



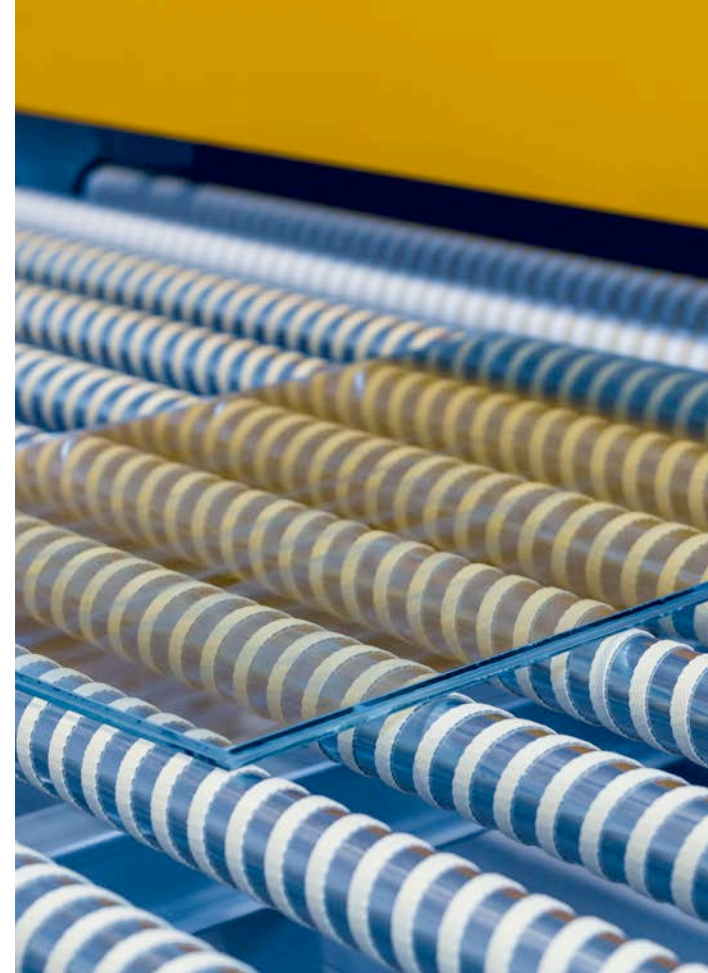
How to get rid of your laminating problems?

Glass processors session

Miika Äppelqvist

Content

- Laminating market development
- Laminating process steps and the related challenges
 - Pre-lamination
 - Washing
 - Assembly
 - Pre-pressing
 - Autoclaving
- Summary



The most growing facade glazing type is HS-lami

- The use of tempered flat glass grows globally ca. 4-7% per annum
- The use of laminated grows ca. 6-9% per annum
- The use of heat-strengthened laminated grows ca. at the rate of 10-20%



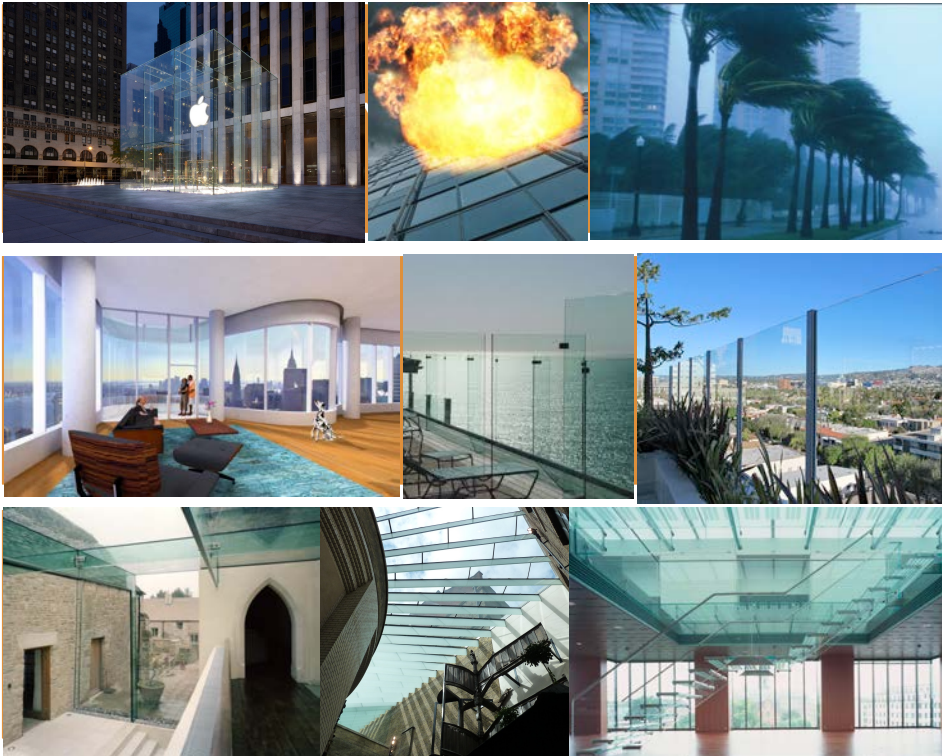
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Laminated glass has several value-adding phases

