. Investment in both filling devices and improved QC procedures are testaments to the influence that gas filling has placed on our industry.

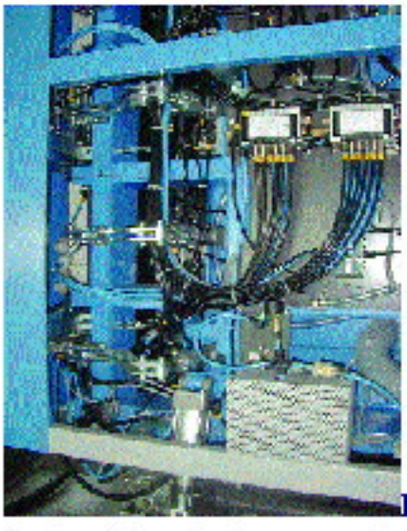
Organizations such as AAMA, IGMA and ASTM are considering the quality and durability of gas-filled IGUs with a focus on both initial fill rates and gas retention. These organizations are in the process of determining future testing required to certify industry products and could use more help from window and door fabricators. The heart of the matter is the length of time a fenestration product will perform, relative to its concentration of gas, to the level it was tested and sold.

Gas Filling In-Depth

The cost of gas filling requires a close look at three areas:

- Known cost related directly to gas filling,
- The value of shop floor space; and
- The company's viewpoint toward product durability in service (intangibles).

The known costs are the easy part and are addressed below. A square foot of floor space carries a cost when space is no longer available. The effects of gas filling processes on flow and floor space need to be considered. The cost of gas-filled IGU quality is difficult to quantify because no industry standards exist in the United States for gas retention. Although the cost of quality is the most difficult item on which to place an exact figure, it is, perhaps, the most important item to consider.



Known Cost

Determining the known cost of filling requires separation of labor to fill units, the actual volume of gas used, the cost of the gas and any additional materials recommended by the sealant or spacer supplier, such as gas-tight pop rivets and foil tape. Capital needs to be considered as well, but the numerous options available make it difficult to pinpoint.

As an example, the following is a basic description and cost breakdown of the three most popular methods used today (*see Table 1 for details and assumptions*) and the newest innovation to the market, filling with liquid argon using the Quik-Dose method.

Quik-Dose is a fully automatic argon filling system marketed by our company and manufactured by Besten Inc. of Cleveland. This system is unique to the industry in that it injects a visible

metered dose of liquid argon into the unit, which "boils" in seconds to gaseous argon, displacing ambient air in the unit from the bottom through the same opening that the liquid argon is dispensed.

Another method, timer fill, is one of the most prevalent systems in use today due to its low capital cost. This system displaces the air in a unit by pumping argon gas for a pre-determined length of time at a specified flow rate into the bottom of the unit. Systems can vary from a single station to multiples of ten depending on the needs of the producer.
Vertical auto fill is a fully automated system used in vertical IGU processing lines manufactured by equipment suppliers such as Bystronic Inc., Willian Design Ltd. and Lisec. These systems fill IGUs during the press assembly process by either filling the IGU during assembly or by filling the press chamber with argon before assembly of the top lite, piercing the spacer or filling in a similar manner as a sensor fill unit does. According to Bally, the Bystronic system may use as little as 120 percent of the IGU cavity in the fill process, depending on unit shape, with fill rates in the upper 90-percent range, without piercing the spacer.

Vertical sensor fill is a system that utilizes sensors to monitor exit gas while units are filling. One type of sensor fill uses oxygen sensors to determine the lack of oxygen leaving the unit, while another uses a conductivity sensor to measure the percent of the fill gas that replaces the air inside the unit.

All of the commercially available filling methods employed today are capable of at least a 90-percent fill rate. Extra care needs to be used when filling units with internal grids. The additional turbulence created by internal grids generally requires additional filling time when using a timer fill system. In addition, expect to have the fill percent reduced by the volume of the grid hollow when checking a unit for fill rate. The only known method of filling the grid hollows is a true vacuum-filling system, which is not available commercially today.

Table 1: Comparison of Gas Filling Technologies*

Category	Units/8 hours	% of cavity	Labor: $/unit	Argon: $/unit	Total: $/unit
Liquid Fill	1,200	200	0	.043	.043
Timer Fill	1,200	200	.16	.035	.195
Vertical Auto	1,200	120-600	0	.021-.105	.021-.105
Vertical Sensor	700	300	.137	.052	.189

*** Assumptions:**

1. 24" x 36" x 5/8" airspace = 8.81 liters per unit

2. Liquid argon cost = $.002 per liter
3. Liquid fill = no labor (fully automated); add labor to fill opening if applicable
4. Timer fill = two persons to fill and final seal units
5. Vertical auto fill = no labor (fully automated filling); add labor to fill hole sealing if applicable
6. Vertical auto fill uses 120-600 percent of cavity volume to fill (varies with the system)
7. Vertical sensor fill = one person to fill and final seal unit
8. $12/hour wages and benefits
9. Liquid fill assumes a 30 percent system loss (estimated)

***Additional components and labor if required:**

1. Pop rivet(s) for metal spacer units
2. Overseal for metal spacer units
3. Spacer preparation if necessary
4. Plastic fill hole protectors for metal spacer units
5. Foil tape to cover lance holes in foam spacer units
6. Butyl corner seal material for DuraSeal® units in liquid-fill system.

Floor Space

It is difficult to determine the cost of floor space required for an offline filling station. Although required floor space generally is small, offline filling often involves additional movement and staging of racks of IGUs to be processed. An operation making 1,200 IGUs per day that is one-half day ahead of the glazing lines can occupy 500 square feet of valuable shop floor space easily just in staging of glass. In addition, the extra step in the process can become an additional burden when dealing with rush orders.

Automated inline filling does not require the additional labor; it uses minimal floor space and materials flow management is reduced with the exception of sealing any holes in the spacer required for the filling process. However, when considering an inline filling system, be certain the cycle time of the gas-filling operation does not affect the expected throughput of the IG process. An automated line will only move as fast as the longest cycle time in the process.

Intangible Cost

How real do you believe the recent litigation threats are, and what do you want to do about them? How far do you want to go to ensure that the product you send out the door is what you have advertised? Only a complete review of the needs of sales, marketing and the plant can answer these questions. The only certain statement that can be made is: If you do not have sound IGU fabrication procedures, materials and a reliable method of product QC in place, you are already behind some of your competition. Because you cannot see gaseous argon going into a unit, attention to all of the details in the IGU fabrication process and a good effective QC program are imperative to producing quality IGUs.

The real cost of gas filling is difficult to pinpoint. A detailed study of your existing IGU process can tell you the cost of your labor and materials. But the direction you take to prepare for the future will answer the rest of the equation. Are you confident your existing IG systems will produce IGUs that will pass future testing requirements? Will you invest in additional QC procedures, equipment and personnel? What effect will additional gas-filled IGU standards have on the sales of your products? Is membership in technical organizations governing the testing of fenestration products worth your investment?

Set up multiple discipline teams to study each area of concern and establish specific goals and timelines. You should be able to determine your direction and have enough information to answer this question: What will gas filling cost my company?

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