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Clearing Trapped Air in Five-Sided Irregular Large SGP Laminated Glass with Multiple Openings

Why shaped, perforated SGP plates are difficult to de-air

Large architectural laminates with an ionoplast (SGP) interlayer already ask more of a production line than a modest rectangular PVB unit. When the plate is also a five-sided irregular shape, several square meters in area, and pierced by more than one opening, the difficulty multiplies. Air no longer has a short, even path to a free edge. Rolling, vacuum, and heat that work on a regular rectangle often leave a field of bubbles after the autoclave, and a second bag cycle rarely repairs what the first cycle sealed in.

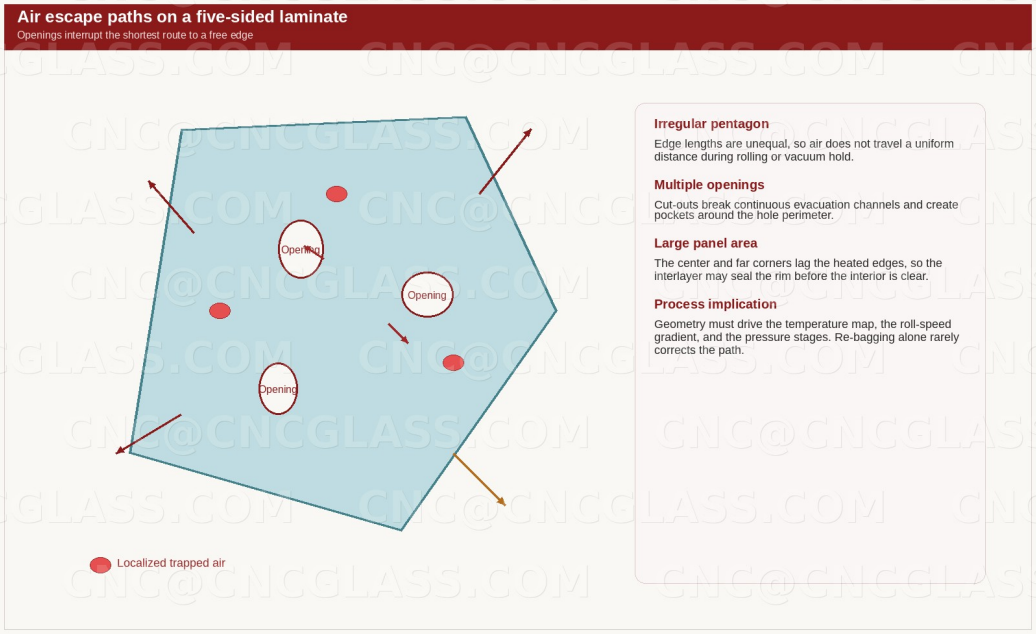


Figure 1. Air escape paths on a five-sided laminate with openings. Unequal edges and cut-outs create pockets that a standard rolling pass cannot clear.

The ionoplast family is valued in curtain walls, railings, and skylights because of its stiffness, bond strength, and residual load capacity after breakage. Those same properties mean the ply does not flow as freely as a softer encapsulant in the early part of the cycle. If the rim softens and pinches while the center or the perimeter of an opening is still cool, gas is locked between glass and film. The defect then looks like a simple bubble, but the real mismatch is among geometry, material response, and process settings.

How geometry and openings trap air

An asymmetrical pentagon has unequal edge lengths. During a nip or a vacuum hold, air travels different distances in different directions. The longer routes lag, and pockets form in the corners that are farthest from a vent. Openings interrupt those routes still further. Each hole is a break in the interlayer plane; flow and evacuation around the cut are local and easily blocked. If the opening is finished before the film has fully softened, the cut edge becomes a dead end rather than a useful vent.

Panel size adds a thermal problem. Heat reaches the edges first. On a large plate the center, and the glass around openings, can remain below the softening window while the perimeter is already tacky. Premature edge seal is then almost inevitable. Re-bagging and re-applying vacuum after that seal has formed does not reopen a reliable escape

path. The pack has to be brought back into a state where the interlayer can move, the edges are not pinched, and the vacuum path reaches both the outer rim and the hole perimeters.

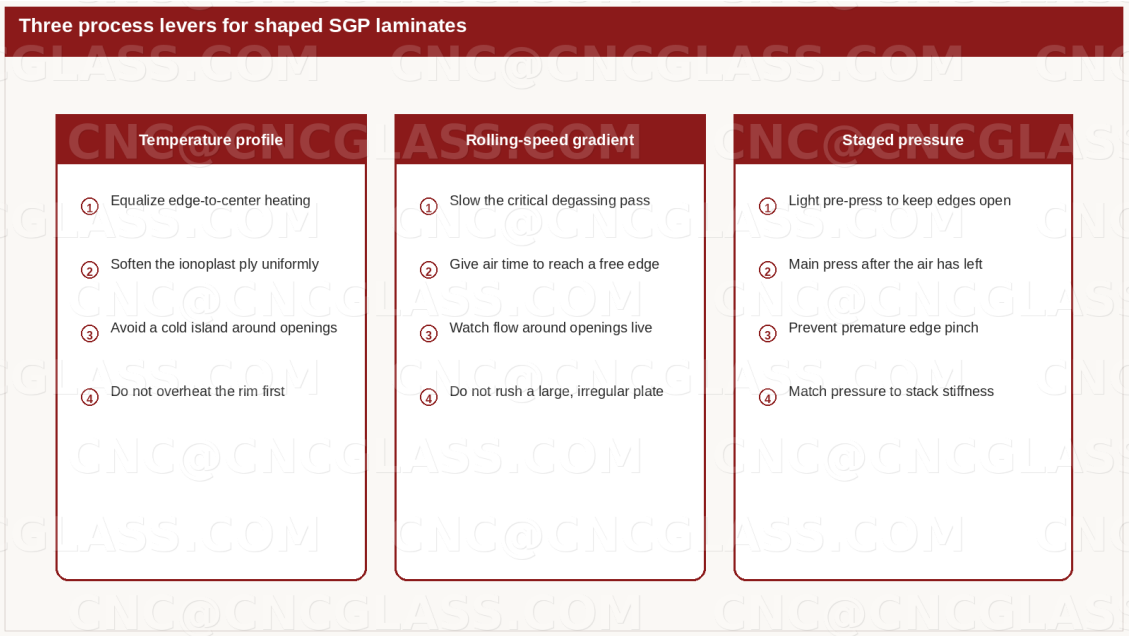


Figure 2. The three process levers that must be tuned together: temperature uniformity, rolling-speed gradient, and staged pressure.

Tune temperature, speed, and pressure as one system

A useful correction starts with the temperature map, not with a single set-point written on a card. The heating arrangement should be adjusted so the ionoplast ply softens as evenly as the geometry allows. Cold islands around openings and a hot rim are the two patterns we watch for first. Once the film is uniformly workable, air has a chance to move.

The rolling-speed gradient is the second lever. A large, irregular plate needs a longer degassing window than a small rectangle. Slowing the critical pass, and watching the pack around each opening as it travels, gives residual air time to reach a free edge. Rushing that pass is a common reason a visually acceptable pre-press still fails in the autoclave.

Pressure must be staged to the structure. A light pre-press should seat the pack without closing the edges. The main press belongs after the air has left. If full pressure arrives too early, the rim becomes a gasket and the interior stays cloudy or bubbled. The stiffness of a dual-glass ionoplast stack makes this timing more exacting than it is with a thin, flexible interlayer.

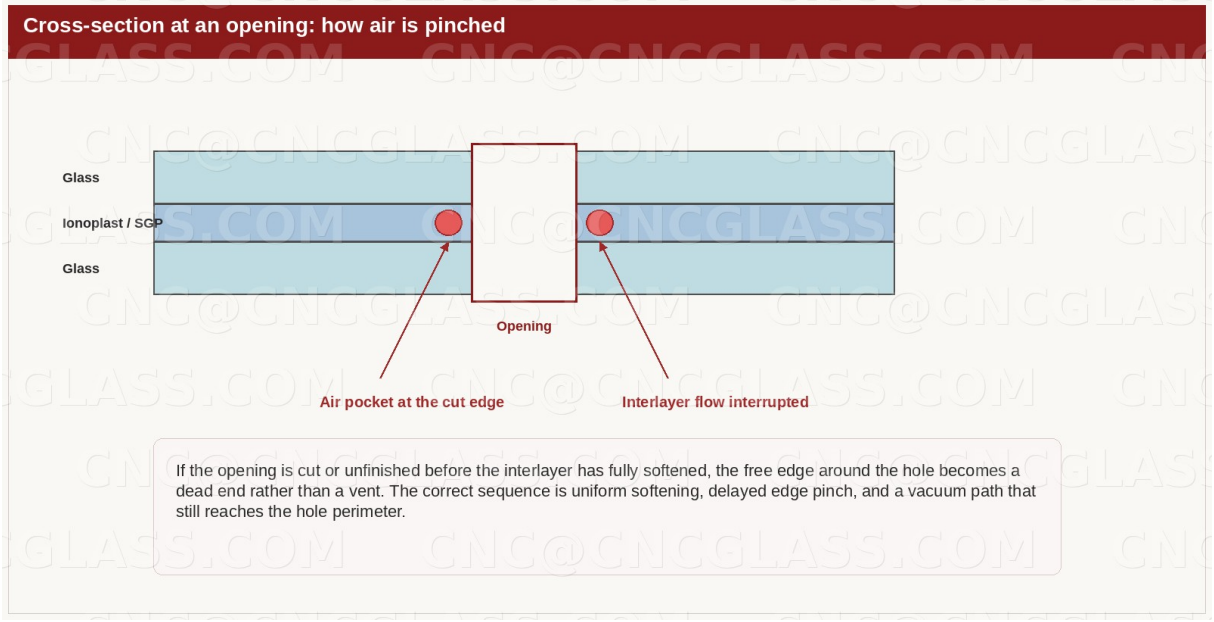


Figure 3. Cross-section at an opening. If the interlayer seals the cut edge too early, residual air is pinched in place rather than vented.

What operators should be able to see and adjust

A one-time parameter change is not enough if the next unusual shape arrives and the line cannot respond. We treat on-site tuning as a chance to build judgment, not only to recover a batch. Operators should be able to read the glass outline and predict where air will linger; to watch the roll and change speed before a pocket is sealed; to bag a shaped, perforated plate so the vacuum path is not pinched at a hole; and to distinguish a process bubble from contamination or a film fault.

When those habits are in place, yield on subsequent irregular SGP work typically rises sharply. Isolated bubbles that remain around an opening can sometimes be cleared by a carefully directed second autoclave cycle, which is preferable to scrapping a large, expensive lite. The aim is not a slogan about a perfect rate; it is a stable method that matches temperature, motion, and pressure to the real geometry of the plate.

Trapped air in a large, five-sided, multi-opening SGP laminate is rarely a mystery of the film itself. It is the result of escape paths that the shape and the openings have already made difficult, compounded by uneven softening and premature edge pinch. Correct the thermal map, the speed gradient, and the pressure stages together, and teach the line why those changes work. That is how the problem is resolved at its root, rather than chased from bag to bag.

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Ask us about process windows for shaped and perforated ionoplast laminates, and about how to set temperature, roll speed, and staged pressure for large irregular plates.