- Several process phases – and the time and path spent in factory is “long”
- Remakes needs all the process from the beginning to the end including in worst case
 - Two or more glasses
 - LowE
 - Cutting
 - Grinding
 - Heat treatment
 - PVB, EVA or Sentryglas film



Laminated glass business drivers



SAFETY & SECURITY

NEW DESIGNS

GLASS AS
STRUCTURAL ELEMENT

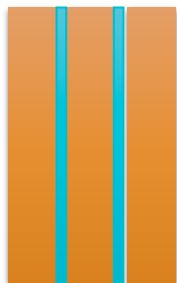
"The Crash and Grab" -standard



Apple store picture - Summary of GPD - 2015, J Vitkala
Source: www.gpd.fi ©James OCallaghan, Eckersley O'Callaghan

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"The Crash and Grab" -standard



3 x 12mm tempered glass

SentryGlas +



Apple store picture - Summary of GPD - 2015, J. Vitkala
Source: www.gpd.fi ©James O'Callaghan, Eckersley O'Callaghan

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SAFETY & SECURITY

NEW DESIGNS

GLASS AS
STRUCTURAL ELEMENT



Transparent “Balcony” on
103 Floor Skyscraper the
Sears Tower, Chicago



The Skyslide is a terrifying transparent slide affixed to the outside of the U.S. Bank Tower in downtown Los Angeles, some 1,000 feet above ground.

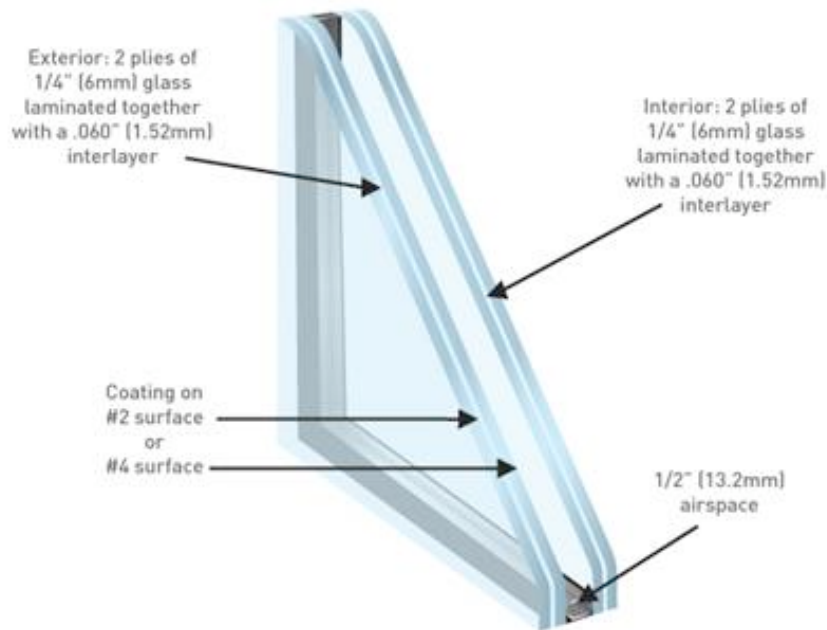
http://www.slate.com/blogs/the_eye/2016/03/07/skyslide_is_a_glass_slide_affixed_to_the_outside_of_the_u_s_bank_tower_in.html

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”Brave men bridge” - China's Shiniuzhai national park in Hunan province. Length ca. 300m

Different coatings are making their way into laminates



Coated laminates are increasing rapidly,
much faster than other types



MosCom Bank,
Moscow, Russia

Coating: Solar Neutral 67, HP Neutral 60/40

Exterior Appearance: Silver, Neutral

Float Glass: ExtraClear

Glass Type: Laminated Glass

Product(s) used in this project: [Solar Neutral 67 \(#2\)](#), [HP Neutral 60/40 \(#2\)](#)



Digitally Printed and Laminated Surfaces
mbar, Helsinki, Finland

SAFETY & SECURITY

NEW DESIGNS

GLASS AS
STRUCTURAL ELEMENT

Glass beams as structural element



Supporting floors/roofs



Glass frames



Fins for glazed façades



Victoria & Albert Museum, London



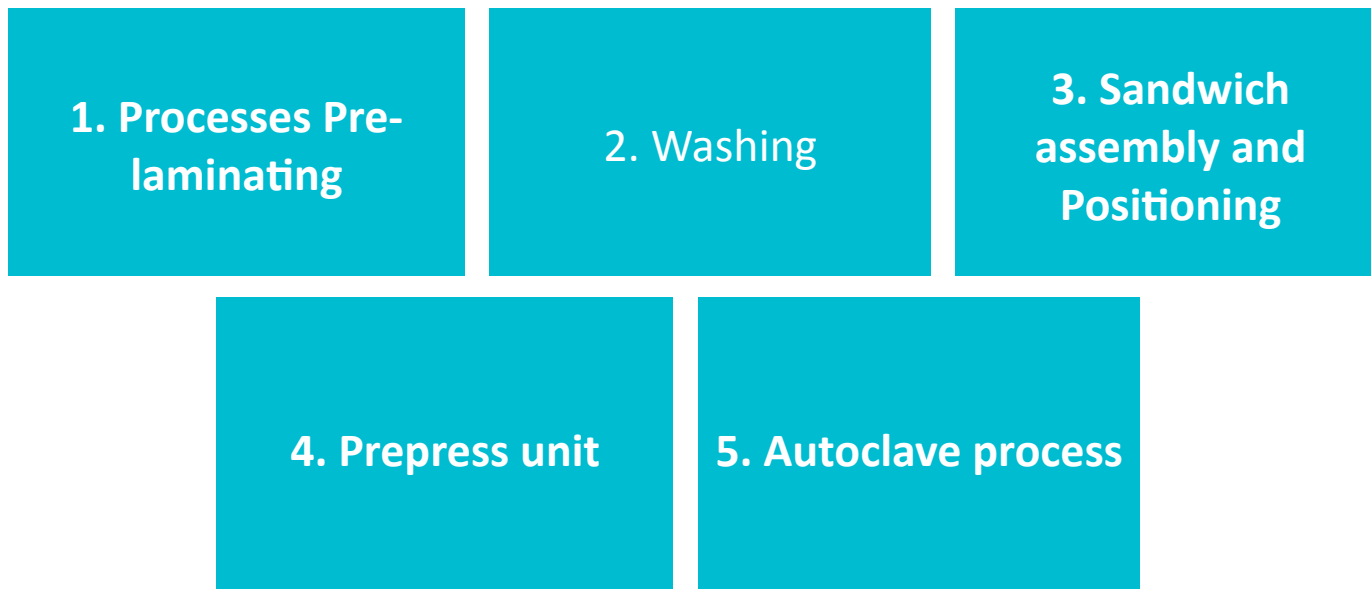
Glass fins as structural element



Laminating process steps and related challenges

Laminating process steps

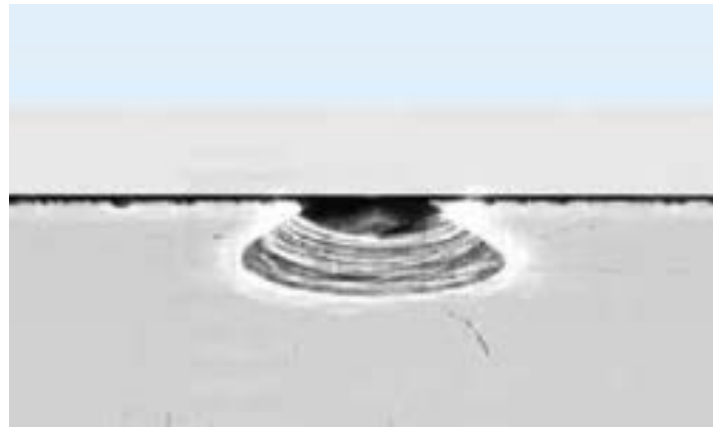
(=sources for different problems)



Processes Pre-laminating

Cutting and grinding

Any deviation in the position of the holes, notches, cut-outs, squareness and tolerances results in panel's alignment conflict, glass/holes mismatching and increased potential laminates defects.



How you are controlling you control pre-processing quality in your factory pre-laminating?

Processes Pre-laminating

Tempering and heat strengthening process can cause big problems

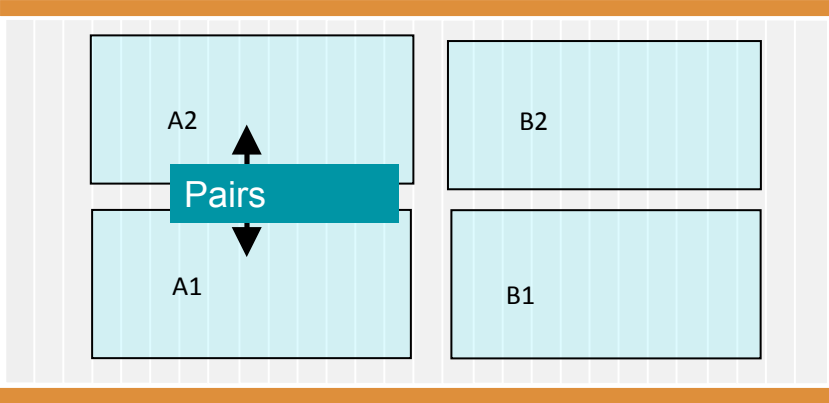
- Minimizing rollerwave and edge kink helps to handle the prepressing
- PVB temperature window gets more narrow the more imperfections are in glass



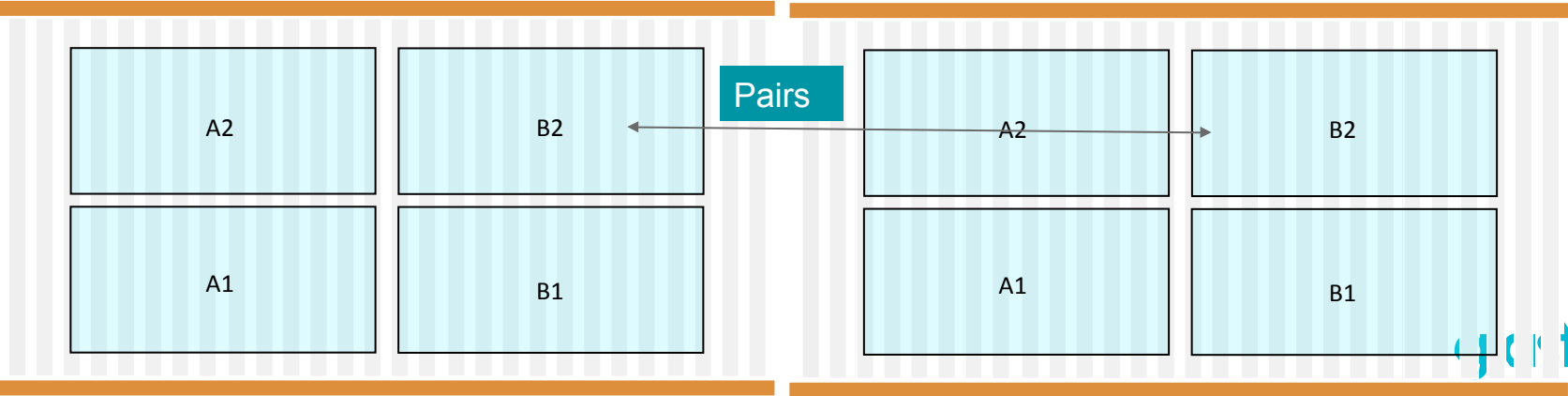
Pre-laminating

How to arrange heat-treated glasses in optimal way

A

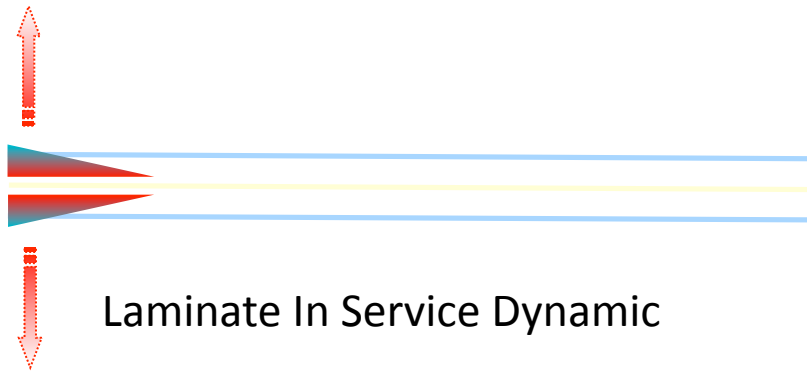
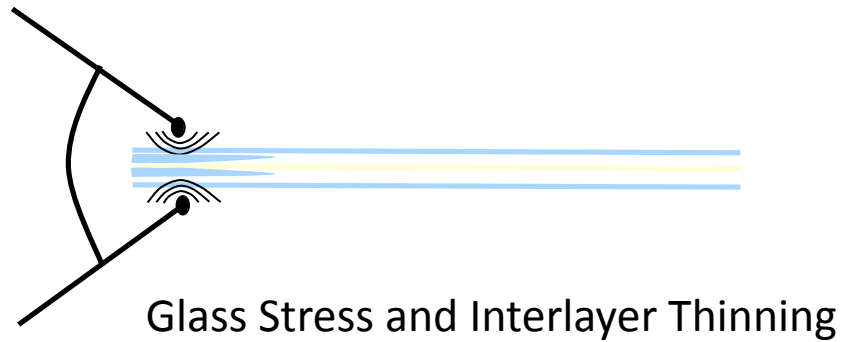
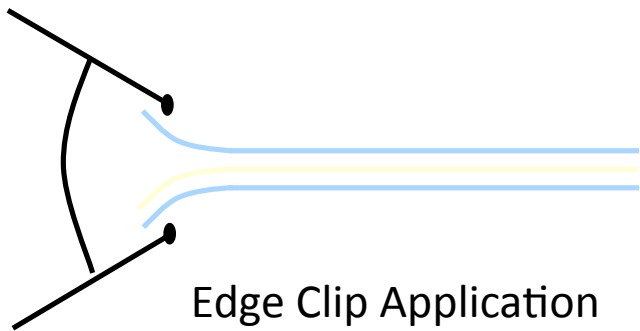


B



Pre-laminating quality control

Can you compensate poor heat-treated quality by clipping?

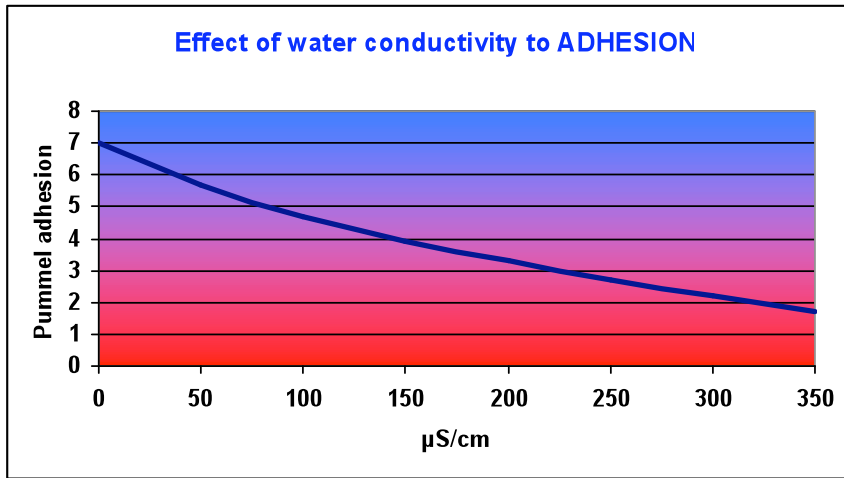


Washing and cleanliness

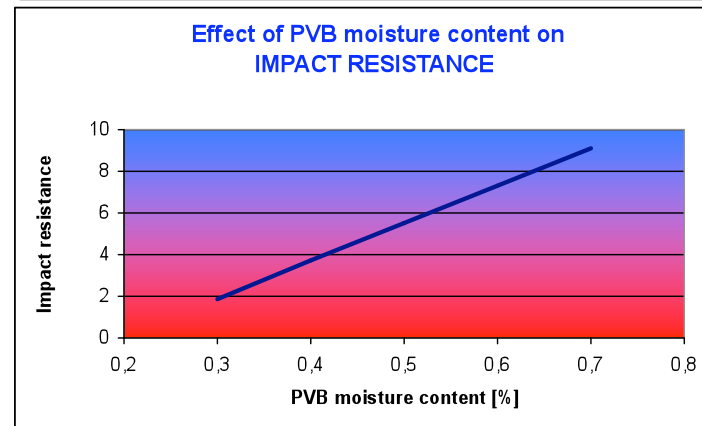
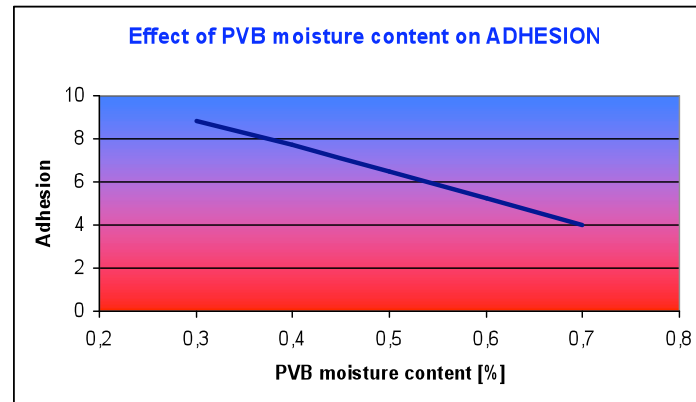
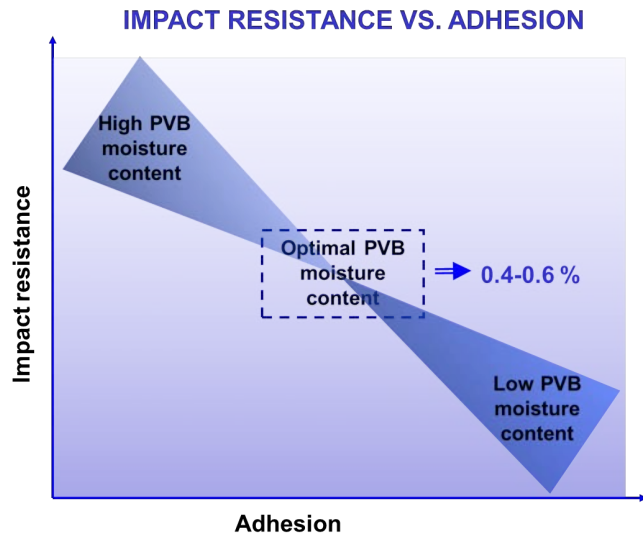
- PERFECTLY CLEAN (Cutting oil, glass splinters, separating powder...)
- PERFECTLY DRY: Water drops create marks in the laminate
- Water in glass after washing makes serious problems in adhesion
- Will occur immediately after prepressing on later in time after installed into a building



Washing and cleanliness



PVB moisture effect on final performance



Assembly station

Positioning accuracy

- Frame and fitting tolerances are getting tighter, (tightest even 0,2-0,5mm)
- Glass pairing accuracy will increase to allow perfect fit to frame structures



Assembly station

Sandwich design

- Use product from same oven
- Position the 2 glasses to have the deformation “in phase”
- Avoid “open” edge
- In case of asymmetric configuration, position the thicker glass at the bottom

Note! You may not be to use thicker PVB than specified!

Avoid



Avoid



Assembly station

Sandwich design

Tin-sides against interlayer with Sentryglas



Prepressing unit – Typical problems

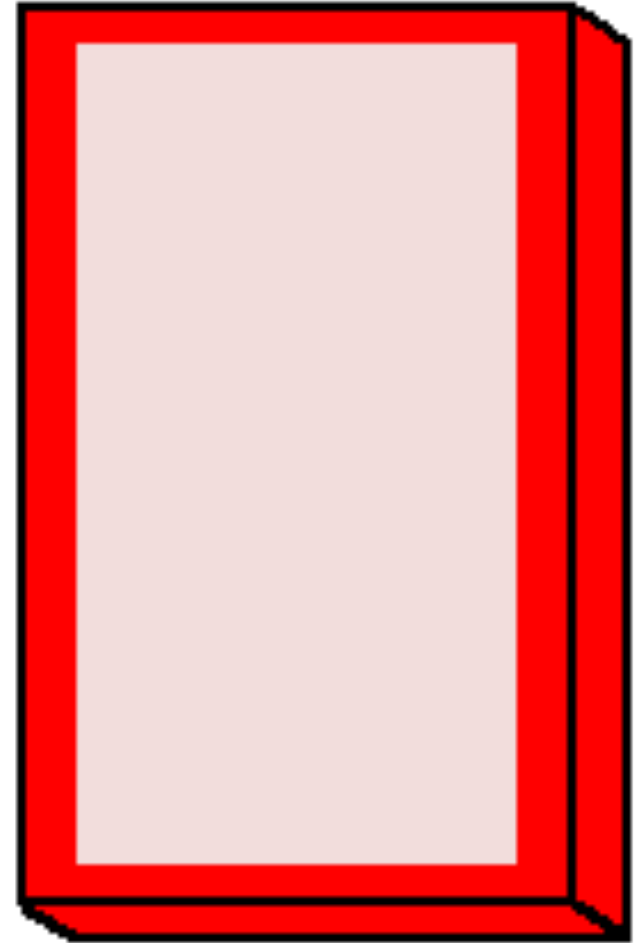
Heating and pressing

1. Trapped air (bubbles)

- Wrong nip-roll setting
- Not enough pressure in nip-roll
- Premature edge sealing

2. No edge sealing (air pockets / bubbles)

- Not enough heating
- Wrong nip-roll setting
- Air flows in during the autoclave process

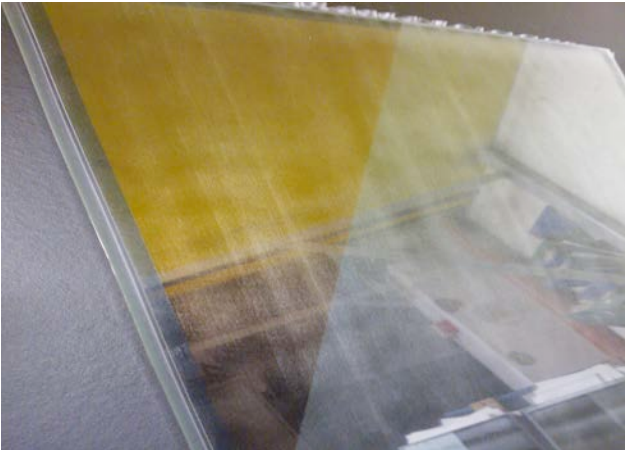


Prepressing unit

Heating and pressing

- Even heating is a key to successful prepressing quality
- Lately, the challenge has been the new coatings and increasing complexity in product mix

Full convection heating with even heat transfer on all surfaces



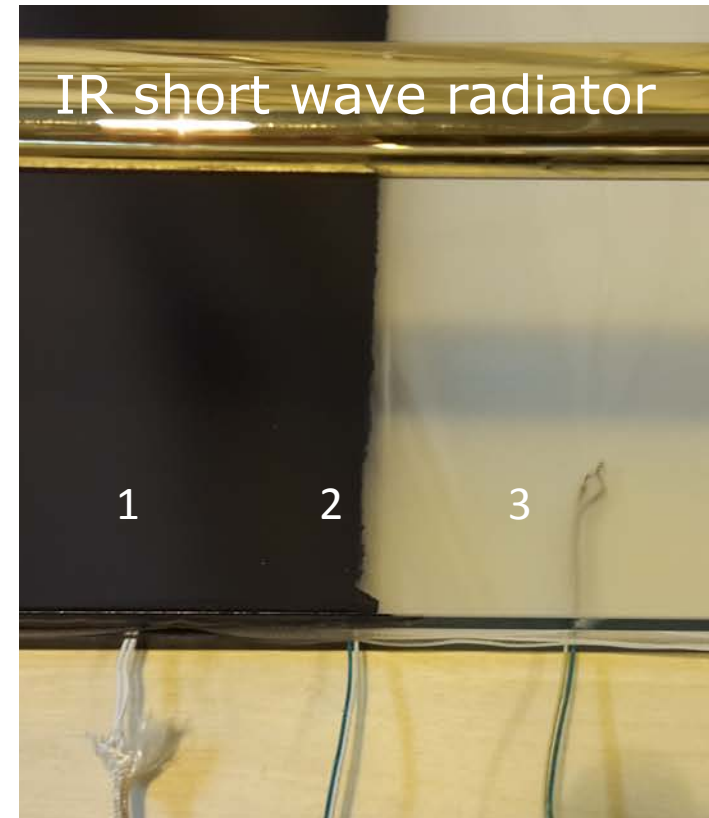
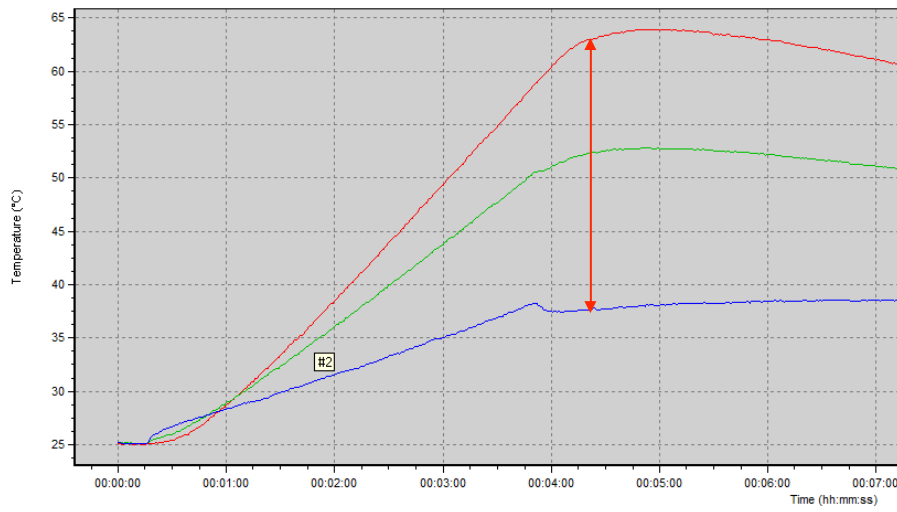
Typical radiation line overheating painted surfaces



Prepressing unit

How radiation behaves?

- Painted surface (1)
- Transition phase lowE to paint (2)
- lowE surface (2)

