LAMINATED GLASS
WHAT IS LAMINATED GLASS?

- Defined as “Two or more lites of glass permanently bonded together with an interlayer material”
- Our process bonds the glass and interlayer together under pressure and heat
LAMINATED GLASS

- Can be made using:
  - Annealed, heat strengthened or tempered glass
  - Tinted, reflective, patterned, mirror and some low e’s
- Adds sound-damping
- UV-blocking properties
- Considered safety glass
  - If glass breaks, glass fragments adhere to interlayer
    - Reducing risk of injury or passage of persons or objects
  - Meets:
    - ANSI safety standards
    - ASTM standards for Laminated Architectural Flat Glass
LAMINATION LINE

1. Air Table

2. Washing process

3. Clean room

4. Nip rollers for de-airing
• After the laminated glass sandwich has come thru the nip rollers, the glass can not be separated
• Next our technicians examine the piece and determine if a Vacuum bag is needed
• Edges are wrapped with a breather material, then wrapped with a bagging material and hooked up to a vacuum
• While in the Autoclave the bagged pieces have a dedicated tube pulling out any possible air left between the glass and interlayer
• Pieces using tempered glass, shapes, having holes/cutouts or have multiple layers of glass/interlayer must be bagged
LAMINATION AUTOCLAVE

- Last step in lamination process
  - Glass is loaded on a steel a-frame
  - Glass will be cooked in a vertical position

- While in the Autoclave glass is being heated and air pulled out at the same time
LAMINATED LIMITATIONS

- Max thickness is 2-3/4” overall
- Max size: 96” x 153”
- Min size:
  - Annealed - can be cut down after lamination
  - Tempered – 12” x 12”
    - But too small to go thru Nip rollers
INTERLAYER TYPES – POLYVINYL BUTYRAL (PVB)

- Most common used (Standard Interlayer)
- Lower cost with clear finish
- Four sided support glazing
- Wet Blanket effect when glass breaks
INTERLAYER TYPES – PVB CONT.

- PVB is offered in a variety of colors and thickness
- Our main supplier is Trosifol by Kuraray
- Supplied as rolls
INTERLAYER TYPES - PVB CONT.

PVB Options:
- Clear
  - Max 96”
- Sound Control
  - Max 84”
- Bronze 52%
  - Max 72”
- Brilliant Black
  - Max 72”
- Diamond White
  - Max 72”

- 7% Shinning White
  - Polar White
  - Max 84”
- 65% Translucents White
  - Arctic Snow
  - Max 96”
- 81% Sand White
  - Cool White
  - Max 96”
PRL Rainbow Interlayer
- Max 60”
- consists of 12 standard colors
- can be combined with any other PVB to create custom PRL Rainbow Interlayer colors
- Maximum 4 layers can be stacked
- Samples sets sold for $75 each
INTERLAYER TYPES - PVB CONT.
INTERLAYER TYPES – SENTRYGLAS® PLUS (SGP)

- Also know as Ionoplast interlayer
- Impact Resistant
- Post – breakage stability
- Structural interlayer
- Manufactured by Kuraray
- Can not be used with 1/8” glass
- Edges can be exposed
  - Less susceptible to moisture intrusion
INTERLAYER TYPES – SGP CONT.

SGP Options
- Clear
  - Rolls
    - Thickness .035
    - Max 72”
  - Sheets
    - Thickness .090 sheets
    - 72” x 120” (stock)
    - 84” x 144” (special order)
- Translucent White
  - Rolls
    - Thickness .030
    - Max 60”
INTERLAYER THICKNESSES

- **Annealed**
  - Can be made with .030, .060, .070, .090 or .105

- **Heat Strengthened or Tempered**
  - Minimum of .060 interlayer
  - Due to the process of heat treated glass each piece may have different distortions from the rollers. When sandwiched the additional interlayer will fill in this difference
    - 1/8" tempered glass not recommended, will have bad distortion

- **Textured glass**
  - Require .090 interlayer
We only laminate using:
- **Energy Advantage from Pilkington**
  - Hard coat
- **SN68 from Guardian**
  - Soft coat – requires edge deletion

**Edge Deletion** is required for all high performance glass
- Reduces the possibility of interaction from the chemicals in the sealant and the silver layers in the glass coating
- Applications with butt joints will show the edge deletion
LAMINATING LOW E GLASS

Two Options for Low E layup

• Embedded
  • Low E coating in direct contact with interlayer
  • Thermal performance is about the same as if not using Low E glass
• Exposed
  • Low E on exterior of laminated sandwich
  • to be used in an insulated unit facing the air spacer
LAMINATION FABRICATION

- Annealed laminated pieces
  - Fabricated after the lamination process

- Tempered laminated pieces
  - Must have all fabrication done before being laminated
  - While in lamination process pieces can shift and cause a slight offset
CUSTOM LAMINATED OPTIONS
COMBO INTERLAYERS

- Combining 2 layers of PVB on one laminated sandwich
- Possibility for air bubbles
- Interlayers and glass can shift during lamination process
  - No guarantee
  - To have a straight line at butt joint of interlayers
    or
  - Will measure exactly to measurements requested

Clear with 65% translucent white

81% sand white with 65% translucent white
CUSTOM LAMINATED OPTIONS ARIA

• Custom cutting shapes in various glass types and combing like a puzzle in lamination
CUSTOM LAMINATED OPTIONS  OFFSET

Created by having one glass smaller than the other and either centering or aligning one or more edge during lamination

- Can not guarantee offset will hold to measurements given
  - Can shift about 1/8” during lamination process
- Interlayer will not be removed from offset location
- No warranty
CUSTOM LAMINATED OPTIONS

It is possible to laminate other materials in the laminated sandwich

- Fabric
- Vinyl
- Metal
- Organic

These types of jobs are very custom and bid on a case by case basis with no warranty
BULLET RESISTANT (BR)

- 1-1/16” over all
  - Can create thicker overall if requested
- Max size is 48” x 96”
- Tested up to Level 3
  - Not UL Approved
- Made using Glass, PVB and Polycarbonate
  - Exact make-up not given out (trade secret)
    - Every manufacture has its own unique make-up
- Not considered physical attack resistant or blast resistant
LAMINATED - LIMITED 5 YEAR WARRANTY

- From date of manufacture
  - Will need order / invoice number to provide
- When using PVB interlayer, PRL will not offer a warranty if the edges are exposed.
  - PVB can absorb moisture resulting in discoloration at the edge and perimeter of the product and/or cause delamination
- Custom laminated products may not offer a warranty
PRL’S LAMINATED GLASS PROCESS: