Challenges of bent IG

By Joe Erb and Tracy Rogers

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Bent glass has long been used in commercial and residential design to help create a unique and eye-catching façade. The shape and style of monolithic bent glass is almost limitless, and the process of bending glass continues to be as much an art as it is a science (See Figure 1 for typical bends).

However, fabrication of bent glass and bent insulating glass presents significant challenges. Driven by regulatory drivers and energy rating programs, the requirement for improved thermal efficiency creates a dimensional challenge for bent glass that the flat glass market has never experienced. Bent IG requires that the fabricator now bend two, three and potentially multiple flat pieces of glass with different surface coatings to a parallel shape that will be separated with a fixed width air spacer (See Figure 2).

The challenge: how can we minimize the irregularity of a process that lends itself toward inherent variation and potential flaws?

Fortunately, newer technologies have helped mitigate the challenges of fabricating bent IG, giving architects more freedom to be creative.

Figure 1

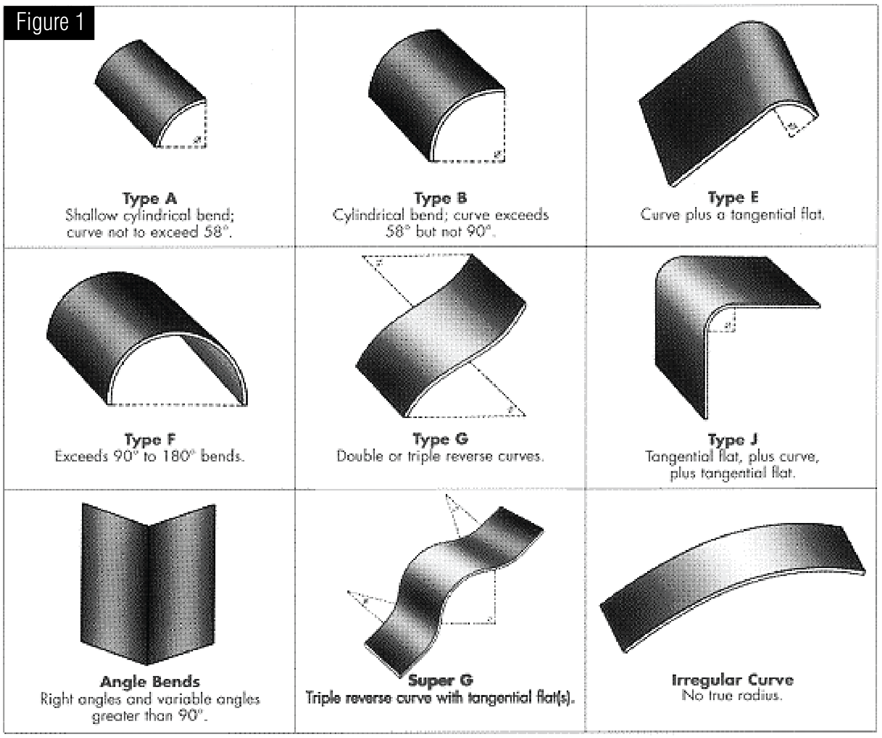
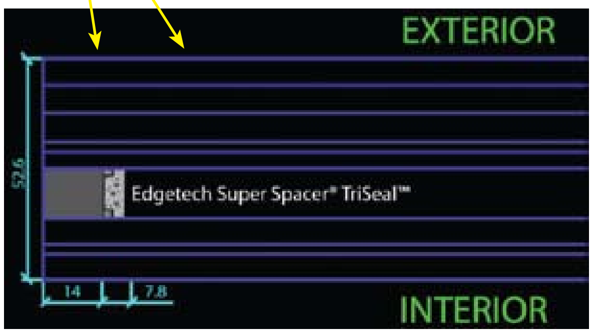


Figure 2



Long-term durability of bent IG

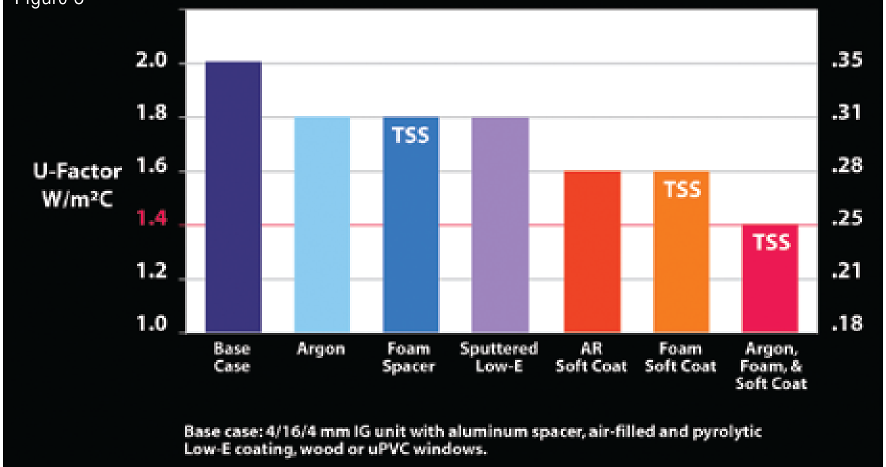
Traditional flat glass IG has been tested to many standards around the world to validate the manufacturing processes of the fabricator to consistently make quality units that will last. With the collective work of many in the industry, we have seen the consolidation of the durability testing in Europe into one norm (EN1279). The North American market also has implemented numerous standards for testing durability over the years, including the ASTM E 773/774 and CGSB 12.8. The latest standard is ASTM E 2190, which has harmonized the U.S. and Canadian testing requirement.

Edge seal design plays a significant role in determining the long-term durability of IG. It is important to remember that simply passing a durability test is not a guarantee that the selected system is the best choice for consistently constructing a durable seal. Manufacturing systems that reduce handling steps, while providing the necessary flexibility and energy saving characteristics, are more likely to provide the desired repeatable long-term durability.

It is well known that bent glass edge seals are typically subjected to even greater and more dynamic stresses than traditional flat glass IG. Because of this, fabricators and design professionals should be more diligent about specifying and using an appropriate edge seal. Proper system design and specification are necessary to reduce the cost associated with failed bent glass IG units.

Durability of seals for bent glass also can impact the selection process for other components of the bent glass or flat glass. Trade-offs can be made with glass coatings, gas fill-

Figure 3



Base case: 4/16/4 mm IG unit with aluminum spacer, air-filled and pyrolytic Low-E coating, wood or uPVC windows.

ing and spacer to achieve the desired energy savings related to the façade.

Figure 3 outlines some available options for achieving lower U-factors. Using a base case IG construction of rigid metal spacer, air-filled and pyrolytic low-E glass in a PVC or clad-wood frame, we can achieve a 2.0 W/m2 C U- factor.

To reduce this value by 0.2 using the glazing technologies, we can change out one of the three components.

1. Replace air with argon gas.
2. *Replace the rigid spacer with flexible foam spacer.
3. Replace the pyrolytic low-E with sputter-coated low-E.

Each selection has a consequence. Those with an asterisk indicate the selection that offers the maximum efficiency and lowest potential for return due to manufacturing defects:

• Argon filling improves the thermal efficiency of the IG but adds expense and process steps. Consumers still question the long-term retention of argon in units. You cannot see it, smell it, taste it or feel it, so how can we be sure it stayed inside the IG?

• * Flexible foam spacers reduce manufacturing steps and increase thermal efficiencies with proven durability. It is possible to visually identify when this high-performance spacer has been used in an IG.

• Sputter- coated low-E improves thermal efficiency of the IG, but makes it more susceptible to scratches and handling damage.

To reduce this value by 0.4 from the base case using these glazing technologies, we can change out two of the three components.

1. Replace air with argon gas and replace the pyrolytic coating with a sputter coating.

2.*Replace the rigid spacer bar with flexible foam spacer and replace the pyrolytic coating with a sputter-coated low-E.

Again, each selection has a similar consequence:

• Replacing air with argon still creates questions by the consumer, and the sputter coating has to be handled more carefully to avoid coating damage.

•*Flexible foam spacers reduce manufacturing steps and increase thermal efficiencies with proven durability. Sputter-coated low-E improves thermal efficiency of the IG, but it is more susceptible to scratches and handling damage.

With each of the options listed, you will achieve lowered U-factor. Additionally, substitutions of some components have far fewer costs and manufacturing implications than others.

Joe Erb is product manager and Tracy Rogers is technical director for Edgetech I.G., Cambridge, Ohio. Write them at jerb@edgetechig.com and tgrog@earthlink.net.