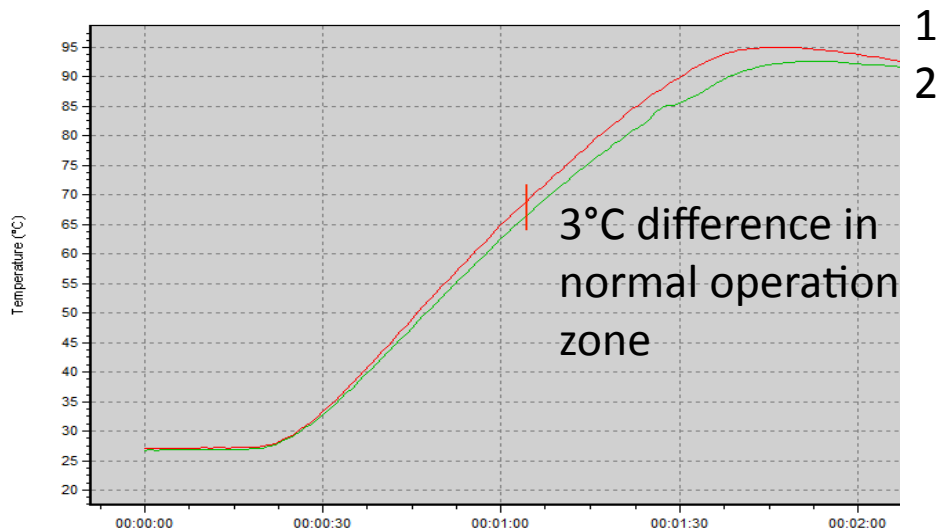


30°C difference in less than 4 minutes

Prepressing unit

Why convection wins the game?

- Painted surface (1)
- lowE surface (2)

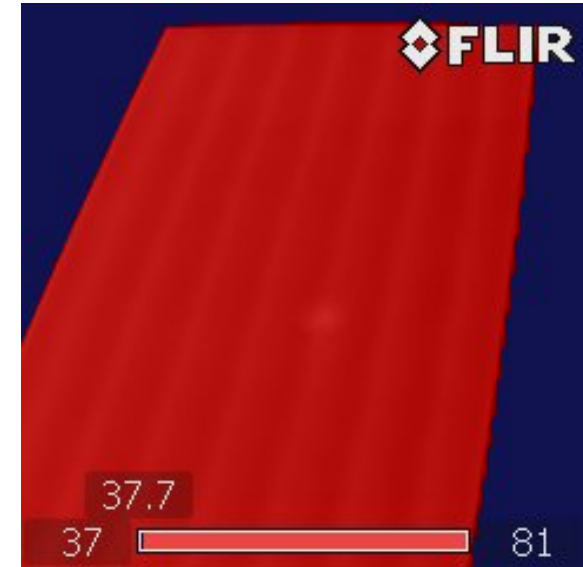


Symmetrical convection system for equal heat transfer to both surfaces

Prepressing unit

Heating equally glass after glass with convection

- All film materials have a optimum window for good adhesion to glass surfaces – the better the control the easier it is to match the window
- Modern convection systems keeps the temperature stable allowing to stay in the process window easily
- With convection systems the only controlled parameter is thickness – no matter the glass type
→ Recipe free-process → **total change to production management**



Case Example: Glassexperten Denmark 5 year old line (other manufacturer)

Upgrade of only convection pre-press to existing lamination line

- 30 % reduction in waste (bubbles etc.)
- Re-autoclaving from 13% to 4%
- 40 % of more throughput with lowE glasses
- 50% reduction in energy consumption
- Reduction of PVB thickness from 1,14 to 0,76mm
- Earlier used clamping, not anymore
- Recipe-free process

- Today's glass types require today's technology for profitable business



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Prepressing unit

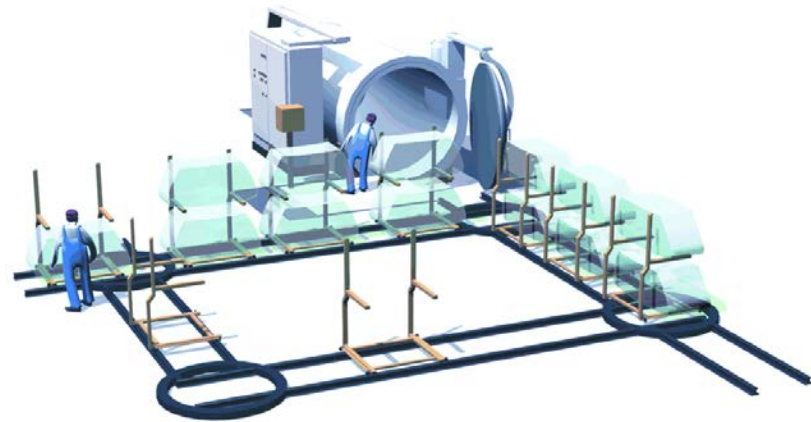
Heating equally glass after glass

Space out glasses for free air circulation!

- Spacer should match laminate thickness

Fix the loading

- Fasten laminates firmly
- Do not bend the laminates





Keys to success

Keys to succeed

- Pay attention to pre-lamination processes:
 - Cutting and grinding with proper edge work quality
 - Heat treatment with proper glass flatness
 - Edge kink
 - Rollerwave
- Washing quality
 - Dry glass is a must
- Even heating in prepressing with heating system suitable to your glass mix

